EXHIBIT 1

NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION ACT (EXCERPT)
Act 451 of 1994

PART 307
INLAND LAKE LEVELS

324.30701 Definitions.

Sec. 30701. As used in this part:

(a) "Commissioner" means the county drain commissioner or the county road commission in counties not having a drain commissioner, and, if more than 1 county is involved, each of the drain commissioners or drain commissioner and road commission in counties having no drain commissioner.

(b) "County board" means the county board of commissioners, and if more than 1 county is involved, the boards of commissioners of each of those counties.

(c) "Court" means a circuit court, and if more than 1 judicial circuit is involved, the circuit court designated by the county board or otherwise authorized by law to preside over an action.

(d) "Dam" means an artificial barrier, structure, or facility, and appurtenant works, used to regulate or maintain the level of an inland lake.

(e) "Delegated authority" means the county drain commissioner or any other person designated by the county board to perform duties required under this part.

(f) "Inland lake" means a natural or artificial lake, pond, impoundment, or a part of 1 of those bodies of water. Inland lake does not include the Great Lakes or Lake St. Clair.

(g) "Interested person" means the department and a person who has a record interest in the title to, right of ingress to, or reversionary right to land that would be affected by a permanent change in the natural or normal level of an inland lake.

(h) "Normal level" means the level or levels of the water of an inland lake that provide the most benefit to the public; that best protect the public health, safety, and welfare; that best preserve the natural resources of the state; and that best preserve and protect the value of property around the lake. A normal level shall be measured and described as an elevation based on national geodetic vertical datum.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Compiler's note: For transfer of authority, powers, duties, functions, and responsibilities of the Land and Water Management Division, with the exception of the farmland and open space preservation program, natural rivers program, and Michigan information resource inventory system, to the Director of the Michigan Department of Environmental Quality, see E.R.O. No. 1995-16, compiled at MCL 324.99901 of the Michigan Compiled Laws.

Popular name: Act 451

Popular name: NREPA

324.30702 Determination of normal inland lake level; motion or petition to initiate action; delegation of powers and duties by county board; maintenance.

Sec. 30702. (1) The county board of a county in which an inland lake is located may upon the board's own motion, or shall within 45 days following receipt of a petition to the board of 2/3 of the owners of lands abutting the inland lake, initiate action to take the necessary steps to cause to be determined the normal level of the inland lake.

(2) Unless required to act by resolution as provided in this part, the county board may delegate powers and duties under this part to that county's commissioner, road commission, or other delegated authority.

(3) If a court-determined normal level is established pursuant to this part, the delegated authority of the county or counties in which the lake is located shall maintain that normal level.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Compiler's note: For transfer of authority, powers, duties, functions, and responsibilities of the Land and Water Management Division, with the exception of the farmland and open space preservation program, natural rivers program, and Michigan information resource inventory system, to the Director of the Michigan Department of Environmental Quality, see E.R.O. No. 1995-16, compiled at MCL 324.99901 of the Michigan Compiled Laws.

Popular name: Act 451

Popular name: NREPA

324.30703 Preliminary study; costs; contents of study.

Sec. 30703. (1) Before proceeding on a motion made or a petition filed under section 30702, the county board may require that a preliminary study be conducted by a licensed professional engineer. The county board, by resolution, may require a cash payment from the petitioners sufficient to cover the actual preliminary study costs or of $10,000.00, whichever is less.

(2) A preliminary study shall include all of the following:
(a) The feasibility of a project to establish and maintain a normal level of the inland lake.
(b) The expediency of the normal level project.
(c) Feasible and prudent alternative methods and designs for controlling the normal level.
(d) The estimated costs of construction and maintenance of the normal level project.
(e) A method of financing initial costs.
(f) The necessity of a special assessment district and the tentative boundaries if a district is necessary.
(g) Other information that the county board resolves is necessary.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30704 Initiating proceeding for determining normal inland lake level and establishing special assessment district; required finding; multicounty lake; joinder permitted.

Sec. 30704. (1) If the county board, based on the preliminary study, finds it expedient to have and resolves to have determined and established the normal level of an inland lake, the county board shall direct the prosecuting attorney or other legal counsel of the county to initiate a proceeding by proper petition in the court of that county for determination of the normal level for that inland lake and for establishing a special assessment district if the county board determines by resolution that one is necessary as provided in section 30711.

(2) If the waters of an inland lake are located in 2 or more counties, the normal level of the lake may be determined in the same manner if the county boards of all counties involved, by resolution, direct the prosecuting attorney or other legal counsel of 1 or more of the counties to institute proceedings. All counties may make a single preliminary study.

(3) The department may join a proceeding initiated under this section.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30705 Special assessment bonds; lake level orders; proceedings; issuance of notes; full faith and credit.

Sec. 30705. (1) The special assessment district may issue bonds or lake level orders in anticipation of special assessments. All proceedings relating to the making, levying, and collection of special assessments authorized by this part and the issuance of bonds or lake level orders in anticipation of the collection of bonds or orders shall conform as nearly as possible to the proceedings for levying special assessments and issuing special assessment bonds or lake level orders as set forth in the drain code of 1956, 1956 PA 40, MCL 280.1 to 280.630.

(2) The special assessment district may issue notes in anticipation of special assessments made against lands in the special assessment district or public corporation at large. The final maturity of the notes shall be not later than 10 years from their date. The notes are subject to the revised municipal finance act, 2001 PA 34, MCL 141.2101 to 141.2821.

(3) A county board by a vote of 2/3 of its members may pledge the full faith and credit of a county for payment of bonds or notes issued by a special assessment district.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 2002, Act 215, Imd. Eff. Apr. 29, 2002.

Popular name: Act 451

Popular name: NREPA

324.30706 Initiation of proceedings by director of department.

Sec. 30706. If the department finds it expedient to have the normal level of an inland lake determined, the department may initiate by civil action on behalf of the state, in the court of any county in which the lake is located, a proceeding for determination of the normal level.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30707 Hearing; notice; service; powers and duties of court.

Sec. 30707. (1) Upon filing of a civil action under this part, the court shall set a day for a hearing. The prosecuting attorney or other legal counsel of the county or counties or the department shall give notice of the hearing by publication in 1 or more newspapers of general circulation in the county and, if the waters of the inland lake are situated in 2 or more counties, in 1 or more newspapers of general circulation in each of the counties in which the inland lake is located. The notice shall be published at least once each week for 3 successive weeks before the date set for the hearing.

(2) The commissioner shall serve a copy of the published notice of hearing by first-class mail at least 3 weeks prior to the date set for the hearing to each person whose name appears upon the latest city or township tax assessment roll as owning land within a tentative special assessment district at the address shown on the roll; to the governing body of each political subdivision of the state in which the lake is located; and to the governing body of each affected political subdivision of the state. If an address does not appear on the roll, then a notice need not be mailed to the person. The commissioner shall make an affidavit of mailing. The failure to receive a notice properly mailed shall not constitute a jurisdictional defect invalidating proceedings under this part.

(3) The prosecuting attorney or the legal counsel of the county shall serve notice on the department at least 21 days prior to the date of the hearing.

(4) In a determination of the normal level of an inland lake, the court shall consider all of the following:

(a) Past lake level records, including the ordinary high-water mark and seasonal fluctuations.

(b) The location of septic tanks, drain fields, sea walls, docks, and other pertinent physical features.

(c) Government surveys and reports.

(d) The hydrology of the watershed.

(e) Downstream flow requirements and impacts on downstream riparians.

(f) Fisheries and wildlife habitat protection and enhancement.

(g) Upstream drainage.

(h) Rights of riparians.

(i) Testimony and evidence offered by all interested persons.

(j) Other pertinent facts and circumstances.

(5) The court shall determine the normal level to be established and maintained, shall have continuing jurisdiction, and may provide for departure from the normal level as necessary to accomplish the purposes of this part. The court shall confirm the special assessment district boundaries within 60 days following the lake level determination. The court may determine that the normal level shall vary seasonally.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30708 Maintenance of normal level; acquisition by gift, grant, purchase, or condemnation; contract for operation and maintenance of existing dam; dam in adjoining county; operation of pumps and wells.

Sec. 30708. (1) After the court determines the normal level of an inland lake in a proceeding initiated by the county, the delegated authority of any county or counties in which the inland lake is located shall provide for and maintain that normal level.

(2) A county may acquire, in the name of the county, by gift, grant, purchase, or condemnation proceedings, an existing dam that may affect the normal level of the inland lake, sites for dams, or rights in land needed or convenient in order to implement this part. A county may enter into a contract for operation and maintenance of an existing dam. The county may construct and maintain a dam that is determined by the delegated authority to be necessary for the purpose of maintaining the normal level. A dam may be acquired, constructed, or maintained in a county adjoining the county in which the lake is located.

(3) For the purpose of maintaining the normal level, a delegated authority may drill wells or pump water from another source to supply an inland lake with additional water, may lower the level of the lake by pumping water from the lake, and may purchase power to operate pumps, wells, or other devices installed as part of a normal level project.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30709 Powers of department.

Sec. 30709. (1) After the court determines the normal level of an inland lake in a proceeding initiated by the department, the department may provide for and maintain that normal level.

(2) In a proceeding initiated by the department, the department has the same powers in connection with a normal level project as a county has under sections 30708, 30713, and 30718.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30710 Condemnation of private property.

Sec. 30710. If the department or the delegated authority determines that it is necessary to condemn private property for the purpose of this part, the department or county may condemn the property in accordance with the uniform condemnation procedures act, Act No. 87 of the Public Acts of 1980, being sections 213.51 to 213.77 of the Michigan Compiled Laws.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30711 Defraying project costs by special assessment; special assessment roll; reassessment.

Sec. 30711. (1) The county board may determine by resolution that the whole or a part of the cost of a project to establish and maintain a normal level for an inland lake shall be defrayed by special assessments against the following that are benefited by the project: privately owned parcels of land, political subdivisions of the state, and state owned lands under the jurisdiction and control of the department. If the county board determines that a special assessment district is to be established, the delegated authority shall compute the cost of the project and prepare a special assessment roll.

(2) If the revenues raised pursuant to the special assessment are insufficient to meet the computation of cost included in section 30712, or if these revenues are insufficient to meet bond obligations, the special assessment district may be reassessed without hearing using the same apportioned percentage used for the original assessment.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30712 Computation of project costs.

Sec. 30712. (1) Computation of the cost of a normal level project shall include the cost of all of the following:

(a) The preliminary study.

(b) Surveys.

(c) Establishing a special assessment district, including preparation of assessment rolls and levying assessments.

(d) Acquiring land and other property.

(e) Locating, constructing, operating, repairing, and maintaining a dam or works of improvement necessary for maintaining the normal level.

(f) Legal fees, including estimated costs of appeals if assessments are not upheld.

(g) Court costs.

(h) Interest on bonds and other financing costs for the first year, if the project is so financed.

(i) Any other costs necessary for the project which can be specifically itemized.

(2) The delegated authority may add as a cost not more than 15% of the sum calculated under subsection (1) to cover contingent expenses.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30713 Contract with agency or corporation; provisions.

Sec. 30713. The delegated authority of a county in which an inland lake is located may contract with a state or federal government agency or a public or private corporation in connection with a project for the establishment and maintenance of a normal level. The contract may specify that the agency or corporation will pay the whole or a part of the cost of the project or will perform the whole or a part of the work connected with the project. The contract may provide that payment made or work done relieves the agency or corporation in whole or in part from assessment for the cost of establishment and construction of the project.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30714 Special assessment roll; public hearing; notice; approval; appeal.

Sec. 30714. (1) A special assessment roll shall describe the parcels of land to be assessed, the name of the owner of each parcel, if known, and the dollar amount of the assessment against each parcel.

(2) The delegated authority shall set a time and place for a public hearing or hearings on the project cost and the special assessment roll. Notice of a hearing shall be by both of the following:

(a) By publication of notice at least twice prior to the hearing in a newspaper that circulates in the special assessment district, the first publication to be at least 10 days before the hearing.

(b) As provided in Act No. 162 of the Public Acts of 1962, being sections 211.741 to 211.746 of the Michigan Compiled Laws.

(3) At or after a public hearing, the delegated authority may approve or revise the cost of the project or the special assessment roll. Before construction of a project is begun, the county board shall approve the cost and the special assessment roll by resolution.

(4) The special assessment roll with the assessments listed shall be final and conclusive unless appealed in a court within 15 days after county board approval.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30715 Assessment payments; installments; amount; interest, penalty, and collection; lien; preliminary study payment credited.

Sec. 30715. (1) The county board may provide that assessments under this part are payable in installments.

(2) Assessment payments shall be sufficient to meet bond and note obligations of the special assessment district.

(3) Special assessments under this part shall be spread upon the county tax rolls, and shall be subject to the same interest and penalty charges and shall be collected in the same manner as county taxes.

(4) From the date of approval of the special assessment roll by the county board, a special assessment under this part shall constitute a lien on the parcel assessed. The lien shall be of the same character and effect as a lien created for county taxes.

(5) A payment for the cost of the preliminary study under section 30703 shall be credited against an assessment for the amount of the payment made by the person assessed.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30716 Bonds and notes; issuance.

Sec. 30716. With approval of the county board and subject to the revised municipal finance act, 2001 PA 34, MCL 141.2101 to 141.2821, the district may issue bonds or notes that shall be payable by special assessments under this part. Bonds or notes shall not be issued exceeding the cost of the lake level project that is being financed.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 2002, Act 216, Imd. Eff. Apr. 29, 2002.

Popular name: Act 451

Popular name: NREPA

324.30717 Acceptance and repayment of advance.

Sec. 30717. The delegated authority may accept the advance of work, material, or money in connection with a normal level project. The obligation to repay an advance out of special assessments under this part may be evidenced by a note or contract. Notes and contracts issued under this section are subject to the revised municipal finance act, 2001 PA 34, MCL 141.2101 to 141.2821.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 2002, Act 217, Imd. Eff. Apr. 29, 2002.

Popular name: Act 451

Popular name: NREPA

324.30718 Dam construction or maintenance; plans and specifications; approval by department; bids; work relief project.

Sec. 30718. Plans and specifications for a dam constructed or maintained under this part shall be prepared by a licensed professional engineer under the direction of the delegated authority. The plans and specifications shall be approved by the department before construction begins. The department shall review and approve or reject the plans and specifications within 30 days after they are received by the department. If the plans and specifications are rejected, the department shall propose changes in the plans and specifications that would result in their approval by the department. Bids for doing the work may be advertised in the manner the delegated authority directs. The contract shall be let to the lowest responsible bidder giving adequate security for the performance of the contract, but the delegated authority may reserve the right to reject any and all bids. The county may erect and maintain a dam as a work relief project in accordance with the law applicable to a work relief project.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30719 Dam construction; underspill device; fish ladder.

Sec. 30719. (1) The department may require that a new dam that is proposed to be constructed be equipped with an underspill device for the release of cold bottom waters for the protection of downstream fish habitats.

(2) The department may require the installation of a fish ladder or other device to permit the free passage of fish.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30720 Unauthorized change of level; penalty.

Sec. 30720. A person who is not authorized by a delegated authority or the department to operate a dam or other normal level control facility and who changes, or causes to change, the level of an inland lake, the normal level of which has been established under this part or any previous act governing lake levels, and for which the delegated authority or the department has taken steps to maintain the normal level, is guilty of a misdemeanor punishable by a fine of not more than $1,000.00 or imprisonment for not more than 1 year, or both, and shall be required to pay the actual cost of restoration or replacement of the dam and any other property including any natural resource that is damaged or destroyed as a result of the violation.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30721 Establishment of normal inland lake level prohibited in certain cases.

Sec. 30721. A normal level shall not be established for an inland lake in either of the following cases:

(a) The inland lake is used as a reservoir for a municipal water supply system, unless a normal level determination is petitioned for by the governing body of the municipality.

(b) The state has title, flowage rights, or easements to all riparian land surrounding the inland lake, unless a normal level determination is petitioned for by the department.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30722 Inspection; report; repairs; penalty; expenditure.

Sec. 30722. (1) The delegated authority of a county shall cause an inspection to be made of each dam on an inland lake within the county which has a normal level established under this part or under any previous act governing lake levels. The inspection shall be conducted by a licensed professional engineer. The inspection shall take place every third year from the date of completion of a new dam or every third year from the determination of a normal level for an existing dam. An inspection report shall be submitted promptly to the department in the form and manner the department prescribes.

(2) If a report discloses a need for repairs or a change in condition of the dam that relates to the dam's safety or danger to natural resources, the department shall conduct an inspection to confirm the report. If the report is confirmed and the public safety or natural resources are endangered by the risk of failure of the dam, the department may require the county either to repair or to replace the dam. Plans and specifications for the repairs or replacement shall be prepared by a licensed professional engineer under the direction of the delegated authority. The plans and specifications shall be approved by the department before construction

begins. The department shall review and approve or reject the plans and specifications within 30 days after they are received by the department. If the plans and specifications are rejected, the department shall propose changes in the plans and specifications that would result in their approval by the department. If the dam is in imminent danger of failure, the department may order an immediate lowering of the lake level until necessary repair or replacement is complete.

(3) A person failing to comply with this section, or falsely representing dam conditions, is guilty of misconduct in office.

(4) If an inspection discloses the necessity for maintenance or repair, the delegated authority, without approval of the county board, may spend not more than $10,000.00 annually for maintenance and repair of each lake level project. An expenditure of more than $10,000.00 annually shall be approved by resolution of the county board.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30723 Other requirements not abrogated.

Sec. 30723. This part does not abrogate the requirements of other state statutes.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

EXHIBIT 2

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF ROSCOMMON

IN THE MATTER OF THE WATER LEVEL OF
HOUGHTON LAKE, HIGGINS LAKE AND
LAKE ST. HELEN

File No. 81-3003-CF

ICHIGAN } ss
ROSCOMMON }
19 DAY OF
... A.D. 19 82
...T W. SMITH
OUNTY CLERK
Anna Br...
DEPUTY

ORDER

At a session of said Court held in the Courthouse in the Village of Roscommon, Roscommon County, State of Michigan, on the 24th day of February, 1982.

PRESENT: THE HONORABLE CARL L. HORN
Circuit Judge

This cause having come on to be heard on the Petition to Establish Water Level of Houghton Lake, Higgins Lake and Lake St. Helen, heretofore filed in this cause on behalf of the Roscommon County Board of Commissioners; it appearing that proper notice was given to interested parties; this having heard testimony of behalf of the Michigan Department of Natural Resources and interested persons appearing at the public hearing on said petition; it appearing that the following order will provide the most benefit to the public and best protect the natural resources of the state, and preserve and protect the values of property developed around said lakes; and the Court being fully advised in the premises:

IT IS HEREBY ORDERED AND ADJUDGED that the legal level of Higgins Lake, Roscommon County, Michigan, heretofore established at 1154.11 feet above mean sea level, be continued; provided, however, that said level be lowered to a level not less than 1153.61 feet, commencing on or about November 1 of each year, and restored to its legal level, commencing on or about April 15, or ice-out, which ever shall first occur, in each year.

IT IS FURTHER ORDERED AND ADJUDGED that the legal level of Houghton Lake, Roscommon County, Michigan, heretofore established at 1138.1 feet above mean sea level, be continued; provided, however, that said level be lowered to a level not less than 1137.6 feet, commencing on or about November 1 of each year, and restored to its legal level, commencing on or about April 15, or ice-out, which ever shall first occur, in each year.

IT IS FURTHER ORDERED AND ADJUDGED that the legal level of Lake St. Helen, Roscommon County, Mcihigan, heretofore established at 1154.15 feet above mean sea level, be continued; provided, however, that said level be lowered to a level not less than 1153.65 feet, commencing on or about November 1 of each year, and restored to its legal level, commencing on or about April 15, or ice-out, which ever shall first occur, in each year.

EXHIBIT

11.53.25
1154.75

IT IS FURTHER ORDERED AND ADJUDGED that, in adjusting the lake levels as herein provided, the person or persons responsible for such operations shall make every reasonable effort to take into consideration stream flows into the lake and projected snow melt runoff within the water shed, as well as providing a minimum release during refill operations.

Carl L. Horn

CARL L. HORN, Circuit Judge

lowered to a level not less than 1153.85 feet, commencing on or about November 1 of each year, and restored to its legal level, commencing on or about April 15, or ice-out, which ever shall first occur, in each year.

[illegible]

1154.25

EXHIBIT 3

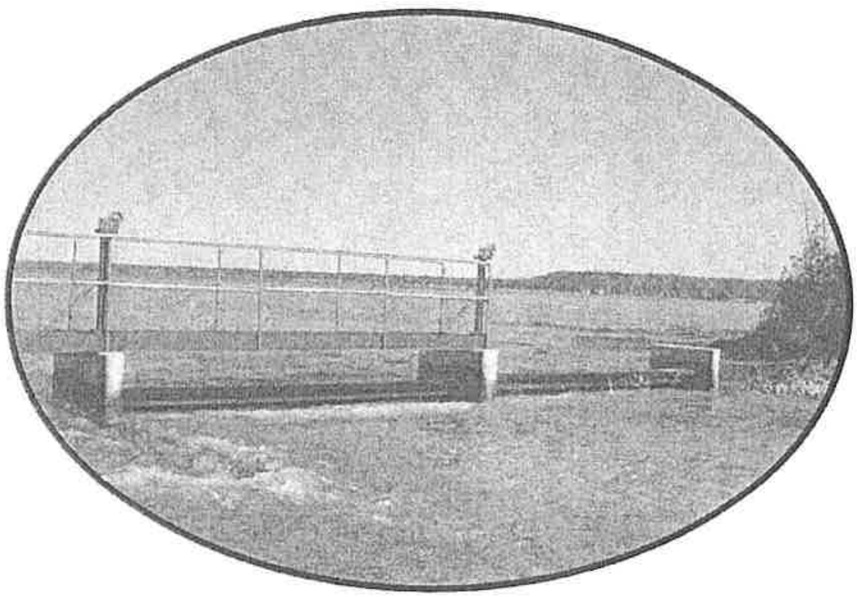
Commissioners Copy

Spicer group

ENGINEERS • SURVEYORS • PLANNERS

Higgins Lake Level Control Structure
2010 Engineering Report

State Identification No.: 2011
NW Quarter of Section 34, T24N, R03W
Gerrish Township, Roscommon County, Michigan
Located on the Cut River
Per Part 307, Act 451 of 1994



Prepared for:

Roscommon County Board of Commissioners
500 Lake St.
Roscommon, MI 48653

Prepared By:

Spicer Group, Inc.
230 S. Washington
Saginaw, Michigan 48607-1286
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Date of Report: December 14, 2010

Project I.D. Number 118475SG2010

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I. SUMMARY

The Roscommon County Board of Commissioners has commissioned Spicer Group to complete an engineering analysis of the Higgins Lake Level Control Structure (LCS). Spicer Group has prepared this report to summarize the conclusions and recommendations of the engineering analysis. This report should be adopted as a guideline for the County related to needed improvements, maintenance and operational changes for the Higgins Lake LCS.

The scope of services, as requested by the County, that were completed by Spicer Group and summarized in this report include:

- Inspection of the existing LCS as it pertains to water control and development of recommendations to address deficiencies observed.
- Calculation of hydraulic capacity of the LCS and development of recommendations that address deficiencies determined.
- Analyze historical lake level data and, based on the data, develop recommendations regarding operation of the LCS.
- Assess impact of wave action at the LCS and estimate water loss due to wave action.
- Assess impact of flow through the unregulated section of the LCS and estimate water loss through the section.
- Assess water loss from the lake due to evaporation.
- Prepare recommendations related to the operation of the LCS.
- This study does not include an assessment of the suitability of the court established lake level as it relates to lake uses and erosion rates along the lake.

The general conclusion is that the Higgins Lake LCS has adequate hydraulic capacity during large runoff events. However, discharge from the lake is limited by the capacity of the Cut River. Additionally, this study has found that the level of Higgins Lake has averaged below the court established legal lake level during the summer months in typical years. Factors such as water loss due to evaporation, wave action and flow through an unregulated low flow channel contribute to the low summer levels. Losses due to evaporation have been calculated to be the most substantial factor followed by flow through the unregulated span and then by losses due to wave action.

In 2007, the structure was altered to include two additional tilting weir gates (also referred to as "flop gates") totaling 33 feet in length and an unregulated low-flow channel measuring roughly 4.75 feet in width. Through comparison of historical data, the average lake level was found to have been lower in the period following these alterations than the period prior. This does not appear to be attributable to a drought as precipitation in the years immediately following the structure's alteration has been well above average. Therefore, if legal levels are to be maintained annually, water levels must exceed the legal level in the early summer months to conserve an adequate volume to maintain the legal level through the later summer months.

The Higgins Lake structure is in need of minor repairs and modifications, but, overall, the LCS is in good condition. Alterations are needed to improve LCS operation to enable lake levels to be maintained closer to the legal level. Specifically, a restrictor should be placed in the low flow channel to reduce the amount of flow to the Cut River in late summer. Also, scour protection should be added to the low flow channel, improvements should be made to the sheet piling portions and improvements should be made to the stop logs. Also, the staff gage should be replaced.

II. BACKGROUND

This section outlines Spicer Group's understanding of the background and history of the LCS. The following information is based on records and data that were provided by Roscommon County.

The legal lake level in Higgins Lake was set by an order issued in 1982 by a Roscommon Circuit Court, in accordance with Part 307 of Public Act 451 of 1994. This order set the legal level at 1154.11 feet above mean sea level for summer and 1153.61 feet for winter months. In 2009, the legal winter level was temporarily amended (effective through 2013/2014) to be 1153.36 beginning between September 15 and November 1. These orders did not specify the elevation datum. Therefore, Spicer Group has assumed the datum to be NGVD '29. This assumption is corroborated by the 1969 and 1995 reports by Ayres, Lewis, Norris and May Consulting Engineers which refer to the "USGS datum." The USGS datum at Higgins Lake is based on NGVD '29 elevations. Furthermore, it is assumed that the intent of 2009 order was to lower the lake level relative to the NGVD '29 and conversions to the NAVD '88 were not completed.

In accordance with Part 307, Roscommon County is responsible for the operation, maintenance and improvement of the LCS. The purpose of this analysis and report is to provide the County with conclusions and recommendation consistent with their responsibilities pursuant to Part 307.

The Higgins Lake Level Control Structure (LCS) regulates flow leaving Higgins Lake to the Cut River. The structure was originally constructed in 1950 however an original engineering plan set of the structure has not been provided. Significant hydraulic modifications to the structure were made in 2007. Improvements to the LCS which included the addition of two (2) 17-foot tilting weir gates and the creation of a 4.75 foot low-flow channel in the center of the structure. These additions in conjunction with the existing three stop log bays, sheet pile weir, and tilting weir gate provide a total length of approximately 90 feet. An overview drawing of the existing structure is shown in Appendix A and a photograph of the upstream face of the structure is shown in the Inspection section (see Figure 1).

Several previous studies have been done on Higgins Lake including two reports by Ayres, Lewis, Norris, and May, Inc. in 1969 and 1995. These studies assess the hydraulics of the LCS and the capacity of the Cut River. Both studies concluded that under high flow conditions, the capacity of the LCS to dewater the lake is limited by the capacity of the downstream river. The 1995 report found that flow out of Higgins Lake is limited by the capacity of the Cut River when flows exceed 110-120 cfs. Therefore, improvements to the LCS beyond the capacity of the downstream river would not be useful in operating lake levels. With the improvements made to the structure in 2007, the Higgins Lake LCS is capable of conveying more flow than the Cut River can accept. This finding is corroborated by testimony from property owners that during large storm, there is no visible head loss across the structure. Therefore, under these conditions, the Cut River capacity limits the flow from Higgins Lake.

Recently, the Board of Commissioners has received complaints of the lake level being too low. At other times, complaints have been received that the lake level is too high. A committee regarding Higgins Lake was formed. The committee includes participation from the Board of Commissioners. Based on input from the committee and the public, the Board of Commissioners directed to have this evaluation of the Higgins Lake LCS completed.

III. INSPECTION

A surface visual inspection of the Higgins Lake LCS was performed by Spicer Group on July 26, 2010. This inspection focused primarily on those aspects of the structure affecting its capacity and hydraulics and secondarily on structural components of the LCS. The following sections detail the findings of this inspection. For reference, a drawing of the existing LCS is in Appendix A. Specific features of the structure are labeled below in Figure 1. Additional pictures of individual components of the LCS are included in Appendix B.

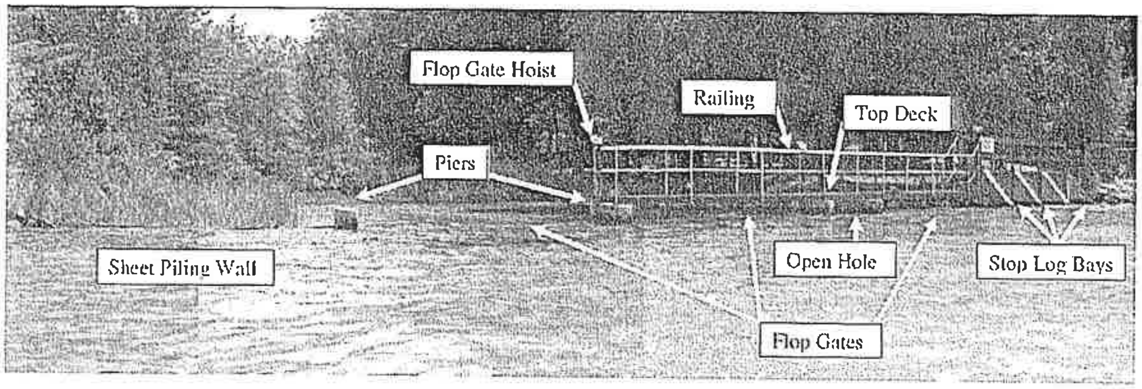


Figure 1: Structural features of the Higgins Lake LCS from the upstream face.

A. Top Deck and Railing

The top deck and railing were found to be in generally good condition with some rust. There is presently no step at the south end of the structure from which to step onto the top deck. The addition of a step here would make access easier.

B. Center Piers

Concrete comprising the center piers appears to be in good condition with only minor areas of spalling.

C. Sheet Piling Walls

The sheet piling cap at north end of structure is in poor condition and uneven. Improvements should be made to this portion of the structure and the cap elevation should be raised slightly.

D. Gates and Operational Features

Gates and gate hoists appear to be in good working order. The stop logs in the three southernmost bays are in poor condition and allow some water to flow between them. Improvements to the stop logs should be made. Also, the staff gage is worn and hard to read. A new staff gage should be installed.

E. Apron Concrete

The apron concrete is in generally good condition. However, no apron exists below the unregulated low flow channel. Scour has begun to occur in this concentrated flow area. The concrete apron should be extended across the open span to resist further erosion.

IV. LAKE LEVEL

In 1982, a court order established the legal level of Higgins Lake at 1154.11 feet for summer months and 1153.61 feet between November 1 and April 15, or ice-out, whichever occurs first. This order was amended in November of 2009 (effective until 2013/2014) to establish the legal winter level at 1153.36 feet with lowering of the lake level beginning each year between September 15 and November 1. Lake level data were obtained from USGS gage #442805084411001. For a period of record from 1986 to 2009, the lake level has averaged 0.1 feet above the legal level to 0.3 feet below the legal level during summer months and 0.15 to 0.4 feet above the legal level during winter months relative to the legal level effective prior to 2009. This comparison is shown below in Figure 2. Note that the legal winter level was amended in 2009 and therefore, the winter lake level trends shown in Figure 2 do not reflect operating procedures currently employed at the Higgins Lake LCS. However, the trends for summer months should be indicative of current procedures as the summer level has not been altered.

Average monthly precipitation data shown in the below graph was collected by the Michigan State University Climatologist's Office using gages located near Houghton and Higgins Lakes for the years of 1971 through 2000 and 1951 through 1978 respectively.

Note that Figure 2 shows the average monthly lake level for the period prior to 2007 and the average level after 2007. As stated in the Hydraulics section, the LCS was modified in 2007 and a low-flow channel was added. It appears from Figure 2 that the average lake level has decreased by 0.1 to 0.4 feet relative with the periods prior to the modification.

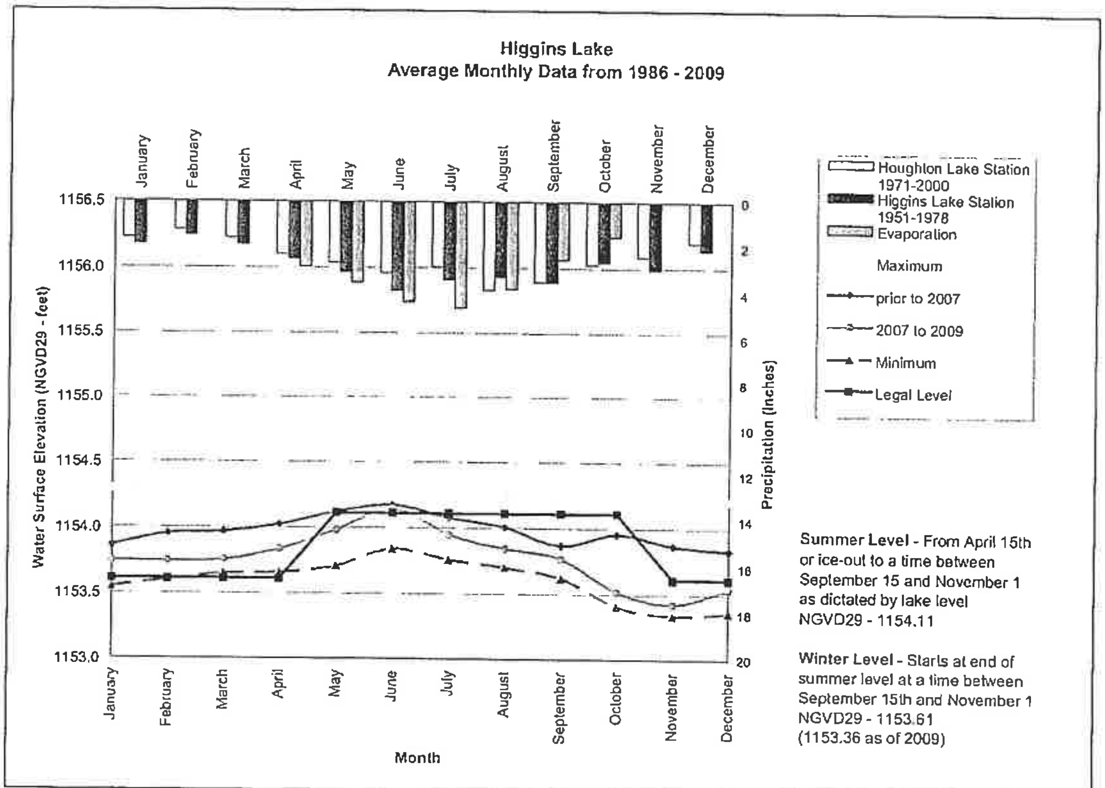


Figure 2: USGS gage data for Higgins Lake related to precipitation and evaporation.

The following sections outline various sources of water loss from Higgins Lake that impact summer water levels.

A. Evaporation

The Michigan State University "Enviro-weather" website provided potential evapo-transpiration (PET) rates for July and August of 2010. The weather station used to obtain these data is located in Arlene, approximately 20-25 miles west of Higgins Lake. Rates of PET were typically between 0.1 and 0.3 inches per day. However, these data included transpiration, which does not occur on open water bodies.

To assess evaporation alone, pan evaporation measurements were used. Monthly averages for pan evaporation were taken from the NOAA Nation Climatic Data Center (NCDC) at Lake City for the years 1967-2008. This site is also approximately 20-25 miles west of Higgins Lake. To convert these pan evaporation rates to lake evaporation rates, pan rates were multiplied by 0.7 as suggested by the "General Guidelines for Calculating a Water Budget" from the Land and Water Management Division of the Michigan DNRE (March 2010). This yielded an average summer evaporation rate of 0.11 inches/day with the highest monthly rate occurring in July (0.15 inches/day). This rate closely matched the summer rate shown in Figure 2 of the aforementioned DNRE document which was 0.11 inches/day (20 inches total evaporation for May-October). The DNRE report is included in Appendix D along with evaporation rates calculated from NCDC data in Appendix E. Monthly evaporation rates are shown on Figure 2 as a hyetograph along the top horizontal axis.

B. Precipitation

Precipitation data were collected from the Michigan State University Climatology website. These data were broken down on a monthly basis for gauging stations at both Higgins Lake and

Houghton Lake as shown in Figure 2. When compared to lake levels in Higgins Lake, months of historically high precipitation have allowed lake levels to rise during summer months.

Data were also collected from the NOAA NCDC on Houghton Lake and at the Roscommon Airport. Though these gages were not specifically on Higgins Lake, they provided a detailed view of changes in precipitation over various time periods. Of particular interest was that in the period of 2007-2010, average rainfall has been over two inches higher than the average of prior years. This appears to indicate that a lack of rainfall has not contributed to lower lake levels observed for the period after the LCS was modified in 2007.

C. Wave Losses

An estimate was created for wave action occurring over the Higgins Lake LCS. This analysis used field observations gathered on 8/31/2010 to estimate wave velocity and frequency. Based on these observations, a design wave speed of 5.0 feet/second was assumed with a frequency of 1.0 waves/second. To obtain an estimate of water loss from wave action, it was assumed that the mean water surface (midpoint of waves) was at the top of the LCS and therefore, the volume of water contained in each wave above this height left the lake. Table 1 gives average daily water loss for waves of varying heights sustained for 24 hour periods. The wave height shown is the distance from crest to trough of each wave.

Table 1: Water lost due to wave action for waves of varying height. Height is given as the total height from crest to trough.

Height (inches)	24-hr Loss (in/day)
4	0.03
6	0.05
9	0.08
12	0.10
18	0.16
24	0.21

D. Water Loss Through Low-Flow Channel

The low-flow channel cut in the dam is approximately 4.75 feet wide with a 4-inch rubber restrictor on one side. From the top of the concrete sill to the top of the pier, the opening is three feet in height however, the distance from the top of the concrete sill to summer legal lake level it is only two feet. Assuming Higgins Lake is at its normal summer level and backwater effects from the Cut River are negligible, it is calculated that 33 cfs flows through the low-flow channel. This flow rate is equivalent to 0.08 in/day draining from the lake assuming there is no inflow to the lake. If 1.0 foot of tailwater is assumed, 28 cfs is allowed to pass through the low-flow channel which equates to a loss of 0.07 in/day, again assuming no inflow to the lake.

E. Summary of Findings

Prior to 2007, the LCS on Higgins Lake did not have a center low-flow channel allowing constant flow to the Cut River and therefore water exited the lake by either evaporation, wave loss over the LCS, or operation of the LCS. By cutting a hole in the center of the structure, the amount of water leaving the LCS during summer months was calculated to increase by roughly 30 percent over the losses due to evaporation and wave action alone. This finding was corroborated through comparison of lake level trends before and after the lake level control structure was modified. Average lake levels in Higgins Lake have decreased by an average of about 0.20 feet in the past three years. Table 2 shows a summary of losses from Higgins Lake based on what are thought to be typical summer conditions.

Table 2: Summary of normal water losses from Higgins Lake.

Water Loss Type	Depth Loss (in/day)
Evaporation	0.10-0.15
Wave Action	0.05
Low-Flow Channel	0.07

Note that this observed decrease in lake level is based on only three years of available data. Upon further data collection, these findings can be reassessed. Although, since precipitation has been above average for the past three years, it seems unlikely that a lack of precipitation has lead to this decrease in water surface.

V. HYDRAULICS

A review and basic assessment of hydraulic calculations for the Higgins Lake LCS was compiled. In performing this review, the first step was to review recently completed studies. A report by Ayres, Lewis, Norris and May, Inc. in May 1995 indicated that the LCS capacity was 55 cfs without a rise in the lake above its legal summer level. The overall capacity of the Cut River was determined to be 110-120 cfs. In general accordance with the 1995 report, modifications were made to the LCS in 2007. The modifications included the addition of two tilting weir (flop) gates totaling 33 feet in length and a low-flow channel roughly 4.75 feet in width. This altered the hydraulic characteristics of the structure such that the hydraulic capacity of the LCS now exceeds the capacity of the Cut River.

A discharge request filed with the Michigan Department of Natural Resources and Environment (MDNRE) on June 9, 2010, reported a 100-year peak flow at the Higgins Lake LCS of 330 cfs. Weir calculations for flow over the structure indicate that with all stop logs removed, gates down, and flow in the Cut River one foot above the invert of the low-flow channel (one foot below legal summer level), 330 cfs can pass through the structure with Higgins Lake at its summer level using the weir and submerged weir equations shown in Appendix C. The center span was modeled as a culvert using Culvertmaster computer software. Despite these calculations, information from the 1995 report coupled with testimony from local residents, indicates that during high flows, there is no noticeable head loss across the LCS. Therefore, flow over the Higgins Lake LCS is ultimately controlled by the downstream Cut River and the LCS provides adequate capacity.

VI. RECOMMENDATIONS

Lake level data on Higgins Lake have shown that the lake has historically been maintained below its legal summer level, notably later in the summer. The following sections outline physical and operational changes that are recommended to help maintain the lake near its legal level and to improve the structural condition of the structure.

A. Structural Improvements

The open span in the center of the Higgins Lake LCS creates high velocities which have caused scour to occur along the downstream toe of the structure therefore, the concrete apron should be extended across the open span to resist further erosion. Also, the sheet pile weir on the north end of the structure has deteriorated and should be improved. Such improvements may include the addition of riprap reinforcement, new sheet piling, and/or a concrete cap on the existing sheeting. When performing such improvements, the sheet piling should be set to an elevation roughly 0.2 feet above the legal summer level. This will assist in attempting to conserve water by holding the elevation at desired times, in excess of the legal level.

Stop logs in the three southernmost bays are in poor condition. However, since the present structure has sufficient capacity to regulate flow using primarily the gates, these logs are seldom needed for lake level regulation. Therefore, rather than replacing the stop logs with new stop logs, a fabricated insert with a top elevation slightly above the legal summer level may be used instead. This would only rarely, if ever, need to be operated.

B. Operational Features

The low-flow channel in the center of the LCS allows constant flow from the structure. Since levels have historically been lower than the legal level, this flow should be reduced during the summer months of July, August and into September. It is recommended that a removable insert be fabricated to enable greater retention of water in the lake. An example of such an insert is shown in Appendix F. If necessary, further control of water leaving the lake could be achieved by mitigating the effects of wave action. This could be done through the installation of a concrete, riprap, or steel break wall. However, the option of controlling wave loss would likely be far more costly than the installation of a restrictor plate and produce less results as more flow discharges via the center span than via wave action.

Operational features which provide accurate and reliable lake level data can facilitate more precise control of lake levels. Spicer Group recommends that the existing staff gage be replaced with one calibrated to the current lake datum. Since Higgins Lake has not been shown to be prone to large, frequent fluctuations in lake level (see Figure 2), the structure does not typically require that the LCS gates be operated regularly to adjust level. Therefore, a remotely transmitting lake level sensor would not be cost effective. Furthermore, the wave action near the Higgins Lake LCS would likely cause any digital sensor to be inaccurate.

C. Operation Guidelines

Note that these guidelines will depend largely on the capacity of the Cut River downstream of the LCS. The 1995 report indicated that the capacity of the Cut River was between 110 and 120 cfs. This is substantially less than the 330 cfs 100-year peak flow rate identified by the MDNRE.

1. Summer Level (NGVD 1154.11)

As stated previously, the level of Higgins Lake has historically been maintained below the court established summer level. Therefore, additional water must be retained in the months of May and June. Recent flow data suggests that roughly 0.4 feet of water is lost between July and September. Therefore, to maintain an average level near the summer legal level, approximately 0.2 feet of water above the legal lake level should be achieved in June.

Around April 15 or ice-out each year, the LCS should be closed to limit flow from the lake. Maintain the LCS to limit flow unless levels rise to more than 0.2 feet above the legal level. If this should occur, operate the LCS to allow the lake to return to a level of 0.2 feet above the legal level.

In the months of July, August, and September, the lake level will naturally decrease. Therefore, the LCS should remain closed in an effort to maintain the lake near the court established legal level. Also, the flow restriction device should be installed in the unregulated section of the LCS. Under the court order effective for winter seasons of 2009/2010 through 2013/2014, the LCS should be opened beginning between September 15 and November 1 to draw the lake down to its legal winter level. Due to the limitation of the Cut River to accept flow, it should not be necessary to remove stop logs during this drawdown period.

2. *Winter Level (NGVD 1153.36 through winter 2013/2014)*

Maintain the LCS in its open position during the winter months. In the event that the lake level drops more than 0.2 feet below the legal level, operate the LCS. On April 15 or ice-out, the LCS gate should be incrementally raised.

EXHIBIT 4

NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION ACT (EXCERPT)
Act 451 of 1994

PART 301
INLAND LAKES AND STREAMS

324.30101 Definitions.

Sec. 30101. As used in this part:

(a) "Bottomland" means the land area of an inland lake or stream that lies below the ordinary high-water mark and that may or may not be covered by water.

(b) "Bulkhead line" means a line that is established pursuant to this part beyond which dredging, filling, or construction of any kind is not allowed without a permit.

(c) "Dam" means an artificial barrier, including dikes, embankments, and appurtenant works, that impounds, diverts, or is designed to impound or divert water.

(d) "Department" means the department of environmental quality.

(e) "Expand" means to occupy a larger area of an inland lake or stream than authorized by a permit issued under this part for marina mooring structures and watercraft moored at the marina.

(f) "Fund" means the land and water management permit fee fund created in section 30113.

(g) "Height of the dam" means the difference in elevation measured vertically between the natural bed of an inland lake or stream at the downstream toe of the dam, or, if it is not across a stream channel or watercourse, from the lowest elevation of the downstream toe of the dam, to the design flood elevation or to the lowest point of the top of the dam, whichever is less.

(h) "Impoundment" means water held back by a dam, dike, floodgate, or other barrier.

(i) "Inland lake or stream" means either of the following:

(*i*) An artificial or natural lake, pond, or impoundment that is a water of the United States as that term is used in section 502(7) of the federal water pollution control act, 33 USC 1362.

(*ii*) A natural or artificial lake, pond, or impoundment; a river, stream, or creek which may or may not be serving as a drain as defined by the drain code of 1956, 1956 PA 40, MCL 280.1 to 280.630; or any other body of water that has definite banks, a bed, and visible evidence of a continued flow or continued occurrence of water, including the St. Marys, St. Clair, and Detroit Rivers.

Inland lake or stream does not include the Great Lakes, Lake St. Clair, or a lake or pond that has a surface area of less than 5 acres.

(j) "Marina" means a facility that is owned or operated by a person, extends into or over an inland lake or stream, and offers service to the public or members of the marina for docking, loading, or other servicing of recreational watercraft.

(k) "Minor offense" means either of the following violations of this part if the project involved in the offense is a minor project or the department determines that restoration of the affected property is not required:

(*i*) The failure to obtain a permit under this part.

(*ii*) A violation of a permit issued under this part.

(*l*) "Mooring structures" means structures used to moor watercraft, including, but not limited to, docks, piers, pilings, mooring anchors, lines and buoys, and boat hoists.

(m) "Ordinary high-water mark" means the line between upland and bottomland that persists through successive changes in water levels, below which the presence and action of the water is so common or recurrent that the character of the land is marked distinctly from the upland and is apparent in the soil itself, the configuration of the surface of the soil, and the vegetation. On an inland lake that has a level established by law, it means the high established level. Where water returns to its natural level as the result of the permanent removal or abandonment of a dam, it means the natural ordinary high-water mark.

(n) "Project" means an activity that requires a permit pursuant to section 30102.

(o) "Property owners' association" means any group of organized property owners publishing a directory of their membership, the majority of which are riparian owners and are located on the inland lake or stream that is affected by the proposed project.

(p) "Reconfigure" means to, without expanding the marina, do either of the following:

(*i*) Change the location of the dock or docks and other mooring structures at the marina to occupy an area of the inland lake or stream that was not previously authorized by a permit issued under this part.

(*ii*) Decrease the distance available for ingress and egress to an outside slip as described in section 30106a.

(q) "Riparian interest area" means that portion of an inland lake or stream over which a riparian owner has an ownership interest.

(r) "Riparian owner" means a person who has riparian rights.

(s) "Riparian rights" means those rights which are associated with the ownership of the bank or shore of an inland lake or stream.

(t) "Seasonal structure" includes any type of dock, boat hoist, ramp, raft, or other recreational structure that is placed into an inland lake or stream and removed at the end of the boating season.

(u) "Seawall" means a vertically sloped wall constructed to break the force of waves and retain soil for the purpose of shore protection.

(v) "Structure" includes a wharf, dock, pier, seawall, dam, weir, stream deflector, breakwater, groin, jetty, sewer, pipeline, cable, and bridge.

(w) "Upland" means the land area that lies above the ordinary high-water mark.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 1999, Act 106, Imd. Eff. July 7, 1999;—Am. 2006, Act 275, Imd. Eff. July 7, 2006;—Am. 2009, Act 139, Imd. Eff. Nov. 4, 2009;—Am. 2014, Act 351, Eff. Jan. 16, 2015;—Am. 2018, Act 631, Eff. Mar. 29, 2019.

Compiler's note: For transfer of authority, powers, duties, functions, and responsibilities of the Land and Water Management Division, with the exception of the farmland and open space preservation program, natural rivers program, and Michigan information resource inventory system, to the Director of the Michigan Department of Environmental Quality, see E.R.O. No. 1995-16, compiled at MCL 324.99901 of the Michigan Compiled Laws.

Popular name: Act 451

Popular name: NREPA

324.30101a Applicability of powers and duties of department to "navigable waters" and "waters of the United States" as defined in federal law.

Sec. 30101a. For the purposes of this part, the powers, duties, functions, and responsibilities exercised by the department because of federal approval of Michigan's permit program under section 404(g) and (h) of the federal water pollution control act, 33 USC 1344, apply only to "navigable waters" and "waters of the United States" as defined under section 502(7) of the federal water pollution control act, 33 USC 1362, and further refined by federally promulgated rules and court decisions that have the full effect and force of federal law. Determining whether additional regulation is necessary to protect Michigan waters beyond the scope of federal law is the responsibility of the Michigan legislature based on its determination of what is in the best interest of the citizens of this state.

History: Add. 2013, Act 98, Imd. Eff. July 2, 2013.

Popular name: Act 451

Popular name: NREPA

324.30102 Operations prohibited without permit; exception.

Sec. 30102. (1) Except as provided in this part, a person without a permit from the department shall not do any of the following:

(a) Dredge or fill bottomland.

(b) Construct, enlarge, extend, remove, or place a structure on bottomland.

(c) Construct, reconfigure, or expand a marina.

(d) Create, enlarge, or diminish an inland lake or stream.

(e) Structurally interfere with the natural flow of an inland lake or stream.

(f) Construct, dredge, commence, extend, or enlarge an artificial canal, channel, ditch, lagoon, pond, lake, or similar waterway where the purpose is ultimate connection with an existing inland lake or stream, or where any part of the artificial waterway is located within 500 feet of the ordinary high-water mark of an existing inland lake or stream.

(g) Connect any natural or artificially constructed waterway, canal, channel, ditch, lagoon, pond, lake, or similar water with an existing inland lake or stream for navigation or any other purpose.

(2) A person shall not remove submerged logs from rivers or streams for the purpose of submerged log recovery. This subsection does not prohibit the department from issuing a permit under this part for other purposes, including removing logjams or removing logs that interfere with navigation of the river or stream.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 2009, Act 139, Imd. Eff. Nov. 4, 2009;—Am. 2011, Act 218, Imd. Eff. Nov. 10, 2011.

Compiler's note: For transfer of authority, powers, duties, functions, and responsibilities of the Land and Water Management Division, with the exception of the farmland and open space preservation program, natural rivers program, and Michigan information resource inventory system, to the Director of the Michigan Department of Environmental Quality, see E.R.O. No. 1995-16, compiled at MCL 324.99901 of the Michigan Compiled Laws.

Popular name: Act 451

Popular name: NREPA

324.30103 Exceptions; "water withdrawal" and "agricultural drain" defined.

Sec. 30103. (1) A permit is not required under this part for any of the following:

(a) Any fill or structure existing before April 1, 1966, in waters covered by former 1965 PA 291, and any fill or structures existing before January 9, 1973, in waters covered for the first time by former 1972 PA 346.

(b) A seasonal structure placed on bottomland to facilitate private noncommercial recreational use of the water if it does not unreasonably interfere with the use of the water by others entitled to use the water or interfere with water flow.

(c) Reasonable sanding of beaches to the existing water's edge by the riparian owner or a person authorized by the riparian owner.

(d) Maintenance of an agricultural drain, regardless of outlet, if all of the following requirements are met:

(*i*) The maintenance includes only activities that maintain the location, depth, and bottom width of the drain as constructed or modified at any time before July 1, 2014.

(*ii*) The maintenance is performed by the landowner or pursuant to the drain code of 1956, 1956 PA 40, MCL 280.1 to 280.630.

(e) Maintenance and operation of a waste collection or treatment facility either ordered to be constructed or approved for operation under a state or a federal water pollution control law and this part. For purposes of this subdivision, "operation" includes dredging, filling, or construction and placement of structures in the waste collection or treatment facility in compliance with this act.

(f) Construction and maintenance of minor drainage structures and facilities that are identified by rule promulgated by the department under section 30110. Before a rule is promulgated pursuant to this subsection, the rule must be approved by the majority of a committee consisting of the director of the department, the director of the department of agriculture and rural development, and the director of the state transportation department or their designated representatives. The rules shall be reviewed at least annually.

(g) Maintenance of a drain that either was legally established and constructed before January 1, 1973, pursuant to the drain code of 1956, 1956 PA 40, MCL 280.1 to 280.630, except those legally established drains constituting mainstream portions of certain natural watercourses identified in rules promulgated by the department under section 30110, or was constructed or modified under a permit issued pursuant to this part. As used in this subdivision, "maintenance of a drain" means the physical preservation of the location, depth, and bottom width of a drain and appurtenant structures to restore the function and approximate capacity of the drain as constructed or modified at any time before July 1, 2014, and includes, but is not limited to, the following activities if performed with best management practices:

(*i*) Excavation of accumulated sediments back to original contours.

(*ii*) Reshaping of the side slopes.

(*iii*) Bank stabilization where reasonably necessary to prevent erosion. Materials used for stabilization must be compatible with existing bank or bed materials.

(*iv*) Armoring, lining, or piping if a previously armored, lined, or piped section is being repaired and all work occurs within the footprint of the previous work.

(*v*) Replacement of existing control structures, if the original function of the drain is not changed and the original approximate capacity of the drain is not increased.

(*vi*) Repair of stabilization structures.

(*vii*) Culvert replacement, including culvert extensions of not more than 24 additional feet per culvert.

(*viii*) Emergency reconstruction of recently damaged parts of the drain. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption.

(h) Projects constructed under the watershed protection and flood prevention act, 16 USC 1001 to 1012.

(i) Construction and maintenance of privately owned cooling or storage ponds used in connection with a public utility except at the interface with public waters.

(j) Maintenance of a structure constructed under a permit issued pursuant to this part and identified by rule promulgated under section 30110, if the maintenance is in place and in kind with no design or materials modification.

(k) A water withdrawal.

(*l*) Annual installation of a seasonal dock or docks, pilings, mooring buoys, or other mooring structures previously authorized by and in accordance with a permit issued under this part.

(m) Controlled access of livestock to streams for watering or crossing if constructed in accordance with applicable practice standards set by the United States Department of Agriculture, Natural Resources Conservation Service.

(n) Temporary drawdowns of impoundments at hydroelectric projects licensed by the federal energy regulatory commission (FERC) and subject to FERC's authority if both of the following apply:

(*i*) The FERC licensee has consulted this state during the drawdown plan development and this state's concerns have been addressed in the drawdown plan as FERC considers appropriate.

(*ii*) Adverse environmental impacts, including stream flow, aquatic resources, and timing, have been avoided and minimized to the extent practical.

(o) Removal, by the riparian owner or a person authorized by the riparian owner, of plants that are an aquatic nuisance as defined in section 3301, if the removal is accomplished by hand-pulling without using a powered or mechanized tool and all plant fragments are removed from the water and properly disposed of on land above the ordinary high-water mark as defined in section 30101.

(p) Raking of lake bottomlands by the riparian owner or a person authorized by the riparian owner. To minimize effects on the lake bottomlands, the areas raked shall be unvegetated before raking and predominantly composed of sand or pebbles, and the raking shall be performed without using a powered or mechanized tool. For the purposes of this subdivision, the pulling of a nonpowered, nonmechanized tool with a boat is not the use of a powered or mechanized tool.

(2) As used in this section, "water withdrawal" means the removal of water from its source for any purpose.

(3) As used in this part, "agricultural drain" means a human-made conveyance of water that meets all of the following requirements:

(a) Does not have continuous flow.

(b) Flows primarily as a result of precipitation-induced surface runoff or groundwater drained through subsurface drainage systems.

(c) Serves agricultural production.

(d) Was constructed before January 1, 1973, or was constructed in compliance with this part or former 1979 PA 203.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 2006, Act 33, Imd. Eff. Feb. 28, 2006;—Am. 2009, Act 139, Imd. Eff. Nov. 4, 2009;—Am. 2013, Act 98, Imd. Eff. July 2, 2013;—Am. 2014, Act 253, Imd. Eff. June 30, 2014;—Am. 2018, Act 163, Eff. Aug. 21, 2018.

Popular name: Act 451

Administrative rules: R 281.811 et seq. of the Michigan Administrative Code.

Popular name: NREPA

324.30104 Application for permit; fees; refund.

Sec. 30104. (1) A person shall not undertake a project subject to this part except as authorized by a permit issued by the department pursuant to part 13. An application for a permit shall include any information that may be required by the department. If a project includes activities at multiple locations, 1 application may be filed for the combined activities.

(2) Except as provided in subsections (3) and (4), until October 1, 2019, an application for a permit shall be accompanied by an application fee based on an administrative cost in accordance with the following schedule:

(a) For a permit for a seasonal drawdown or associated reflooding, or both, of a dam or impoundment for the purpose of weed control that is issued for the first time after October 9, 1995, an initial fee of $500.00 with subsequent permits for the same purpose being assessed a $50.00 fee.

(b) For activities included in a minor project category established under section 30105(7), a fee of $100.00.

(c) For activities included in a general permit category established under section 30105(8), a fee of $50.00.

(d) For construction or expansion of a marina, a fee as follows:

(*i*) $50.00 for an expansion of 1-10 slips to an existing permitted marina.

(*ii*) $100.00 for a new marina with 1-10 proposed marina slips.

(*iii*) $250.00 for an expansion of 11-50 slips to an existing permitted marina, plus $10.00 for each slip over 50.

(*iv*) $500.00 for a new marina with 11-50 proposed marina slips, plus $10.00 for each slip over 50.

(*v*) $1,500.00 if an existing permitted marina proposes maintenance dredging of 10,000 cubic yards or more, unless the dredge material has been determined through testing to be 90% or more sand, or the addition of seawalls, bulkheads, or revetments of 500 feet or more.

(e) For major projects other than a project described in subdivision (d)(*v*), involving any of the following, a fee of $2,000.00:

(*i*) Dredging of 10,000 cubic yards or more, unless the dredge material has been determined through testing to be 90% or more sand.

(*ii*) Filling of 10,000 cubic yards or more.

(*iii*) Seawalls, bulkheads, or revetments of 500 feet or more.

(*iv*) Filling or draining of 1 acre or more of wetland contiguous to a lake or stream.

(*v*) New dredging or upland boat basin excavation in areas of suspected contamination.
(*vi*) Shore projections, such as groins and underwater stabilizers, that extend 150 feet or more into a lake or stream.
(*vii*) New commercial docks or wharves of 300 feet or more in length.
(*viii*) Stream enclosures 100 feet or more in length.
(*ix*) Stream relocations 500 feet or more in length.
(*x*) New golf courses.
(*xi*) Subdivisions.
(*xii*) Condominiums.
(f) For the removal of submerged logs from bottomland of an inland lake, a $500.00 fee.
(g) For all other projects not listed in subdivisions (a) through (f), a fee of $500.00.
(3) A project that requires review and approval under this part and 1 or more of the following acts or parts of acts is subject to only the single highest fee required under this part or the following acts or parts of acts:
(a) Section 3104.
(b) Part 303.
(c) Part 323.
(d) Part 325.
(e) Section 117 of the land division act, 1967 PA 288, MCL 560.117.
(4) If work has been done in violation of a permit requirement under this part and restoration is not ordered by the department, the department may accept an application for a permit if the application is accompanied by a fee equal to 2 times the permit fee required under this section.
(5) If the department denies an application for a permit under this part, the department shall promptly refund the application fee paid under this section.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 1995, Act 171, Imd. Eff. Oct. 9, 1995;—Am. 1996, Act 97, Imd. Eff. Feb. 28, 1996;—Am. 1999, Act 106, Imd. Eff. July 7, 1999;—Am. 2003, Act 163, Imd. Eff. Aug. 12, 2003;—Am. 2004, Act 325, Imd. Eff. Sept. 10, 2004;—Am. 2006, Act 275, Imd. Eff. July 7, 2006;—Am. 2006, Act 531, Imd. Eff. Dec. 29, 2006;—Am. 2008, Act 276, Imd. Eff. Sept. 29, 2008;—Am. 2009, Act 139, Imd. Eff. Nov. 4, 2009;—Am. 2011, Act 90, Imd. Eff. July 15, 2011;—Am. 2011, Act 218, Imd. Eff. Nov. 10, 2011;—Am. 2013, Act 13, Imd. Eff. Mar. 27, 2013;—Am. 2013, Act 98, Imd. Eff. July 2, 2013;—Am. 2015, Act 76, Eff. Oct. 1, 2015.

Popular name: Act 451

Popular name: NREPA

324.30104b Applicability of MCL 324.30306b to proposed project or proposed permit application.

Sec. 30104b. Section 30306b applies to a proposed project or a proposed permit application under this part.

History: Add. 2006, Act 592, Imd. Eff. Jan. 3, 2007;—Am. 2010, Act 179, Imd. Eff. Sept. 30, 2010;—Am. 2015, Act 76, Eff. Oct. 1, 2015.

Popular name: Act 451

Popular name: NREPA

324.30105 Pending applications; posting on website; public hearing; review of application; statement; final inspection and certification; notice of hearing; conditional permit in emergency; provisions applicable to minor project; issuance of general permits; minor project category; general permit for activities in drains; definitions.

Sec. 30105. (1) The department shall post on its website all of the following under this part:
(a) A list of pending applications.
(b) Public notices.
(c) Public hearing schedules.
(2) The department may hold a public hearing on pending applications.
(3) Except as otherwise provided in this section, upon receiving an application, the department shall submit copies for review to the director of the department of community health or the local health department designated by the director of the department of community health, to the city, village, or township and the county where the project is to be located, to the local conservation district, to the watershed council established under part 311, if any, to the local port commission, if any, and to the persons required to be included in the application pursuant to section 30104. Each copy of the application shall be accompanied by a statement that unless a written request is filed with the department within 20 days after the submission for review, the department may grant the application without a public hearing where the project is located. The department may hold a public hearing upon the written request of the applicant or a riparian owner or a

governmental unit or other person that is entitled to receive a copy of the application pursuant to this subsection.

(4) After completion of a project for which an application is approved, the department may cause a final inspection to be made and certify to the applicant that the applicant has complied with the department's permit requirements.

(5) At least 10 days' notice of a hearing to be held under this section shall be given by publication in a newspaper circulated in the county where the project is to be located, to the person requesting the hearing, and to the governmental units and other persons that are entitled to receive a copy of the application pursuant to subsection (3).

(6) In an emergency, the department may issue a conditional permit before the expiration of the 20-day period referred to in subsection (3).

(7) After providing notice and an opportunity for a public hearing, the department shall establish minor project categories of activities and projects that are similar in nature, have minimal adverse environmental effects when performed separately, and will have only minimal cumulative adverse effects on the environment. The department may act upon an application received pursuant to section 30104 for an activity or project within a minor project category without providing notices pursuant to subsection (3). The department shall develop a minor project category under this subsection for repair or replacement of a failed seawall. All other provisions of this part, except provisions applicable only to general permits, are applicable to a minor project.

(8) The department, after notice and an opportunity for a public hearing, shall issue general permits on a statewide basis or within a local unit of government for projects that are similar in nature, that will cause only minimal adverse environmental effects when performed separately, and that will only have minimal cumulative adverse effects on the environment. Before authorizing a specific project to proceed under a general permit, the department may provide notice pursuant to subsection (3) but shall not hold a public hearing and shall not typically require a site inspection. A general permit issued under this subsection shall not be valid for more than 5 years. Among the activities the department may consider for general permit eligibility under this subsection are the following:

(a) The removal of qualifying small dams.

(b) The maintenance or repair of an existing pipeline, if the pipeline is maintained or repaired in a manner to ensure that any adverse effects on the inland lake or stream will be minimized.

(9) The department may issue, deny, or impose conditions on project activities authorized under a minor project category or a general permit if the conditions are designed to remove an impairment to the inland lake or stream, to mitigate the effects of the project, or to otherwise improve water quality. The department may also establish a reasonable time when the proposed project is to be completed or terminated.

(10) If the department determines that activity in a proposed project, although within a minor project category or a general permit, is likely to cause more than minimal adverse environmental effects, the department may require that the application be processed according to subsection (3) and reviewed for compliance with section 30106.

(11) The department shall develop by December 31, 2013 and maintain a general permit for activities in drains legally established pursuant to the drain code of 1956, 1956 PA 40, MCL 280.1 to 280.630. The general permit is subject to all of the following:

(a) The general permit shall cover installation and replacement of culverts, clear span bridges, and end sections; culvert extensions; drain realignments; installation of bank stabilization structures and grade stabilization structures; spoil placement; and other common drain activities that use best management practices.

(b) A drain commissioner or drainage board may submit an application for an authorization under the general permit on a countywide basis. The department of agriculture and rural development may submit an application for an authorization under the general permit on behalf of an intercounty drainage board on a drainage-district-wide basis.

(c) The department shall grant or deny an authorization under the general permit by March 1 if the drain commissioner or drainage board applies for the authorization by the preceding January 20. An authorization under the general permit is valid until March 30 of the year after the year in which the authorization is granted.

(d) By December 31 of each year, the drain commissioner or drainage board shall submit a report to the department that includes the names of the drains on which activities were performed under the general permit during that calendar year, the locations and nature of the activities, and plans and other documentation demonstrating that those activities met the general permit requirements.

(e) A drain commissioner or drainage board is not eligible to be granted a new authorization under the general permit if significant violations of the general permit under a previous authorization granted to that drain commissioner or drainage board have not been corrected.

(12) As used in this section:

(a) "Failed seawall" means a seawall that has deteriorated to the point that it no longer effectively breaks the force of waves or retains soil for the purpose of shore protection and meets either or both of the following:

(*i*) The seawall is currently breaking the force of waves and retaining soil across a minimum of 50% of its length and there is evidence of a previous seawall along the other 50% of its length.

(*ii*) The seawall was breaking the force of waves and retaining soil but was damaged by a single catastrophic event which occurred within the 2 years prior to the repair or replacement of the seawall.

(b) "Qualifying small dam" means a dam that meets all of the following conditions:

(*i*) The height of the dam is less than 2 feet.

(*ii*) The impoundment from the dam covers less than 2 acres.

(*iii*) The dam does not serve as the first dam upstream from the Great Lakes or their connecting waterways.

(*iv*) The dam is not serving as a sea lamprey barrier.

(*v*) There are no threatened or endangered species that have been identified in the area that will be affected by the project.

(*vi*) There are no known areas of contaminated sediments in the area that will be affected by the project.

(*vii*) The department has received written permission for the removal of the dam from all riparian property owners adjacent to the dam's impoundment.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 1995, Act 171, Imd. Eff. Oct. 9, 1995;—Am. 1999, Act 106, Imd. Eff. July 7, 1999;—Am. 2004, Act 325, Imd. Eff. Sept. 10, 2004;—Am. 2006, Act 275, Imd. Eff. July 7, 2006;—Am. 2006, Act 531, Imd. Eff. Dec. 29, 2006;—Am. 2009, Act 120, Eff. Nov. 6, 2009;—Am. 2013, Act 98, Imd. Eff. July 2, 2013;—Am. 2014, Act 351, Eff. Jan. 16, 2015.

Compiler's note: Enacting section 1 of Act 120 of 2009 provides:

"Enacting section 1. This amendatory act does not take effect unless both of the following requirements are met:

"(a) $4,000,000.00 from the cleanup and redevelopment trust fund created in section 3e of 1976 IL 1, MCL 445.573e, and $4,000,000.00 from the community pollution prevention fund created in section 3f of 1976 IL 1, MCL 445.573f, is appropriated by the legislature to the environmental protection fund created in section 503a of the natural resources and environmental protection act, 1994 PA 451, MCL 324.503a.

"(b) $2,000,000.00 is appropriated by the legislature from the environmental protection fund to support the program under part 303 of the natural resources and environmental protection act, 1994 PA 451, MCL 324.30301 to 324.30329."

Popular name: Act 451

Popular name: NREPA

Administrative rules: R 281.811 et seq. of the Michigan Administrative Code.

324.30106 Prerequisite to issuance of permit; specification in permit.

Sec. 30106. The department shall issue a permit if it finds that the structure or project will not adversely affect the public trust or riparian rights. In passing upon an application, the department shall consider the possible effects of the proposed action upon the inland lake or stream and upon waters from which or into which its waters flow and the uses of all such waters, including uses for recreation, fish and wildlife, aesthetics, local government, agriculture, commerce, and industry. The department shall not grant a permit if the proposed project or structure will unlawfully impair or destroy any of the waters or other natural resources of the state. This part does not modify the rights and responsibilities of any riparian owner to the use of his or her riparian water. A permit shall specify that a project completed in accordance with this part shall not cause unlawful pollution as defined by part 31.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30106a Construction, expansion, or reconfiguration of marina; issuance of permit; conditions; definitions.

Sec. 30106a. (1) The department shall issue a permit to construct, expand, or reconfigure a marina if the department determines that the marina meets the conditions of section 30106 and all of the following conditions:

(a) The marina extends from riparian property of the applicant.

(b) The marina does not unreasonably interfere with navigation.

(c) The marina is located and designed to be operated consistently with the correlative rights of other riparians, including the rights of adjacent riparians.

(2) In order to be designed consistently with the correlative rights of other riparians as required under

subsection (1), the marina shall be configured so that all boat mooring under any wind condition will occur solely within the marina's riparian interest area. Additionally, boat mooring and ingress and egress for an outside slip shall require a minimum maneuvering distance of 1.5 times the length of the slip. This minimum distance shall be measured from the end of the slip or, for broadside moorage, the outside beam of a watercraft moored at the slip, to the boundary of the marina's riparian interest area.

(3) In order to support the determinations under this section, the department may require the applicant to do either of the following:

(a) Submit a riparian interest area estimate survey, sealed by a licensed surveyor. In making its determination on the need for a riparian interest area estimate survey, the department shall consider factors such as the shape of the water body, the location of the marina on the water body, how much frontage is available to locate the marina, and the dock and mooring configurations.

(b) Obtain an easement from any affected adjacent riparian owner authorizing an incursion and record the easement with the register of deeds for the county in which the marina is located.

(4) The owner or operator of a marina existing on the effective date of the amendatory act that added this section that has not been authorized by a permit issued under this part shall obtain a permit under this section before expanding or reconfiguring the marina, or by January 1, 2012, whichever comes first. The owner or operator of a marina existing on the effective date of the amendatory act that added this section that has been authorized by a construction permit under this part does not need to obtain a new construction permit except to expand or reconfigure.

(5) As used in this section:

(a) "Marina's riparian interest area" means the riparian interest area of an applicant for a permit under subsection (1) and any adjacent area for which the applicant has secured written authorization from the riparian owner whose interest is or may be affected.

(b) "Outside slip" means a slip that is accessed from a location between the boundary of the marina's riparian interest area and the mooring structure.

(c) "Slip length" means the longer of either of the following:

(*i*) The total length of all mooring structures, including the docks and pilings.

(*ii*) The total length of the vessel moored in the slip, including, but not limited to, outboard engines, boat hoists, bowsprits, and swim platforms.

History: Add. 2009, Act 139, Imd. Eff. Nov. 4, 2009.

Popular name: Act 451

Compiler's note: NREPA

324.30106b Dredging or placing dredged spoils on bottomland; permit; conditions.

Sec. 30106b. A permit under this part to dredge or place dredged spoils on bottomland is subject to both of the following:

(a) The permit shall be valid for a period of 5 years.

(b) During the term of the permit, the department shall not require additional environmental studies or surveys unless an act of God results in significant geological or ecological changes to the permitted area.

History: Add. 2013, Act 87, Imd. Eff. June 28, 2013.

Popular name: Act 451

Popular name: NREPA

324.30107 Duration, terms, and revocation of permit; hearing; modification or revocation of general permit.

Sec. 30107. (1) A permit is effective until revoked for cause but not beyond its term and may be subject to renewal. A permit may specify the term and conditions under which the work is to be carried out. A permit may be revoked after a hearing for violation of any of its provisions, any provision of this part, any rule promulgated under this part, or any misrepresentation in application.

(2) A general permit may be modified or revoked if, after opportunity for a public hearing, the department determines that the activities authorized by the general permit have more than a minimal adverse impact on the environment on an individual or cumulative basis, or the activities generally would be more appropriately processed according to section 30105(3) and reviewed for compliance with section 30106.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 2006, Act 531, Imd. Eff. Dec. 29, 2006.

Popular name: Act 451

Popular name: NREPA

324.30108 Bulkhead line; establishment; application; jurisdiction; duties.

Sec. 30108. The department may establish by permit a bulkhead line on its own application or on the application of a local unit of government. The application shall be filed as provided in section 30104(1) with public notice and hearings as provided in section 30105. Upon acceptance of the bulkhead line by the affected units of government, the area landward of the bulkhead line shall after that acceptance be under the jurisdiction of those units of government as to the placement of structures and fills in the waters unless jurisdiction is returned to the state. In establishing a bulkhead line, the department shall provide for local requirements and ensure the public trust in the adjacent waters against unreasonable interferences.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30109 Ordinary high-water mark agreement with riparian owner; agreement as proof of location; fee.

Sec. 30109. Upon the written request of a riparian owner and upon payment of a service fee, the department may enter into a written agreement with the riparian owner establishing the location of the ordinary high-water mark for his or her property. In the absence of substantially changed conditions, the agreement shall be conclusive proof of the location in all matters between the state and the riparian owner and his or her successors in interest. Until October 1, 2019, the service fee provided for in this section shall be $500.00. The department shall forward all service fees collected under this section to the state treasurer for deposit into the fund.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 1995, Act 171, Imd. Eff. Oct. 9, 1995;—Am. 1999, Act 106, Imd. Eff. July 7, 1999;—Am. 2003, Act 163, Imd. Eff. Aug. 12, 2003;—Am. 2008, Act 276, Imd. Eff. Sept. 29, 2008;—Am. 2011, Act 90, Imd. Eff. July 15, 2011;—Am. 2015, Act 76, Eff. Oct. 1, 2015.

Popular name: Act 451

Popular name: NREPA

324.30110 Rules; promulgation and enforcement; hearing; review; proceeding by riparian owner.

Sec. 30110. (1) The department may promulgate and enforce rules to implement this part.

(2) If a person is aggrieved by any action or inaction of the department, he or she may request a formal hearing on the matter involved. The hearing shall be conducted by the commission in accordance with the provisions for contested cases in the administrative procedures act of 1969, Act No. 306 of the Public Acts of 1969, being sections 24.201 to 24.328 of the Michigan Compiled Laws.

(3) A determination, action, or inaction by the commission following the hearing is subject to judicial review as provided in Act No. 306 of the Public Acts of 1969.

(4) This section does not limit the right of a riparian owner to institute proceedings in any circuit court of the state against any person when necessary to protect his or her rights.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

Administrative rules: R 281.811 et seq. of the Michigan Administrative Code.

324.30111 Rights of riparian owner as to water frontage and exposed bottomland.

Sec. 30111. This part does not deprive a riparian owner of rights associated with his or her ownership of water frontage. A riparian owner among other rights controls any temporarily or periodically exposed bottomland to the water's edge, wherever it may be at any time, and holds the land secure against trespass in the same manner as his or her upland subject to the public trust to the ordinary high-water mark.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995.

Popular name: Act 451

Popular name: NREPA

324.30111b Public road end; prohibited use; violation as misdemeanor; fine; civil action; definitions.

Sec. 30111b. (1) A public road end shall not be used for any of the following unless a recorded deed, recorded easement, or other recorded dedication expressly provides otherwise:

(a) Construction, installation, maintenance, or use of boat hoists or boat anchorage devices.

(b) Mooring or docking of a vessel between 12 midnight and sunrise.

(c) Any activity that obstructs ingress to or egress from the inland lake or stream.

(2) A public road end shall not be used for the construction, installation, maintenance, or use of a dock or wharf other than a single seasonal public dock or wharf that is authorized by the local unit of government, subject to any permit required under this part. This subsection does not prohibit any use that is expressly authorized by a recorded deed, recorded easement, or other recorded dedication. This subsection does not permit any use that exceeds the uses authorized by a recorded deed, recorded easement, other recorded dedication, or a court order.

(3) A local unit of government may prohibit a use of a public road end if that use violates this section.

(4) A person who violates subsection (1) or (2) is guilty of a misdemeanor punishable by a fine of not more than $500.00. Each 24-hour period in which a violation exists represents a separate violation of this section. A peace officer may issue an appearance ticket as authorized by sections 9c to 9g of chapter IV of the code of criminal procedure, 1927 PA 175, MCL 764.9c to 764.9g, to a person who violates subsection (1) or (2).

(5) This section does not prohibit a person or agency from commencing a civil action for conduct that violates this section.

(6) As used in this section:

(a) "Local unit of government" means a township, city, or village in which the public road end is located.

(b) "Public road end" means the terminus at an inland lake or stream of a road that is lawfully open for use by the public.

History: Add. 2012, Act 56, Imd. Eff. Mar. 22, 2012;—Am. 2014, Act 168, Imd. Eff. June 12, 2014.

Popular name: Act 451

Popular name: NREPA

324.30112 Civil action; commencement by department; fine; violation as misdemeanor; penalty; civil sanction as appropriate to violation.

Sec. 30112. (1) The department may commence a civil action in the circuit court of the county in which a violation occurs to enforce compliance with this part, to restrain violation of this part or any action contrary to an order of the department denying a permit, to enjoin the further performance of, or order the removal of, any project that is undertaken contrary to this part or after denial of a permit by the department, or to order the restoration of the affected area to its prior condition.

(2) In a civil action commenced under this part, the circuit court, in addition to any other relief granted, may assess a civil fine of not more than $5,000.00 per day for each day of violation.

(3) Except as provided in subsection (4), a person who violates this part or a permit issued under this part is guilty of a misdemeanor, punishable by a fine of not more than $10,000.00 per day for each day of violation.

(4) A person who commits a minor offense is guilty of a misdemeanor, punishable by a fine of not more than $500.00 for each violation. A law enforcement officer may issue and serve an appearance ticket upon a person for a minor offense pursuant to sections 9c to 9g of chapter IV of the code of criminal procedure, 1927 PA 175, MCL 764.9c to 764.9g.

(5) A person who knowingly makes a false statement, representation, or certification in an application for a permit or in a notice or report required by a permit, or a person who knowingly renders inaccurate any monitoring device or method required to be maintained by a permit, is guilty of a misdemeanor, punishable by a fine of not more than $10,000.00 per day for each day of violation.

(6) Any civil sanction assessed, sought, or agreed to by the department shall be appropriate to the violation.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 2018, Act 631, Eff. Mar. 29, 2019.

Popular name: Act 451

Popular name: NREPA

324.30113 Land and water management permit fee fund.

Sec. 30113. (1) The land and water management permit fee fund is created within the state treasury.

(2) The state treasurer may receive money or other assets from any source for deposit into the fund. The state treasurer shall direct the investment of the fund. The state treasurer shall credit to the fund interest and earnings from fund investments. The state treasurer shall annually present to the department an accounting of the amount of money in the fund. The department shall be the administrator of the fund for auditing purposes.

(3) Money in the fund at the close of the fiscal year shall remain in the fund and shall not lapse to the general fund.

(4) The department shall expend money from the fund, upon appropriation, only to implement this part and

the following:

(a) Sections 3104, 3107, and 3108.

(b) Part 303.

(c) Part 315.

(d) Part 323.

(e) Part 325.

(f) Part 339.

(g) Part 353.

(h) Section 117 of the land division act, 1967 PA 288, MCL 560.117.

(5) The department shall annually report to the legislature how money in the fund was expended during the previous fiscal year.

History: Add. 1995, Act 59, Imd. Eff. May 24, 1995;—Am. 1995, Act 171, Imd. Eff. Oct. 9, 1995;—Am. 2004, Act 246, Eff. Oct. 1, 2004;—Am. 2004, Act 325, Imd. Eff. Sept. 10, 2004;—Am. 2006, Act 496, Imd. Eff. Dec. 29, 2006;—Am. 2014, Act 253, Imd. Eff. June 30, 2014.

Popular name: Act 451

Popular name: NREPA

EXHIBIT 5

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
CADILLAC DISTRICT OFFICE

JENNIFER M. GRANHOLM
GOVERNOR

FILE COPY

DEQ

STEVEN E. CHESTER
DIRECTOR

January 12, 2007

Roscommon County
Commissioner's Office
500 Lake Street
Roscommon, MI 48653

Dear Roscommon County:

SUBJECT: DEQ File Number 06-72-0056-P
T24N, R3W, Section 34, Gerrish Township, Roscommon County

The Department of Environmental Quality, Land and Water Management Division (LWMD) has reviewed the plans submitted regarding the proposed modifications to the Higgins Lake outlet structure (dam). With the following revisions, the LWMD can issue a permit for revisions to the dam.

Move the functions of the low flow outlet bay, now located towards the northeast end of the dam, to the five foot stop log bay located most northeast. This would allow some minimum flow to continue by design. The new low flow bay would have to be modified to permanently prevent boards being inserted into the angle iron slots on either side.

In addition, Mr. Herb Weatherly, the contact person for the County, has requested the permit be modified to allow for the addition of fieldstone riprap to be placed along the shoreline near the dam. He stated this would lessen bank erosion in the area of the dam.

Any permit or structural design would not eliminate the need to manage the flows in accordance with the Circuit Court Order. This includes maintaining minimum flows to the Cut River that would be more then the one five foot bay capacity in many instances. Maximum flows should also be managed to allow for maintenance of the required levels, while minimizing harmful effects such as downstream bank erosion and degradation of the aquatic environment.

If the above revisions are acceptable, please send a cover letter with revised plans. Include top view and cross section drawings, with dimensions, of the dam and riprap area.

Sincerely,

Jeff Silagy
Land and Water Management Division
231-775-3960 ext. 6201

JS:ELM
cc: Mr Herb Weatherly

RECEIVED
JAN 19 2007
By______

EXHIBIT 6

ROSCOMMON COUNTY
BOARD OF COMMISSIONERS

Location: 112 S. Fourth Street
Mailing Address: 500 Lake Street
Roscommon, Michigan 48653
989-275-8021
Fax 989-275-5675

February 14, 2007

Michigan DEQ
Atten: Jeff Silagy
120 West Chapin Street
Cadillac, MI 49601-2158

Dear Mr. Silagy:

We are in receipt of your letter dated January 12, 2007 in regards to DEQ File Number 06-72-0056-P for improvements to the Higgins Lake Dam in Gerrish Township. After meeting with the entire Board of Commissioners we agree to have a five (5) foot cut in the center for permanent flow and then add the two (2) proposed flop gates just to the north of this cut (see attached drawing). We are also requesting the permit be modified to allow for the addition of fieldstone riprap that Mr. Weatherly requested on our behalf. Also enclosed are revised drawings per your request.

With our agreement to the above we look forward to our permit being issued as soon as possible.

Sincerely,

Larry D. Mead
Chairman
Roscommon County Board of Commissioners

LDM:rls

Deqresponseletter/wd/07

EXHIBIT 7

Notice of Authorization

Permit Number 06-72-0056-P

Issued: March 12, 2007
Expiration Date: December 31, 2008

The State of Michigan, Department of Environmental Quality, Land and Water Management Division, 120 West Chapin St., Cadillac, Michigan, 49601-2158, 231-775-3960, under provisions of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and specifically:

- ☒ Part 31 Floodplain/Water Resources Protection.
- ☒ Part 301 Inland Lakes and Streams.
- ☐ Part 303 Wetland Protection.
- ☐ Part 315 Dam Safety.
- ☐ Part 325 Great Lakes Submerged Lands.
- ☐ Part 323 Shorelands Protection and Management.
- ☐ Part 353 Sand Dune Protection and Management.

RECEIVED
MAR 15 2007
By

Authorized activity:

Maintenance and modifications to the Higgins Lake Outlet Structure. All work shall be completed in accordance with permit conditions.

To be conducted at property located: Roscommon County, Waterbody: Cut River
Section 34, Town 24N, Range 3W, Gerrish Township

Permittee: Roscommon County
Commissioner's Office
500 Lake Street
Roscommon, MI 48653

Steven E. Chester, Director
Department of Environmental Quality

Jeff Silagy
District Representative

This notice must be displayed at the site of work.
Laminating this notice or utilizing sheet protectors is recommended.

Please refer to the above Permit Number with any questions or concerns.

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
PERMIT

ISSUED TO:

Roscommon County
Commissioner's Office
500 Lake Street
Roscommon, MI 48653

Permit No.	06-72-0056-P
Issued	March 12, 2007
Extended	
Revised	
Expires	December 31, 2008

This permit is being issued by the Michigan Department of Environmental Quality (MDEQ) under the provisions of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA) and specifically:

- ☒ **Part 301 Inland Lakes and Streams**
- ☐ **Part 315 Dam Safety**
- ☐ **Part 325 Great Lakes Submerged Lands**
- ☐ **Part 323 Shorelands Protection and Management**
- ☐ **Part 303 Wetlands Protection**
- ☐ **Part 353 Sand Dune Protection and Management**
- ☒ **Part 31 Floodplain/Water Resources Protection**

Permission is hereby granted, based on permittee assurance of adherence to State requirements and permit conditions to:

Maintenance and modifications to the Higgins Lake Outlet Structure. All work shall be completed in accordance with permit conditions, information submitted, and the approved attached plans.

RECEIVED
MAR 15 2007
By________

Water Course Affected: Cut River
Property Location: Roscommon **County,** Gerrish Township, **Section** 34
Surf Side Shores **Subdivision, Lot** **Town/Range** 24N, 3W **Property Tax No.**

Authority granted by this permit is subject to the following limitations:

A. Initiation of any work on the permitted project confirms the permittee's acceptance and agreement to comply with all terms and conditions of this permit.
B. The permittee in exercising the authority granted by this permit shall not cause unlawful pollution as defined by Part 31, Floodplain/Water Resources Protection of the NREPA.
C. This permit shall be kept at the site of the work and available for inspection at all times during the duration of the project or until its date of expiration.
D. All work shall be completed in accordance with the plans and the specifications submitted with the application and/or plans and specifications attached hereto.
E. No attempt shall be made by the permittee to forbid the full and free use by the public of public waters at or adjacent to the structure or work approved herein.
F. It is made a requirement of this permit that the permittee give notice to public utilities in accordance with Act 53 of the Public Act of 1974 and comply with each of the requirements of that act.
G. This permit does not convey property rights in either real estate or material, nor does it authorize any injury to private property or invasion of public or private rights, nor does it waive the necessity of seeking federal assent, all local permits or complying with other state statutes.
H. This permit does not prejudice or limit the right of a riparian owner or other person to institute proceedings in any circuit court of this state when necessary to protect his rights.
I. Permittee shall notify the MDEQ within one week after the completion of the activity authorized by this permit, by completing and forwarding the attached, preaddressed post card to the office addressed thereon.
J. This permit shall not be assigned or transferred without the written approval of the MDEQ.
K. Failure to comply with conditions of this permit may subject the permittee to revocation of permit and criminal and/or civil action as cited by the specific State Act, Federal Act and/or Rule under which this permit is granted.
L. Work to be done under authority of this permit is further subject to the following special instructions and specifications:

1. Riprap shall be clean fieldstone, and shall not extend out into the water more then three feet.

2. This permit does not eliminate managing Higgins Lake and the Cut River in accordance with the Court Ordered Lake Level. Minimum and maximum flows must be maintained in the Cut River as necessary to prevent harm to the aquatic ecosystem.

3. Prior to initiating construction, authorized by this permit, the permittee is required to provide a copy of the permit to the contractor(s) for his/her review.

4. The property owner, contractor(s), and any agent involved in obtaining or exercising this permit, are held responsible to ensure the project is constructed in accordance with all drawings and specifications contained in this permit. The contractor is required to provide a copy of the permit to any and all subcontractors doing work authorized by this permit.

5. Authority granted by this permit does not waive permit requirements under Part 91, Soil Erosion and Sedimentation Control, of the NREPA, or the need to acquire applicable permits from the County Enforcing Agent (CEA). To locate the Soil Erosion Program Administrator for your county visit www.deq.state.mi.us/sesca/.

6. Prior to the initiation of any permitted construction activities, a siltation barrier shall be constructed immediately downgradient of the construction site. Siltation barriers shall be specifically designed to handle the sediment type, load, water depth, and flow conditions of each construction site throughout the anticipated time of construction and unstable site conditions. The siltation barrier shall be maintained in good working order throughout the duration of the project. Upon project completion, the accumulated materials shall be removed and disposed of at an upland (non-wetland, non-floodplain) site. The siltation barrier shall then be removed in its entirety and the area restored to its original configuration and cover.

7. All raw areas resulting from the permitted construction activity shall be promptly and effectively stabilized with sod and/or seed and mulch (or other technology specified by this permit or project plans) in a sufficient quantity and manner so as to prevent erosion and any potential siltation to surface waters or wetlands.

8. All dredge/excavated spoils including organic and inorganic soils, vegetation, and other material removed shall be placed on upland (non-wetland, non-floodplain or non-bottomland), prepared for stabilization, and stabilized with sod and/or seed and mulch in such a manner so as to prevent and ensure against erosion of any material into any waterbody, wetland, or floodplain.

9. All fill/backfill shall consist of clean inert material which will not cause siltation nor contain soluble chemicals, organic matter, pollutants, or contaminants. All fill shall be CONTAINED in such a manner so as not to erode into any surface water, floodplain, or wetland. All raw areas associated with the permitted activity shall be STABILIZED with sod and/or seed and mulch, riprap, or other technically effective methods as necessary to prevent erosion.

10. If the project, or any portion of the project, is stopped and lies uncompleted for any length of time other than that encountered in a normal work week, every precaution shall be taken to protect the uncompleted work from erosion, including the placement of temporary gravel bag riprap or other acceptable temporary protection.

11. No work shall be done in the stream during periods of above-normal flows except as necessary to prevent erosion.

12. The permittee is cautioned that grade changes resulting in increased runoff onto adjacent property is subject to civil damage litigation.

13. In issuing this permit, the MDEQ has relied on the information and data which the permittee has provided in connection with the permit application. If, subsequent to the issuance of this permit, such information and data prove to be false, incomplete, or inaccurate, the MDEQ may modify, revoke, or suspend the permit, in whole or in part, in accordance with the new information.

14. The permittee shall indemnify and hold harmless the State of Michigan and its departments, agencies, officials, employees, agents and representatives for any and all claims or causes of action arising from acts or omissions of the permittee, or employees, agents, or representatives of the permittee, undertaken in connection with this permit. This permit shall not be construed as an indemnity by the State of Michigan for the benefit of the permittee or any other person.

15. If any change or deviation from the permitted activity becomes necessary, the permittee shall request, in writing, a revision of the permitted activity and/or mitigation plan from the MDEQ. Such revision requests shall include complete documentation supporting the modification and revised plans detailing the proposed modification. Proposed modifications must be approved, in writing, by the MDEQ prior to being implemented.

16. This permit may be transferred to another person upon written approval of the MDEQ. The permittee must submit a written request to the MDEQ to transfer the permit to the new owner. The new owner must also submit a written request to accept transfer of the permit. The new owner must agree, in writing, to accept all conditions of the permit. A single letter signed by both parties which includes all the above information may be provided to the MDEQ. The MDEQ will review the request and if approved, will provide written notification to the new owner.

17. A permit may be extended for cause. To request an extension of a permit a written request must be submitted to the MDEQ before the expiration date of the permit. The request must indicate the reasons for the extension. The MDEQ will review the request, and if approved, will provide written notification to the permittee.

18. Prior to initiation of construction, a preconstruction meeting shall be held with the contractor, permittee or her/his representative(s), and representatives of the MDEQ. To arrange the required meeting, please contact this office..

19. Notification shall be made to the MDEQ's Land and Water Management Division, five days prior to starting the project. Please notify Mr. Jeff Silagy, 231-775-3960 ext. 6201..

20. "As-Built" construction plans of the project shall be submitted to this office within 30 days of project completion. The "as-built" plans shall be sealed and signed by a licensed professional engineer registered in the State of Michigan, and shall certify the project has been completed in accordance with this permit.

21. All slurry resulting from any dewatering operation shall be discharged through a filter bag or pumped to a sump located away from wetlands and surface waters and allowed to filter through natural upland vegetation, gravel filters, or other engineered devices for a sufficient distance and/or period of time necessary to remove sediment or suspended particles.

22. The project is limited to the area of permittee's ownership and riparian interest. Care shall be taken to minimize downstream siltation. Raw banks shall be sodded or riprapped to prevent erosion. It is understood that a fish ladder waiver and local government approval have been obtained. This permit does not authorize deterioration of downstream water quality or quantity.

23. Any modification or revision to the approved design plans and/or specifications must be approved in writing by the MDEQ.

24. The permittee shall provide passage of flow during and after construction. During periods of low stream flow the permittee shall provide a minimum flow release approximately equivalent to the stream flow into the impoundment.

25. This permit shall become effective on the date of the MDEQ representative's signature. Upon signing by the permittee named herein, this permit must be returned to the MDEQ's Land and Water Management Division, Jeff Silagy for final execution.

Roscommon County

Permittee hereby accepts and agrees to comply with the terms and conditions of this permit.

Larry D. Head 3-9-07

Permittee Date

Larry D. Head, Chairman

Printed Name and Title of Permittee

Steven E. Chester, Director
Department of Environmental Quality

By

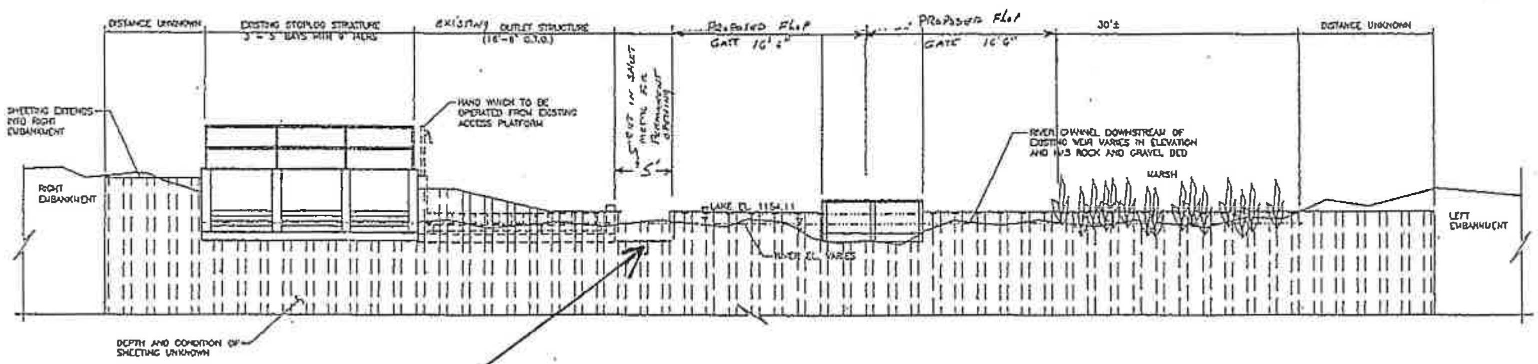
Jeff Silagy
District Representative
Land and Water Management Division
231-775-3960 ext. 6201

cc: Herb Weatherly
Rich O'Neal, DNR Fisheries
Roscommon CEA
Gerrish Township

DEQ copy

MAR 1 2

06-72-56-P



1 S-01 ELEVATION: WEIR LOOKING UPSTREAM
N.T.S.

NOTES:

1. DRAWING IS BASED ON VISUAL OBSERVATIONS AND FIELD MEASUREMENTS OF VISIBLE PORTIONS OF THE STRUCTURE. DO NOT SCALE THIS DRAWING.
2. EXISTING SHEET PILE MEASURES APPROXIMATELY 2" DEEP CORRUGATIONS, WITH 6" BETWEEN CORRUGATION PEAKS. THE STEEL SHEET IS ABOUT 3/16" THICK. ONLY SHEETING ABOVE GROUND WAS MEASURED. IT IS ASSUMED THAT THE SHEETING PASSES BELOW THE EXISTING STRUCTURES AS SHOWN.

Bottom elevation or apron at same level as stream bottom

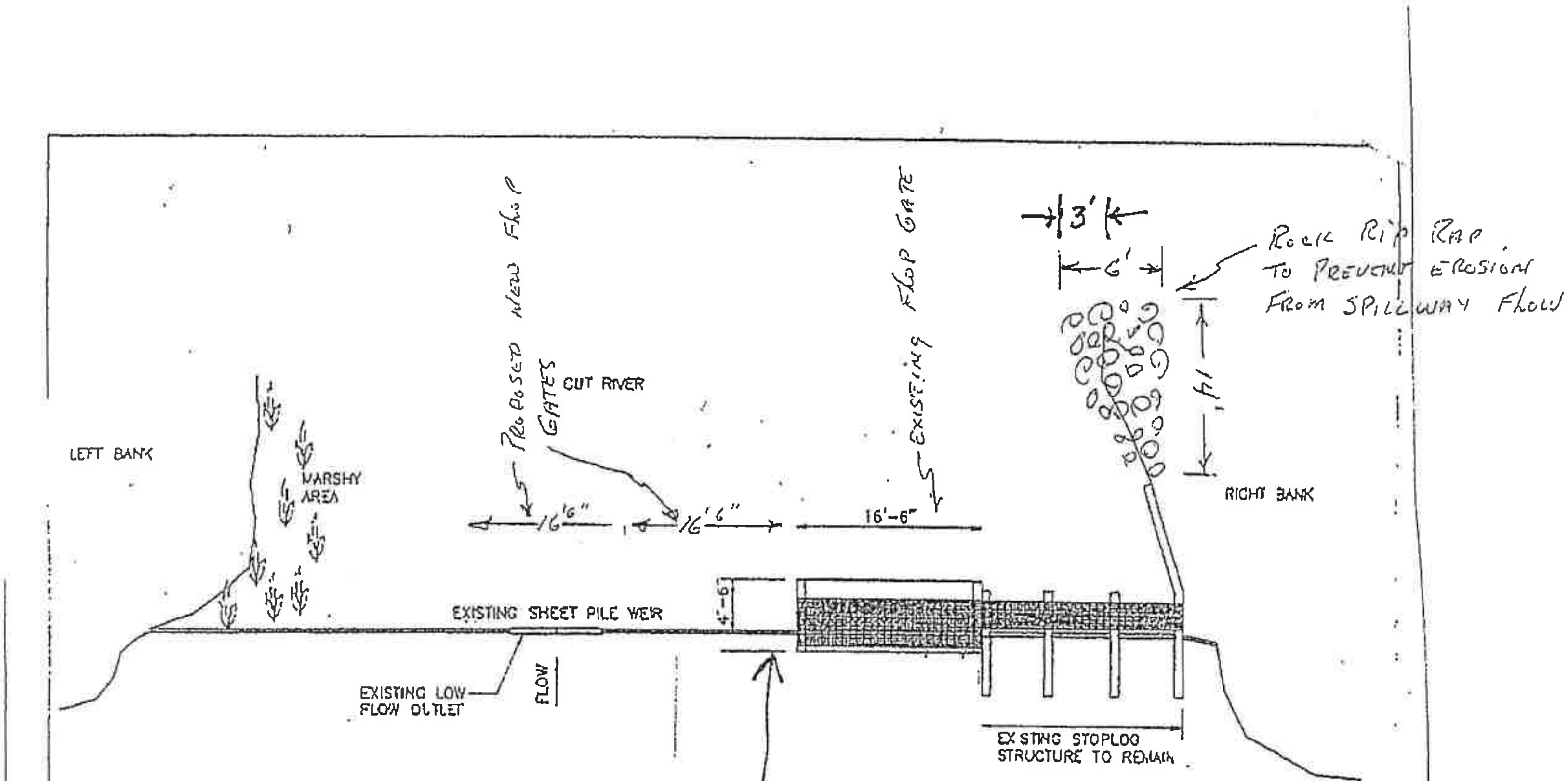
RECEIVED
FEB 2 0 2007
DEQ/LWMD-CADILLAC

REFERENCE DRAWING
NOT FOR CONSTRUCTION

Barr Engineering Company	Scale AS SHOWN; Date 3/11/38; Drawn PHS; Checked JCO	ROSCOMMON COUNTY, MICHIGAN PRUDENVILLE, MICHIGAN	HIGGINS LAKE OUTLET STRUCTURE CUT RIVER AT HIGGINS LAKE SECTION OF EXISTING STRUCTURE
			BARR PROJECT No. 22/72-001

NO. BY CHK APP. DATE REVISION DESCRIPTION

RELEASED TO/FOR A 0 C 0 1 2 3 DATE RELEASED



RECEIVED
FEB 2 0 2007
DEQ/LWMD-CADILLAC

MAR 1 2 2006
06-72-56-P
7 of 7

FIGURE 1
HIGGINS LAKE OUTLET
PLAN OF SPILLWAY

EXHIBIT 8

Carey & Jaskowski

William L. Carey, J.D.
Richard J. Jaskowski, J.D.
Miranda J. Bailey, J. D.
Adam T. Vernon, J.D.

Attorneys at Law
A Professional Limited Liability Company

2373 S. I-75 Business Loop
P.O. Drawer 665
Grayling, MI 49738
Phone: 989-348-5232
Fax: 989-348-7102
E-Mail: wcarey@carey-jaskowski.com
rjaskowski@carey-jaskowski.com

June 20, 2008

Ms. Cheryl Molliard, Controller
Roscommon County
Roscommon County Building
500 Lake Street
Roscommon, MI 48653

RE: Higgins Lake Water Legal Level

Dear Commissioner:

The undersigned represents the Higgins Lake Property Owners Association. As the Association's legal counsel I have been asked to address the maintenance of Higgins Lake water levels. More specifically, this correspondence is intended to place Roscommon County on notice of possible legal action to be taken against the county.

As a county commissioner you are certainly aware that the lake level of Higgins Lake is artificially maintained by manipulation of the Cut River dam. The Roscommon County Circuit Court has, by court order, dictated a maximum legal winter level and a maximum legal summer level for the waters of Higgins Lake. You are further aware that the current limits established by this circuit court are being reviewed by my client. Preliminarily, it is my client's view that both the winter and summer levels of Higgins Lake are set too high for maximum environmental protection of the lake.

The winter and spring of 2008 have brought unusually high amounts of precipitation to our area. Accordingly, the manipulation of the Cut River dam has become extremely important. Recently, the maintenance of the water level of Higgins Lake has been critically neglected. The dam has not been maintaned in a fashion to allow for maximum draw down of the waters. As a result, the current level of the lake is well above the maximum legal limit. Because the water level is too high, many Association members are experiencing significant shoreline destruction. The property destruction is the direct, albeit not total, fault of negligent management of the Cut River dam.

Ms. Cheryl Molliard, Controller
Roscommon County
June 20, 2008
Page Two

The Higgins Lake Property Owners Association is made up of nearly 800 members, all of whom own property on Higgins Lake. The Association speaks in one unified voice as to the mismanagement of the Cut River dam. The Association does, by this correspondence, notify Roscommon County that it will seek legal redress in the courts if the circumstances leading to the most recent property destruction is not immediately addressed in a viable manner. The Michigan Natural Resources and Environmental Protection Act provides for a direct legal cause of action against Roscommon County. There are additional common law actions which my client would also undertake to protect the property interest of its members. If the county wishes to avoid immediate litigation, we request that a special meeting be convened of the County Board of Commissioners for the sole purpose of restructuring the policy related to the management of the Cut River dam.

Thank you for your kind and immediate attention to this matter.

Sincerely,

William L. Carey

WILLIAM L. CAREY
Attorney at Law

WLC/sav

cc: Client

EXHIBIT 9

HIGGINS LAKE, MICHIGAN H.L.P.O.A.

Higgins Lake Property Owners Association

P.O. Box 55 • Roscommon, Michigan 48653-0055

Phone: (989) 275-9181 • Fax: (989) 275-9182

August 26, 2009

Mr. Ken Melvin
Roscommon County Board of Commissioners
500 Lake St.
Roscommon, MI 48653

Dear Mr. Melvin:

With all the recent discussions regarding Higgins Lake level and with the public hearing on lowering the legal winter level an additional 3" scheduled for 8-28-09, the Higgins Lake Property Owners Association executive board felt that a letter clarifying our organization's position on this and related matters would be timely. At an Aug 15th, 2009 meeting our board, with all members present and voting, unanimously voted to send to the county commissioners a letter with the following requests:

We request that the current legal summer lake level be adhered to and that at no time should this level be intentionally exceeded.

We request that you seek court action to make last year's temporary winter lake level of 4.62 the new permanent legal winter level.

We request that one member of the Higgins Lake Lake Level Committee be appointed as the person primarily responsible for the operation of the dam and that a second member of the committee be appointed as their backup.

We request that all requirements of the permit for the dam be adhered to.

Thank you for your attention to our concerns.

Rick Meeks, Vice President and
Chair of the HLPOA Environmental Committee

EXHIBIT 10

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENT
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

REBECCA A. HUMPHRIES
DIRECTOR

September 21, 2010

Commissioner Bob Schneider
Roscommon County Board of Commissioners
500 Lake Street
Roscommon, Michigan 48653

Dear Commissioner Schneider,

The Higgins Lake Property Owners Association recently contacted the Department of Natural Resources and Environment (DNRE) in regard to the lake-level control dam on Higgins Lake. They have concerns with the regulation of lake levels in Higgins Lake on shoreline erosion.

On August 12, 2010 several DNRE representatives from Fisheries Division and Water Resources Division toured the lake with the Property Owners Association. It was very clear that ongoing shoreline erosion was occurring and site photographs indicate significant shoreline loss has occurred in some areas of the lake. The presence of seawalls also indicates shoreline erosion is occurring in various areas of the lake.

The DNRE also is concerned with manipulating natural lake levels in Higgins Lake due to the effects on natural resources. Artificial lake levels are one of the primary causes of shoreline erosion from wave energy during ice-free periods and ice scour during winter. Altering natural water fluctuations in lakes affects the establishment of wetland plant communities and nesting and rearing habitat for fish, mammals and water birds. Amphibian and reptiles are also affected by loss of habitat from erosion and construction of seawalls. Water control dams affect seasonal fish movements in the system and stream flows below the structure. We generally recommend against manipulation of lake levels and promote removal of control dams when possible.

DNRE Fisheries Division is in agreement with the Higgins Lake Property Owners Association that removal of the lake-level control structure on Higgins Lake should be considered. We recognize there will be questions on how this will affect property owners around the lake, especially in reference to boat dockage, boat mooring, and changes in shoreline beach areas. Removing the dam could cause an overall drop in the lake level of Higgins Lake exposing and widening beach areas.

Higgins Lake has a fairly wide shallow, sandy shelf near shore around most of the lake. It is our belief that the primary effect of removing the dam and dropping the lake level will be more beach exposure, which will significantly reduce shoreline erosion. Boat mooring and docking should not be affected with the exception that a wider beach area will be present. It will require engineering information to determine the effects of removing the dam during low and high water conditions. We understand you may be contracting an engineering study of lake levels in Higgins Lake in the near future and

EXHIBIT 11

Final Report to the Muskegon River Watershed Assembly

Name of Study:

Ecohydrologic Evaluation of Removing the Higgins Lake-Level Control Structure.

Prime Contractor: Muskegon River Watershed Assembly

Study Job D.6 Prepare Habitat Models to Examine Fishery-Related Impacts

University of Michigan Subcontract. Michael J Wiley and Andrew J Layman.

A. Problem:

Higgins Lake, in Roscommon County, has a controversial level of shore erosion which has been attributed to high water caused by an old lake-level control structure (dam) at the junction of the lake and the Cut River. The erosion has been severe enough to concern the Higgins Lake Property Owners Association but effects of the erosion on the lake bottom, surrounding vegetation, animal species, and neighboring aquatic habitats have had little study since the dam's construction in 1936. This is despite the fact that the inter-connected Higgins Lake-Cut River-Houghton Lake system comprises the headwaters of the Muskegon River and supports a major inland recreational fishery for Yellow Perch, Smallmouth Bass, Walleye, Lake Trout, Rainbow Trout, Lake Whitefish, Rainbow Smelt, and a number of other species (O'Neal 1997, 2003). The number of angler hours measured during a one year period (2001 – 2002) was 250,962 hours on Higgins Lake and 499,048 hours on Houghton Lake. No data was collected for the Cut but the angler use is relatively high for a smaller river system. The economic value of this combined fishery to the local economy is estimated by MDNR to exceed $6.9 million annually. DNR Fisheries Division stocks Higgins Lake every year with 75,000 trout including lake trout, rainbow trout and brown trout at an annual cost of approximately $75,000. For these reasons, a well-planned and comprehensive assessment of lake level and erosion issues on Higgins Lake must also include an assessment of impacts on fisheries-related habitat and connectivity in the upper Muskegon watershed.

One of the largest inland water bodies in Michigan, Higgins Lake has a surface area of 10,186 acres. It's relatively small watershed includes a number of small tributaries, and it discharges to the Cut River, the headwater of the Muskegon River, which then runs by Marl Lake and joins with Backus Creek before entering Houghton Lake. The Higgins Lake Property Owners Association (HLPOA) contacted DNR Fisheries Division with their concerns regarding the excessive shoreline erosion in 2010. Records and data from the 1939 Fisheries Division survey of the lake indicate reductions have occurred in the amounts of gravel bottom, floating vegetation, and emergent vegetation. In the interim, studies of the dam were done in 1956, 1969, and 1995.

Manipulation of the dam's height to control water levels in Higgins Lake has resulted in large variations in flow to the Cut River, including periods with little to no outflow from Higgins, which MDNR worries will affect downstream fish communities and vegetation, and also those of Marl and Houghton lakes. This is a concern for the fish species that use the Cut River for spawning, including walleye, a recreational sport fish that helps support an important fishery in Houghton Lake. The Cut itself supports an active Smallmouth bass sport fishery, and Smallmouth also constitute an important sport fish in Higgins Lake. Since the control structure limits (but does not completely block) the passage of fish between Higgins Lake and the Cut River, there is also concern that current operations might restrict reproductive success of both species in this connected lake and river system.

B. Background:

The original lake-level control structure at the outlet of Higgins Lake was constructed in 1936, apparently to improve boating and swimming (1952 letter from Higgins Lake Property Owners Association). But the dam fell into disrepair after a period of time because no specific organization managed it. Portions of the existing structure were constructed in 1950 as part of a Roscommon County Improvement Project (Ayers et al. 1995). The legal level of Higgins Lake was set in 1982 at 1154.11 feet above mean sea level for summer, and 1153.61 feet for winter months. In 2009, the legal winter level was temporarily amended (effective through 2013/2014) to be 1153.36 beginning between September 15 and November 1. Roscommon County is responsible for operation, maintenance, and improvement of the dam.

The DNR Fisheries Division has received complaints that the dam has severely restricted flows to the Cut River leading to both lake levels above legal limits and periodic drying of the stream bed. Fisheries Division expressed concerns with improper regulation of the dam in a letter to the Roscommon County Board of Commissioners in 2004.

In 1995, Roscommon County and the Higgins Lake Property Owners Association contracted an engineering firm to evaluate characteristics and capacities of the dam to determine if fluctuations in the lake-level could be minimized. Information from this study was summarized by Ayers et al. (1995), who also indicated earlier lake level control studies had been completed by the Michigan Department Conservation in 1956 and Ayers, Lewis, Norris and May in 1969. Ayers et al. (1995) recommended adding 62 feet of additional spillway to increase the outlet capacity of the structure from 55 cubic feet per second (cfs) to 110 cfs, which would enable lake level maintenance for storms up to a 5-year frequency. The additional flow capacity was added to the structure in 2007. At the request of DNR Fisheries Division, a permanent low flow opening (4.75 feet) in the outlet dam was installed in 2007 to allow to maintain a minimum flow at or near the 95% exceedance flow to the Cut River (approx.. 50 cfs). In 2010, Roscommon County retained an engineering firm, Spicer Group, to inspect the structure and evaluate its hydraulic capacity and water control. Spicer Group (2010) confirmed that the dam has similar outflow capacity (with all gates open) as the Cut River as a result of the additional flow capacity added to the dam in 2007. They found that summer lake levels were lower following installation of the low flow channel and recommended the low flow channel be closed during the summer to help maintain legal lake levels. Evaporation resulted in the greatest loss of water in the system based on simple mass balance estimates.

C. Objectives:

The purpose of this study was to evaluate the likely effects of modifying operations of, or removing the water level control structure between Higgins Lake and the Cut River system. Participating stakeholders in this project included DNR Fisheries Division, DEQ Water Division, the Muskegon River Watershed Assembly (MRWA), the Higgins Lake Property Owners Association, the Higgins Lake Foundation, Huron Pines and researchers from Michigan State University (MSU) and the University of Michigan (UM). Over the period of the study, a series of water management scenarios were developed through conversations with the primary stakeholders, funders, and researchers including representatives of HLPOA, MRWA, MDEQ, and the MSU and UM teams (Table 1). In this section (UM study report) we treat primarily the fishery-related habitat consequences associated with the specified scenarios for both Higgins Lake and the Cut River.

The project directly addresses Management Actions 1, 16, 18 & 21 in the Muskegon River Management Plan (O'Neal 2003). These management actions involve restoring fish passage and natural hydrologic conditions in the system to restore habitat and biological communities.

Table D.6.1. Water level management scenarios examined in this study. All are referenced to the current legally (court) specified summer water level (SLL). The bracketing "extreme" high and low level scenarios were included for calibration and sensitivity analysis purposes and are not actual management possibilities

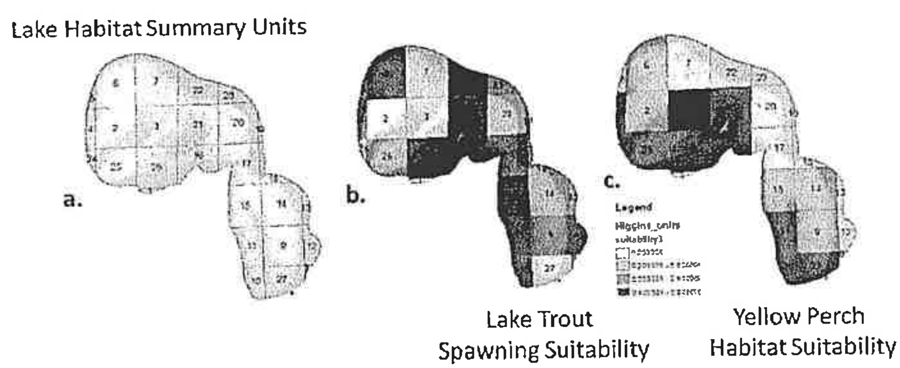
Scenario	Description	WSE (m AMSL)	WSE (ft AMSL)	Change in m	Change in ft
SLL +60	Extreme high (sensitivity test)	353.273	1159.03	1.5	4.92
SLL +1	All gates closed	351.803	1154.21	0.03	0.10
SLL	Summer legal level	351.773	1154.11	0	0.00
SLL -9	Proposed new SLL	351.543	1153.36	-0.23	-0.75
SLL -18	All dam gates open	351.313	1152.60	-0.46	-1.51
SLL -26	Dam removal	351.113	1151.95	-0.66	-2.17
SLL -60	Extreme low (sensitivity test)	350.273	1149.19	-1.5	-4.92

Task D.6.1 Potential impacts on Higgins Lake Fishes & Fishery

D.6.1. METHODS

Overview: To assess the possible impacts of altered water surface elevations (WSE) related to changes in dam management we have focused on modelling habitat changes for (a) a representative set of species of interest to anglers and (b) some typical prey (forage) species. We chose species for our analysis based on the following criteria: (1) one or more published Habitat Suitability Index models (Terrell et al, 1982; Zajak et al. 2015) were available; (2) the suitability models indicated that small changes in depth, or vegetation cover, or substrate distributions (singly or in combination) could significantly affect habitat quality; (3) the species was of interest to Higgins Lake anglers and/or might support the forage base of such species. For those fishes (Table D.6.2)., HSI models were constructed using only model input variables which could be directly related to or modeled from changes in bathymetry These variables included depth, light penetration, extent of littoral and profundal zones, submersed aquatic vegetation cover (SAV), and substrate distribution and availability. All other HSI variables were assumed to be optimal, given that the fishes being modeled are all common in Higgins Lake, and that the focus of the study was to assess impacts related only to potential changes in water surface elevation. To implement the HSI models we needed first to produce WSE sensitive models of basin bathymetry (see MSU final report), substrate, and vegetated cover. Detailed descriptions of the field sampling methods employed, SONAR signal processing, GIS, and statistical methods used to produce these input models can be found in Appendix A (Layman 2015).

For each of the habitat suitability models the lake basin was partitioned into 27 subunits based on intersections of county section lines (figure D.6.1a). HSI values and weighted useable area estimates were computed for each species and management scenario combination in each of these lake subsections and then summed to provide a total habitat quality rating of the lake. Lake habitat subunits were evaluated individually and then summed to represent the entire lake; note individual units can be mapped using GIS to visualize the spatial distribution of available habitat (e.g. figure D.6.1b,c).



Specific Modeling Methods

Predicting Aquatic Vegetation

Important factors effecting the occurrence and distribution of submersed aquatic vegetation (SAV) include light, substrate texture/ stability, wave disturbance, and hydrostatic pressure (Figure D.6.2).

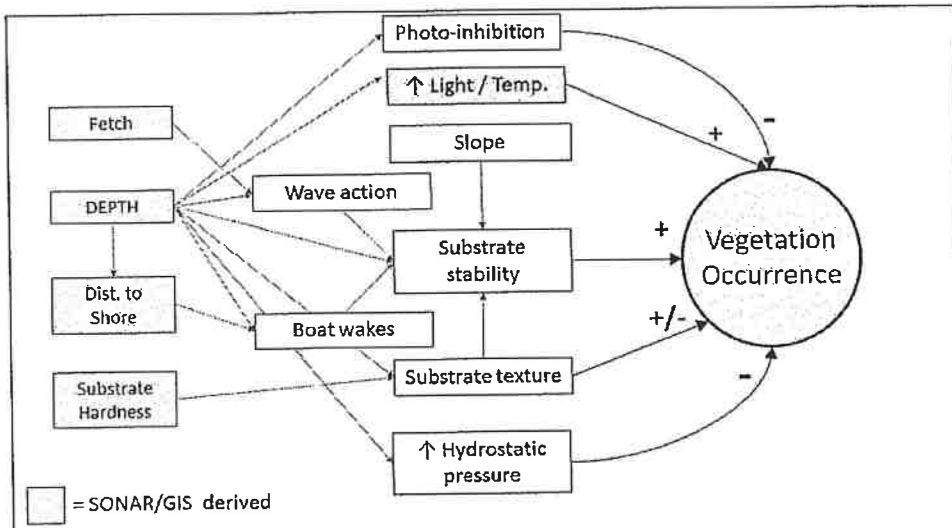


Figure D.6.2. Conceptual model linking factors influencing the occurrence and distribution of aquatic vegetation to key variables measured during this study (in blue).

Since depth affects all four, it necessarily exerts a strong overall control on SAV distribution. During thermal stratification, vertical distributions of temperature and light are correlated in lentic systems; both decreasing with depth. Substrate conditions also influence SAV distributions; substrate stability and penetrability both being important to rooted vascular species. Wave action (energy dissipation per unit depth), substrate texture (grain size) and bottom slope influence substrate stability. When sediments are unstable, vascular plants are more likely to be dislodged and less likely to become established. Sediment texture can also directly influence likelihood of SAV establishment; for example, a cobble bed may be particularly stable and suitable for attached algae but not allow penetration of vascular rooting structures.

Binary logistic regression was used to produce a statistical model relating the distribution of SAV in response to changes to lake-level arising from different management scenarios. Following a similar model developed for bays and estuaries of Lake Superior (Angradi et al. 2013), we explored the following variables as potential predictors: water depth, slope, directionally-weighted fetch, substrate hardness, and percent light remaining at depth, plus all 2-way interactions between predictors using manual step-wise selection. Substrate hardness data was natural log transformed. Models were fit using GLM (Generalized Linear Model) methods in DataDesk 6.3 (Data Description, Inc.). Data inputs required for the SAV modeling included the development of the following data sets.

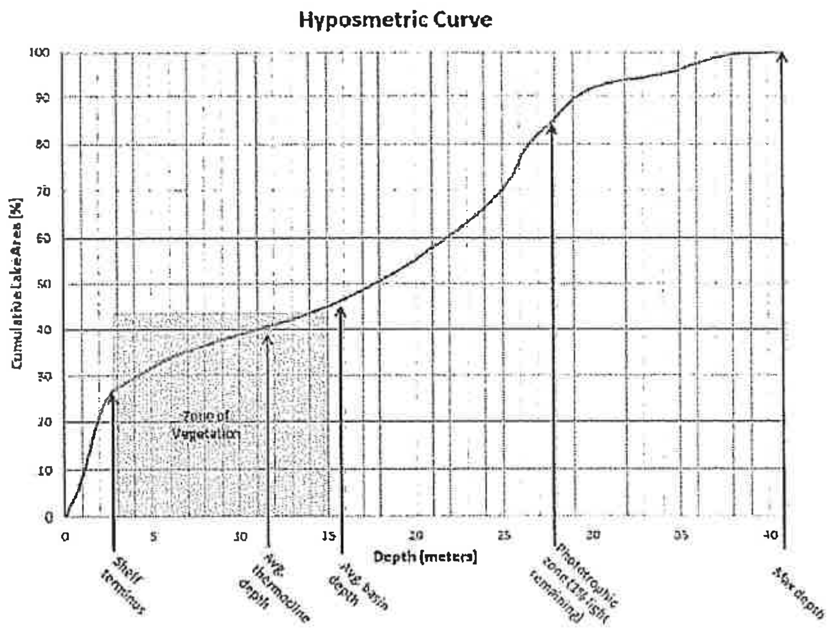
Fish habitat responses to WSE scenarios were similarly muted (Table D.6.4, preceding page). WUA and PUA values for Smallmouth, Northern Pike, and Spottail Shiner declined somewhat with lowered WSEs. On the other hand Yellow Perch and Walleye showed small gains. Walleye spawning habitat and Lake Whitefish spawning habitat were the most sensitive of the WUAs evaluated. Walleye spawning decreased with increasing WSE, while Whitefish spawning area increased rather dramatically. The average (across taxa) habitat response varied from the baseline (1151.9 ft, channel elevation) by 11% at the most, declining with reduced water elevations. Average PUA was even less variable, staying near 19% across all change scenarios (the SLL average value was 18%).

D.6.1. DISCUSSION

The responses of both the vegetation and fish habitat models to more extreme forcing in the sensitivity runs verifies that the models themselves were adequately sensitive to water level change. Nevertheless, the range in WSE elevation change being discussed in terms of management options (and represented in the WSE scenarios we explored) appear to be too small to have large impacts on either the SAV or fish HSI models, and by implication on Higgins Lake fish habitats. This is perhaps not very surprising given the volume and depth of Higgins Lake. With an average depth of slightly more than 52 feet, the scenarios being discussed involve depth changes ranging from < $1/10^{th}$ of 1% of the average, to a maximum of about 4% of the average depth when the lake level is set to the current channel outlet elevation.

Of course the impacts of removing the current dam on fish habitat would depend on the hydraulic details of the physical outlet remaining. Cross-sectional area and roughness would control outlet WSE and so is difficult to predict with precision a dam out water elevation for the lake in advance. The bottom of the outlet channel (1151.9 ft AMSL), was used as a baseline for our comparison in Table D.6.4. It represents the lowest physically conceivable WSE for Higgin Lake given the outlet constraint. However, this is not likely the "natural" pre-dam level, nor the level that would likely follow a dam removal. Based on the lake shore boundary as surveyed in the circa 1840 General Land Office Survey, we estimate that the elevation of the un-regulated outflow to the Cut River at that time was probably near or a bit below 1153 ft. The projected lake boundary for the WSE 1152.6 ft scenario (all boards open) provides a close approximation to the GLO-mapped shoreline and so is our best estimate of both the pre-lake level control condition, and of a reasonable target elevation if the existing dam were to be removed. If realistic WSE regulation options span from 1154.2 ft to 1152.6 ft, then the maximum impact of these differences in terms of fish habitat are even more clearly minimal (maximum average response for PUA and WUA 4-5.5 %).

The reason habitat values are relatively insensitive to the small changes in WSE is related to both the large volume and average depth of Higgins Lake (as noted above), and to the restricted depths at which submersed vegetation flourishes in this lake. Light penetration is good (average seechi depth = 27 ft; MiCorp data) suggesting the trophogenic zone (>1% surface light) extends to 93 ft (28 m). Despite light availability, vegetation coverage in Higgins Lake is low with most of the extensive sandy shelf devoid of vegetation (Fig.D.6.1.E). This is presumably reflects physical substrate instability and low organic content on the extensive shallow sandy shoals. Vegetation is therefore largely restricted to water near the drop-offs and the deeper areas of the western and southern shorelines where wind fetch is reduced (Fig. D.6.5, below)



Large fetch, extensive boat traffic, and possibly some photo-inhibition likely contribute to low SAV coverage on the shoals. In turn, both low SAV coverage and a relative scarcity of gravel and harder substrates suitable for spawning contribute to the relatively low HSI scores for most of the fish taxa examined.

Task D.6.2 Impact of instream flow levels Cut River Fishes & Fishery

D.6.2 METHODS

During the summers of 2013 and 2014 crews from MSU and UM gathered water surface profile, bathymetric, and cross-section data in the Cut River. This report focuses on the river reach centered on the Lansing Rd. Bridge, approximately six river miles downstream from the Higgins Lake Outlet structure. This reach is the most easily accessed and heavily used part of the river by the general public for both fishing and canoe access, although no formal use statistics or creel data are available.

A temporary gauging station was installed by the MSU crew on the upstream side of the bridge in the Spring of 2012, and a flow calibration curve developed. In June 2014 extensive Acoustic Doppler Profiler (ADP), GPS, and traditional land survey methods were used to develop cross-section data for a HEC-RAS hydraulic simulation model of this reach (Fig. D.6.6, Full digital version of the RAS model is available; model geometry file with measured cross-sections in Appendix B). The cross-sections were vertically referenced to the bridge deck (as 1154 amsl; USGS 1963 7.5 min topographic map) and the water surface profile for June 20 2013 (Q = 1.1 cms) used to calibrate the model.

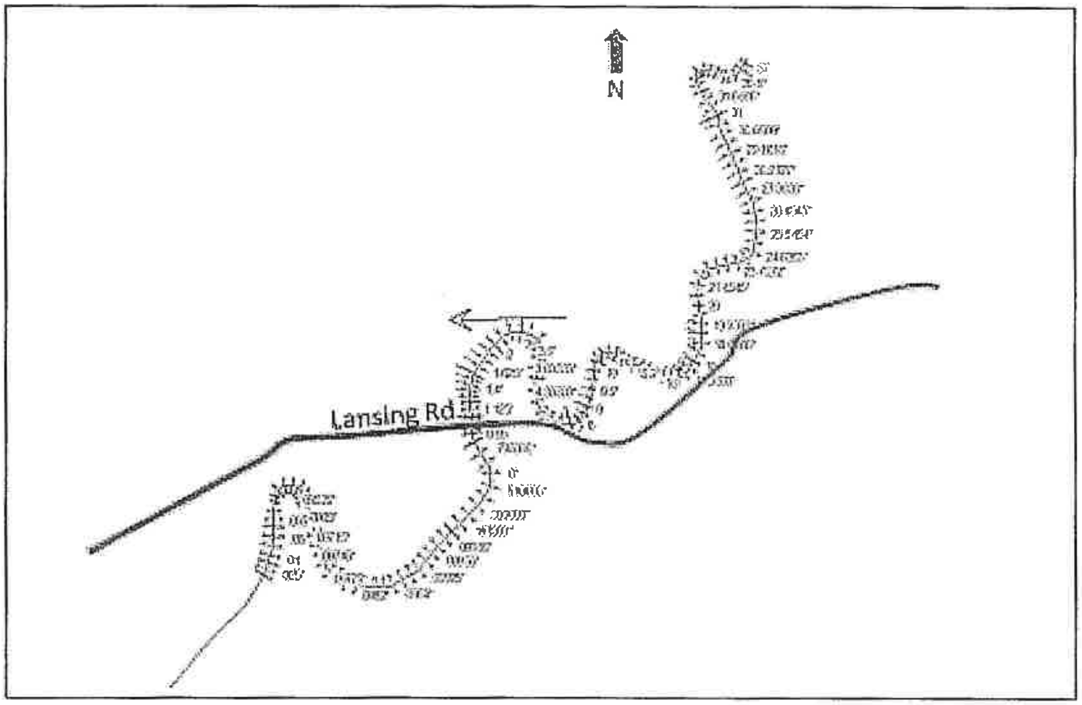


Fig. D.6.6 Channel schematic of HEC-RAS model for the Lansing Rd. Bridge Reach, Cut River.

Standardized HSI functions developed for Minnesota fishes (Aadaland and Kuitunen 2010; Table D.6.1.b, above) were used develop WUA area estimates at representative flows based on HEC-RAS outputs. Simulations were performed as uniform flows and are used here to represent characteristic habitat availabilities at stable flows of 0.25, 0.5, 1.1, 2, 4, and 8 cms (18, 39, 71, 141, and 283 cfs); a range that brackets the flows observed in our gauging study. A complete digital version of the model has been archived with the Muskegon Watershed Assembly.

D.6.2 RESULTS

While there was considerable variation in the amounts of modeled habitat available in the reach with respect to species and life stage, all showed relatively high sensitivity to flow reductions (Fig. D.6.2.7
; Table D.6.5). White Sucker and Smallmouth Bass adult habitat increased more or less in proportionally with flow rate. Reproduction for both of these species was optimal at lower flows, between 100 and 150 cfs. General habitat for adult Walleye was optimal at lower flows (around 75 cfs), however, habitat for spawning adults, fry and juveniles all increased with flow suggesting optimal values > 200 cfs. Most of the other species examined had optimal flows (in terms of hydraulic habitat) in the 100-200 cfs range.

Averaging the flow responses across taxa provides an overview of fish habitat availability for the study reach (Table D.6.6). Plots by life-stage of the combined species data indicate that modeled habitat availability is maximized at flows between 100 and 150 cfs (Fig.D.6.8). In contrast flows < 50 cfs (1.416 cms) show a rapid decline in habitat quality (as assessed by PUA) and availability (as assessed by WUA) for all species and life stages combined, as well as for total wetted channel surface area (Table D.6.6).

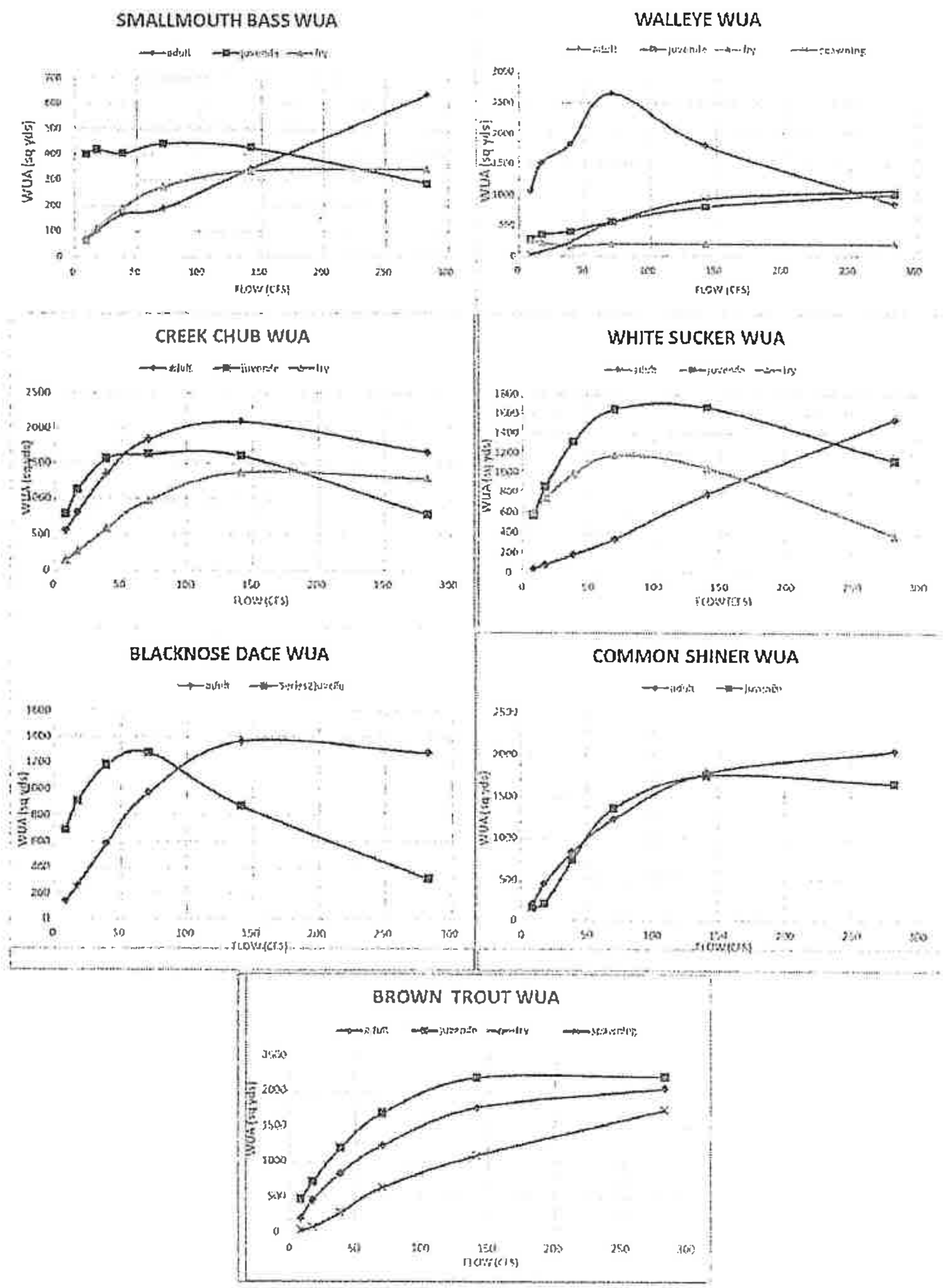


Figure D.6.7 Species-specific WUA response curves

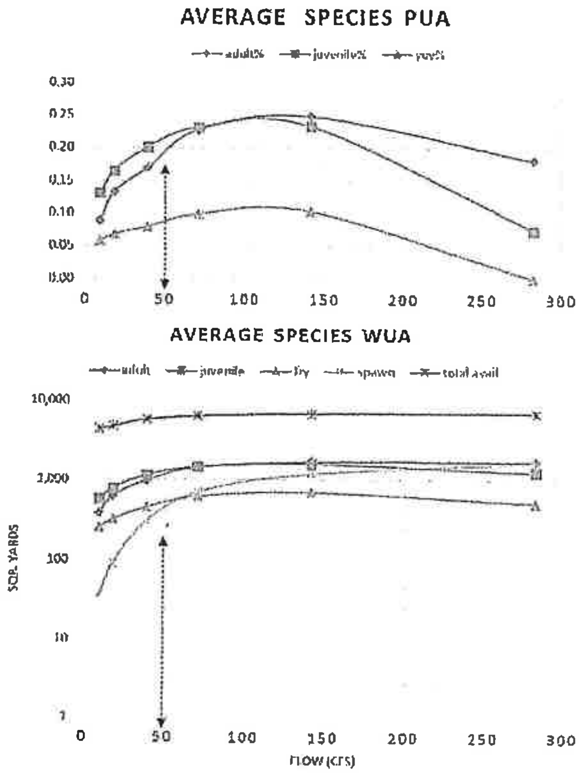


Figure D.6.8. Averaged habitat response curves. Vertical line indicates 50 cfs minimum release target suggested in this report.

Table D.6.5 Lansing Rd Bridge, Cut River WUA and PUA by species

Taxa	cms	cfs	adult	juvenile	fry	spawn	adult%	juvenile%
Blacknose dace	8	283	1277	318			22%	5%
	4	141	1367	872			24%	15%
	2	71	972	1276			18%	24%
	1.1	39	580	1181			12%	25%
	0.5	18	264	907			7%	23%
	0.25	9	141	686			4%	19%
Brown Trout	8	283	2041	2215		1732	35%	38%
	4	141	1761	2195		1083	31%	39%
	2	71	1221	1684		633	23%	32%
	1.1	39	829	1187		281	17%	25%
	0.5	18	445	708		77	11%	18%
	0.25	9	201	463		30	6%	13%
Common Shiner	8	283	2044	1653	3		35%	29%
	4	141	1778	1747	0		31%	31%
	2	71	1228	1355	0		23%	26%
	1.1	39	832	729	0		17%	15%
	0.5	18	448	203	0		11%	5%
	0.25	9	201	149	0		6%	4%
Creek chub	8	283	1655	776	1277		29%	13%
	4	141	2088	1604	1367		37%	28%
	2	71	1840	1628	972		35%	31%
	1.1	39	1351	1567	580		28%	33%
	0.5	18	812	1126	264		21%	29%
	0.25	9	556	788	141		15%	22%
Smallmouth Bass	8	283	634	286	340		11%	5%
	4	141	342	426	333		6%	7%
	2	71	189	441	271		4%	8%
	1.1	39	166	403	191		3%	8%
	0.5	18	100	418	109		3%	11%
	0.25	9	67	400	66		2%	11%
Walleye	8	283	858	1007	195	1062	15%	17%
	4	141	1795	805	195	923	32%	14%
	2	71	2642	552	196	542	50%	10%
	1.1	39	1810	398	162	227	38%	8%
	0.5	18	1511	343	219	73	38%	9%
	0.25	9	1045	272	248	28	29%	7%
White sucker	8	283	1537	1119	364		27%	19%
	4	141	782	1665	1044		14%	29%
	2	71	335	1649	1171		6%	31%
	1.1	39	178	1315	981		4%	27%
	0.5	18	74	856	740		2%	22%
	0.25	9	36	569	598		1%	16%

Table D.6.6 WUA for combined (averaged) taxa; (n=7)

Averaged species scores

WUA (sq yards)					
cfs	adult	juvenile	fry	spawn	total avail
283	1,717	1,260	521	1,671	6,927
141	1,694	1,591	703	1,200	6,813
71	1,440	1,467	624	702	6,330
39	982	1,158	458	304	5,760
18	625	779	319	90	4,711
9	384	569	252	35	4,345

B.6.2 DISCUSSION

While the fish habitat WUA analysis in Higgins Lake suggested minimal sensitivity to changes in WSE, the WUA analysis for the Cut indicates that fish habitat has a strong dependence on instream flow rate. Discharge rates in the Cut River are controlled largely by the outflow at Higgins Lake (see Fig.D.6.9 below). Based on same day measurements, there is significant hysteresis in the relationship indicating hydrologic storage in the Cut above the Lansing Bridge. This is likely to include both ground water inputs known to occur in that reach and possibly outputs from Marl Lake and associated wetlands (Carlson 2006, Baker et al. 2006, MSU report). At higher flows there is also evidence of significant off-channel storage in marl Lake and/or bank storage which can buffer the Cut River from higher discharge rates at the outlet. A more continuous analysis of the two gauging station time-series should clarify the mechanisms involved. The result of these storage effects is that during periods of flow transition the relationship between discharge at the dam and flow at the bridge can be quite variable. However, as the plot indicates, on average the relationship is quite strong and is very close to 1:1. This suggests that for the purposes of instream flow management the target discharge rate at Higgin's Lake should be set to desired rates at the Lansing Rd. bridge.

Habitat response curves generated from the Hec-RAS model suggest flows below 50 cfs are severely constraining in terms of relevant fish habitat. This is then a reasonable estimate for a minimum desirable flow. Flows in the range of 100-150 cfs provide optimal habitat benefits based on these analyses. To the extent that Smallmouth and Walleye constitute species of particular interest in this analysis, it is worthwhile to note that significant spawning habitat is available in the Cut for both species. Furthermore, availability of reproductive habitat is strongly tied to flow rate with optimal flows (in this case during the spawning period) above 150 cfs.

Actual flow rates in the modeled reach are controlled by a combination of the discharge from Higgins and storage effects between the dam and the bridge (including interactions with Marl Lake). Nevertheless discharge at the dam outlet appears to be the primary controlling factor, and flow there is constrained by both the configuration of the dam itself and the water surface elevation of Higgins Lake (Fig.D.6.10). There is no evidence that discharge into the cut is constrained by the stream's own channel shape.

Because of these dependencies the lake level required to ensure adequate flow in the Cut also varies with dam configuration as illustrated below. When all gates are open a given lake elevation generates a higher flow to the cut than the same elevation generates when gates are closed or partially opened. The different dam configurations possible lead to distinct lake stage- dam discharge relationships at the outlet. Overlaying information from WUA analysis here it is clear that at lake levels below 1153.6 ft only the all gates open configuration is capable of generating sufficient discharge rates to avoid threatening habitat conditions downstream. Furthermore, with all gates closed, there is no commonly lake level that can deliver adequate, let alone optimal, flow downstream. Mixed gate configurations can provide optimal flows at higher lake levels (>1153.8 ft) and provide adequate flows down to about 1153.6 ft.

Fig. D.6.9. Observed relationship between flow below dam outlet and flow at Lansing Rd.Bridge

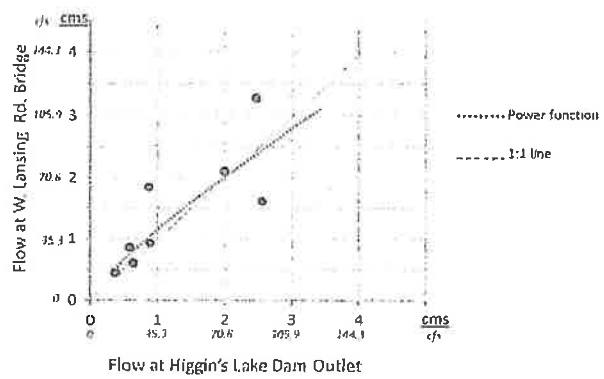
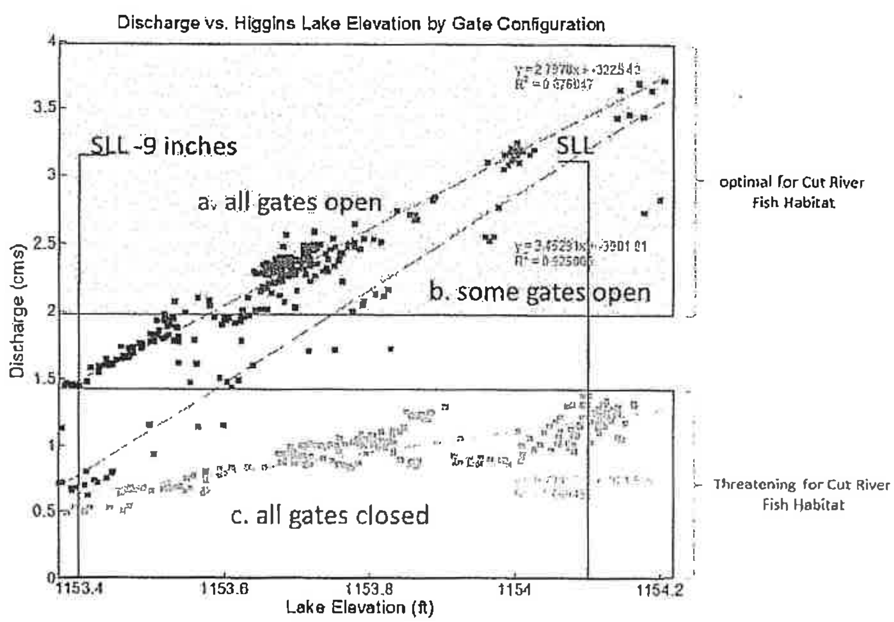


Fig. D.6.10. Relationships between Higgins Lake water surface elevation, dam configuration, dam discharge rate and instream fish habitat at Lansing Rd. bridge reach of the Cut River.



Caveats

It is important to note that WUA and PUA are not direct predictors of either fish population size or fishing quality. The models (both hydraulic and biological) used here attempt only to represent hydraulic and hydraulically linked riverine habitat characteristics (i.e. depth, velocity and substrate) and their relation to flow rate. These models do not reflect constraints of temperature, water quality, fishing pressure, bank management or any other factors which commonly influence local fish population size. Likewise, the analysis uses steady flow assumptions (flow rate is not changing over time or space within the study reach) and so cannot represent variations in habitat associated with flow variation or cumulative effects of flow frequency distributions. The analysis is rigorous, but is only indicative and not predictive in a practical sense. The same is true of the of the HSI-based analyses reported under task D.6.1.

The underlying HSI curves used in both the lake and river analyses represent reasonable summaries of the known habitat preferences and constraints for the species and life stages represented. However, none of the HSI functions we used here were developed locally, nor can be assumed to infallibly represent the habitat requirements of the local populations. They are simply rational summaries of the published literature.

Job D.6 SUMMARY & CONCLUSIONS

In the context of ongoing discussions of water level management in Higgins Lake, the impacts of changing water surface elevations on fish and the regions valuable fishery have been largely overlooked. This study provides MDNR with the first quantitative analysis of the relationships between managed lake elevation and fish habitat features, both in Higgins Lake proper and in the downstream Cut River channel. Based on responses of habitat suitability models to changes in water level and discharge to the Cut River, we draw the following conclusions:

1. The range in the water level targets currently being discussed for Higgins Lake are small enough that none of the scenario levels, including dam removal, are likely to substantially change habitat conditions for the lake fishery.
2. In contrast the Cut River appears to be quite susceptible to low flow disturbance and discharge in the Cut is quite sensitive to variations in both outlet configuration and Higgins Lake water surface elevation.
3. Based on the RAS modeling for the study reach and subsequent WUA analysis, a minimum 50 cfs seems a reasonable target flow rate to protect downstream fishery values.
4. Flows of 100-150 cfs are likely necessary to provide optimal habitat for key species.

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APPENDIX A: LAYMAN THESIS [PDF 67 PP ATACHMENT]
APPENDIX B: HEC RAS GEOMETRY FILE [PDF 22 PP ATACHMENT]

EXHIBIT 12

Final Report to the Muskegon River Watershed Assembly

May 27, 2016

Ecohydrologic Evaluation of Removing the Higgins Lake-Level Control Structure

Anthony D. Kendall, Blaze M. Budd, and David W. Hyndman

Introduction

Higgins Lake, in Roscommon County, has experienced significant shoreline erosion, some of which has been attributed to high water caused by a lake-level control structure (dam) at lake's outlet into the Cut River. The erosion has been severe enough to concern the Higgins Lake Property Owners Association, and the structure's operations are non-compliant with the provisions of the Muskegon River Watershed Plan (O'Neal 2003). The effects of the erosion and accompanying disturbance to the lake bottom, surrounding vegetation, animal species, and neighboring aquatic habitats have had little study since the construction of a permanent dam in 1936. This is despite the fact that the lake and its environs provide significant fishing, recreational and economic benefits to the citizens of Michigan. For these reasons, we conducted a study of the area that included hydrology, wildlife, vegetation, and weather to provide a scientific basis to help local decision makers alleviate the erosion, minimize ecosystem impacts, and maximize recreational benefits from the lake.

As one of the largest inland water bodies in Michigan, Higgins Lake has a surface area of 10,186 acres. It includes a number of tributaries, and discharges into the Cut River, which then runs through Marl Lake and joins with Backus Creek, before entering Houghton Lake. The basis for the initial assessment that enhanced shoreline erosion exists is that the dam maintains artificially high water levels, causing a significant increase in the energy of waves striking shore. When heavy rain events occur, artificially high water elevations are raised further, thus exposing even larger areas of shoreline to enhanced erosion. In some areas, it appears that the shoreline has receded by 35 feet or more and portions of shoreline have been hardened with seawalls and/or rip-rap to limit erosion.

The Higgins Lake Property Owners Association (HLPOA) contacted DNRE Fisheries Division with their concerns regarding the significant shoreline erosion in 2010. Records and data from the 1939 Fisheries Division survey of the lake indicate reductions have occurred in the amounts of gravel bottom, floating vegetation, and emergent vegetation. In the interim, studies of the lake level control dam were done in 1956, 1969, and 1995.

Manipulation of the dam's height to control water levels in Higgins Lake historically resulted in significant variations to the streamflow in the Cut River, including periods with little to no outflow, which affects its fish communities and vegetation, along with those of Marl and Houghton Lakes. This is a concern for the fish species that use the Cut River for spawning, including walleye, a recreational sport fish that helps support an important fishery in Houghton Lake.

This study seeks to apply state-of-the-art data collection tools and computer models to measure the state of the Higgins Lake and Cut River systems, to model hydrologic and ecological function of these systems, and to simulate changes that would likely result from altered dam management or dam removal.

Findings By Task

In this report, we describe the findings of this project based on extensive evaluation of data and models for Higgins Lake, along with its basin and outlet. Our findings are described within each subsection, and summarized at the end of each Task. Tasks 1 through 5 are summarized in this report, as these were hydrology-related tasks completed by Michigan State University. Task 6, fish habitat modeling, was described in an earlier addendum to this report by the University of Michigan. Task 7, surveying members of the Higgins Lake Property Owners Association, is described in brief here as well, along with a presentation of overall survey results. Tasks 8 and 9 pertain to reporting, public presentations, and scientific manuscripts and publications which have been discussed in earlier interim reports. Task 10 is associated with administrative work conducted by the Muskegon River Watershed Alliance.

Task 1: Review Hydrogeologic, Environmental, and Engineering Data

This section describes the synthesis of existing data for the region. Data were compiled that describe the lake, its outlet (the Cut River), and the surrounding hydrogeologic system.

1.1: Outlet Control Structure Studies

Multiple engineering reports have been completed on the operation and maintenance of the the Higgins Lake control structure, which sits at the head of the Cut River (1940, 1941,1956, 1995, 2007). The 1956 report from the Michigan Department of Conservation Engineering and Architecture (MDCEA) titled "*Higgins Lake Level Control, Roscommon and Crawford Counties, Preliminary Engineering Investigation*" mentioned the the two previous studies; "*Memorandum on Proposed Outlet Dam for Higgins Lake, Roscommon County, Michigan*" (Ayers,Lewis,Norris, and May; 1940) and "*Control of Level of Higgins Lake*" (Fargo Engineering Co.;1941). These reports presented designs for new control structures to allow for more manageable openings. However, the operating improvements were not implemented.

Study from Spicer

The main purpose of the Spicer group report #118475SG2010 was to evaluate the structural integrity, functionality, and effectiveness of the Higgins Lake control structure. It described various measures of water loss from the lake, and provided recommendations about dam alterations that would retain more water.

Evaporation: Spicer used MSU's enviro-weather website for a station in Arlene Michigan (26 miles W-SW of Higgins Lake) to estimate the potential evapotranspiration (PET) for July and August of 2010. The PET rates for these months were 0.1 to 0.3 in/day. Spicer then removed transpiration from the calculations and relied on pan evaporation measurements at a NOAA station located 24 miles to the W-SW, outside of Lake City, Station ID GHCND:USC00204502. Their calculated monthly average evaporation during the summer for the recording period from 1967 through 2008 was 0.11 in/day with the highest rates of 0.15 in/day in July.

Wave Loss: Within Table 1 of the Spicer report, wave height with water loss over the dam was estimated for a sustained 24 hour period to be ~ 0.05 in/day

Spicer Report Table 1: Wave loss over the dam as a function of wave height.

Height (inches)	24-hr Loss (in/day)
4	0.03
6	0.05
9	0.08
12	0.10
18	0.16
24	0.21

Low Flow Channel Outlet: The low flow channel is approximately 4.75 feet wide and 3 feet high to the top of the dam catwalk. But the depth of flow through from concrete sill when the lake is at summer legal lake level is ~2 feet. Spicer calculated that the flow during summer levels would be 33 cfs, or 28 cfs with 1 foot of tailwater. Assuming no inflow, the lake level would drop 0.08 in/day at 33 cfs flow, and 0.07 in/day at 28 cfs flow. However, this drawdown calculation does not consider substantial inflows from groundwater and the the 2 tributaries, Big Creek and Little Creek.

Spicer Report Table 2: Summary of normal water loss from Higgins Lake

Water Loss	Depth Loss (in/day)
Evaporation	0.10-0.15
Wave Action	0.05
Low-Flow Channel	0.07

The main conclusion of this Spicer report was that the lake levels are affected by evaporation during the summer months and flow through the low flow structure of the dam, followed by wave loss. The report does not include any new measurements of Cut River flow to compare with outflow estimates from the dam at various lake elevations or dam orientations.

The 1995 report also found that flow out of Higgins Lake is limited by the capacity of the Cut River when flows exceed 110-120 cfs. This is due to the culverts at East Higgins Lake Drive.

1.2: Outlet Control Structure Description

The current Higgins Lake Control Structure consists of a series of 6 manipulable openings plus a 4.75 foot wide low flow channel (Figure 1.2.1). The naming scheme of the openings were adopted based on the daily records of the dam kept by the board of commissioners. The numbered scheme begins from the West to East. 1 through 3 are the stop log gates, 4 through 6 are the flop gates. These gates can be operated independently of each other, with typical configurations of gates 4, 5, or 6 open and with any combination of gates. Gate 4 is 15.5 ft wide, whereas gates 5 and 6 are 17.5 ft wide. Gates 1 - 3 measure 5 ft wide and are rarely opened, and in general impact flows much less than the flop gates opened. The dam structure has had various configurations through time (e.g., Figures 1.2.2 - 1.2.3).

Figure 1.2.1. Image of the 2015 outlet control structure looking toward Higgins Lake from the Cut River. The low flow structure is in the center of the picture.

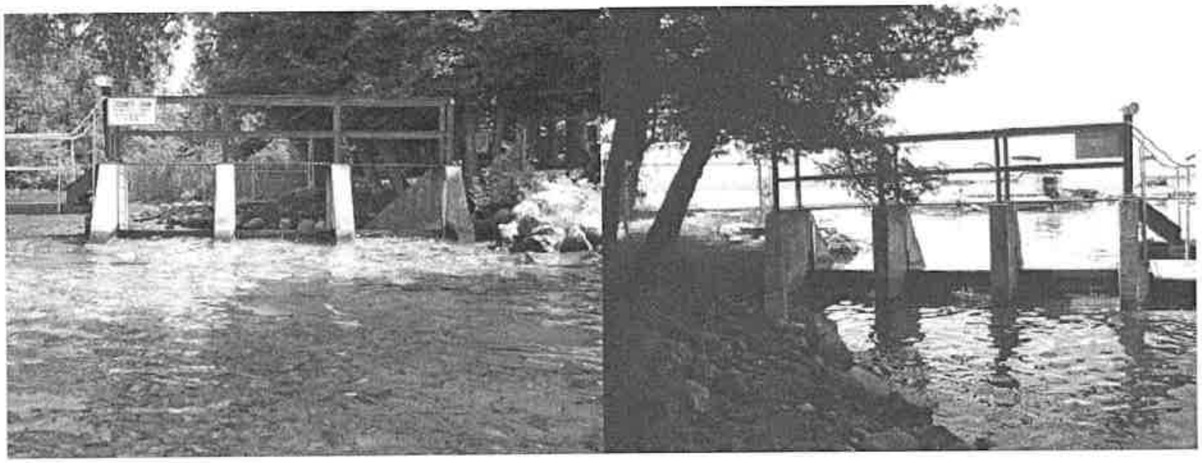


Figure 1.2.2. Image of upstream and downstream side of the stop-log gates (2010 Spicer report). The flow through this section is governed by the use of 5 foot wide wood planks, which are rarely removed due to their unwieldy size and weight.

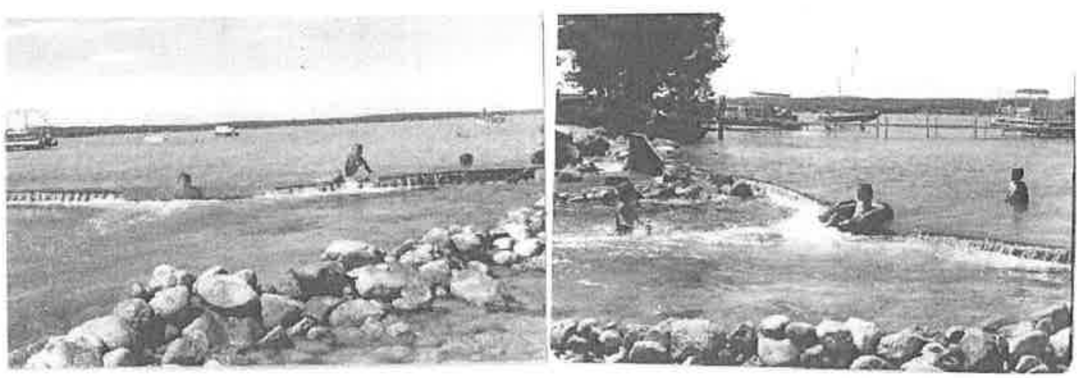


Figure 1.2.3. The outlet at Cut River, during a period when the full dam structure was not in place.

To quantify potential lake level drop scenarios, the outlet control structure was measured and surveyed, in particular the role of rocks adjacent to and within the structure were examined. Lakeward of the control structure, boulders form a loose pavement and are used as riprap along the sides of the shore and entry of the outlet. The presence of these are thought to be from the previous low head and rock dams as an attempt to keep lake levels high during dam out durations, see Figure 1.2.2. The boulders and cobbles are at approximately the same elevations of the flop gate sills along the upstream side of the outlet. Approaching the dam within hundreds of meters is a shallow, gravelly lake bed that appears to be natural in origin. Without any specific evidence to the contrary, it was assumed that this approach is unmodified from the historical condition.

The flow through the opening of the control structure is also lined with boulders and cobbles. It is unknown if the apron of this flow gate is concrete or just rocks. The downstream side of the control structure is primarily medium to coarse sand, which has a high probability of scouring under high flow events, such as during the initial opening of the flop gates each year. Signs of sediment erosion and deposition are apparent just upstream of East Higgins Lake drive culverts.

During a survey on May 2013 of the water levels along the Cut River (from the outlet to the inlet of Marl Lake) channel bottom elevation measurements were taken using a Trimble mapping grade GPS unit (Figure 1.2.4). A channel bottom elevation measured approximately 30 feet downstream of the control structure was 1152.07 ft, which is assumed to be close to the natural channel bottom, where "natural" is defined as unregulated. Channel elevation was recorded in 1956 for the *Higgins Lake Level Control, Roscommon and Crawford Counties* report of 1151.0 ft, indicating a 1.07 ft discrepancy, which could easily be associated with the location of the measurements. MSU's field crew measured elevations just downstream of the control structure, whereas the location of the Michigan Conservation Departments' measurement is unknown. The deeper channel historically could be a legacy of scour from the high flows experienced during logging years, with subsequent aggradation of the channel bed during more recent lower and stable flow periods. It could also be a legacy of reported dredging of the channel, which has since filled in with sediment.

Figure 1.2.4. Photo of GPS and total station survey set up along the Cut River at the culverts under East Higgins Lake Road.

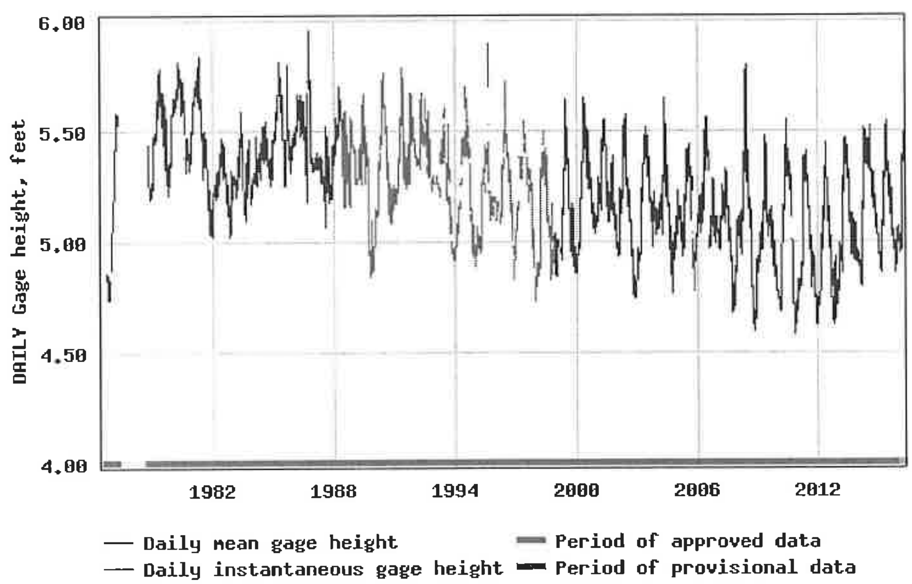
1.3: Historical Lake Levels

The artificial control of the lake began during the lumber boom in the area from mid 1800's to the 1880's. During this period, a dam would be constructed each year, causing water levels to rise 3 to 4 feet to aid in the log runs down the Cut River. After the seasonal transport of the logs down the Cut River, the lake would remain at natural levels for the remainder of the year. After the logging industry left the surrounding area, the lake remained unobstructed until around 1911 when a recreational dam was erected. The new control structure was ambitious and caused enough erosion to have a consensus to remove it within a year after completion.

By 1926 a legal lake level of 1154.11 ft above mean sea level (amsl) was established to a datum provided by Fargo Engineering Co. and confirmed by the Michigan Conservation Department (MCD) in 1956. By 1936 a dam was constructed, but was difficult to operate at the desired level due to the width and height of the stop log gates. The 1941 Fargo report investigated the effects of the legal lake level on the shoreline. The conclusion was that the established lake level of 1926 was acceptable. The 1956 Michigan Conservation Department's report seconded that conclusion of the legal limit of 1154.11 ft amsl. But the same 1956 report also voiced strong concerns that higher water levels would begin to erode the shoreline, since it was already evident as a problem. The state made recommendations to lower the lake during winter and spring to counteract the erosive actions of ice push and spring melts. The 1956 recommendation of the lower winter elevation of 1153.5 ft amsl was to allow for the capture of snow melt and ensure if spring had abnormally high precipitation it would not exceed an elevation of 1154.11 ft. This recommended drawdown was to start by October 1st and the spring recovery was to start when the spring flows/melt had passed. The date on which dam management began its recovering toward the legal level was not mandated, but was an educated decision with practices that varied through time. MCD was very concerned of the inevitable damage to the lakeshore if lake levels were not at or below the legal level. The MCD viewed the legal level similar to a speed limit, not to exceed, but the ability to be lower.

The first USGS gage was installed on Flag Point on September 1, 1942. The zero value of the gage was set to 1148.74 ft AMSL, 1926 datum. The current USGS gage, located in the South Higgins State Park, has been present since October 1, 1976 (Data shown in Figure 1.3.1).

Figure 1.3.1: Graph of lake levels of Higgins Lake from 1976 to 2016 from the USGS gage station, 42805084411001. For reference, the gauge datum is 1148.74 ft, thus on this plot legal summer level is 5.37 feet, and winter levels are 4.62 feet for the 2009-2014 period, and 4.85 feet for all other years.



The original court ruling of 1926, relied on the state law of Inland Lake Levels Act 377 of 1921, and set the lake level at 1154.11 ft. During that period, little thought was made with regards to the flow of the Cut River ecosystem and the possible effects of future development around the lake. During the initial judgment there was no mention of seasonal adjustment. The Inland Lake Level Law, Act 194, Public Acts 1939, provided for establishment of additional levels above or below the legal normal. In 1982, the Circuit Court established a legal winter lake level, not to exceed a decrease of more than 6 inches below the legal summer level, 1153.61 ft amsl.

The most recent adjustment to the legal lake levels were from a 2009 Circuit Court judgement that lowered established winter lake level from 1153.61 ft to 1153.36 amsl for a 5 year period. This trial period expired during spring 2014, without a renewal or extension, thus the current winter legal lake level is maintained at 1153.61 ft amsl until April 1st or ice out, whichever comes first, then raised to the summer level.

1.4: Historical Lake Bathymetry

The bathymetry of Higgins Lake was first fully mapped during the winters of 1936 and 1937. For this effort, the survey crew (part of the Civilian Conservation Corps, or CCC) would wait until the ice was thick enough to support the weight of participants and allow for drilling holes to access the water. Lead lines were employed to reach the lake bottom and from the top of the ice the depth was recorded. The ice surface was surveyed in and used as the reference for elevation. The sample spacing within the shoal area was every 20 ft until the deep basin which then was every 50 ft. A maximum depth of 135 feet was recorded in the northwestern section of the north basin, while a typical shoal depth of less than 10 feet was recorded. Indeed, no data were available on depth variations within this zone, which necessitated Task 2 of this study.

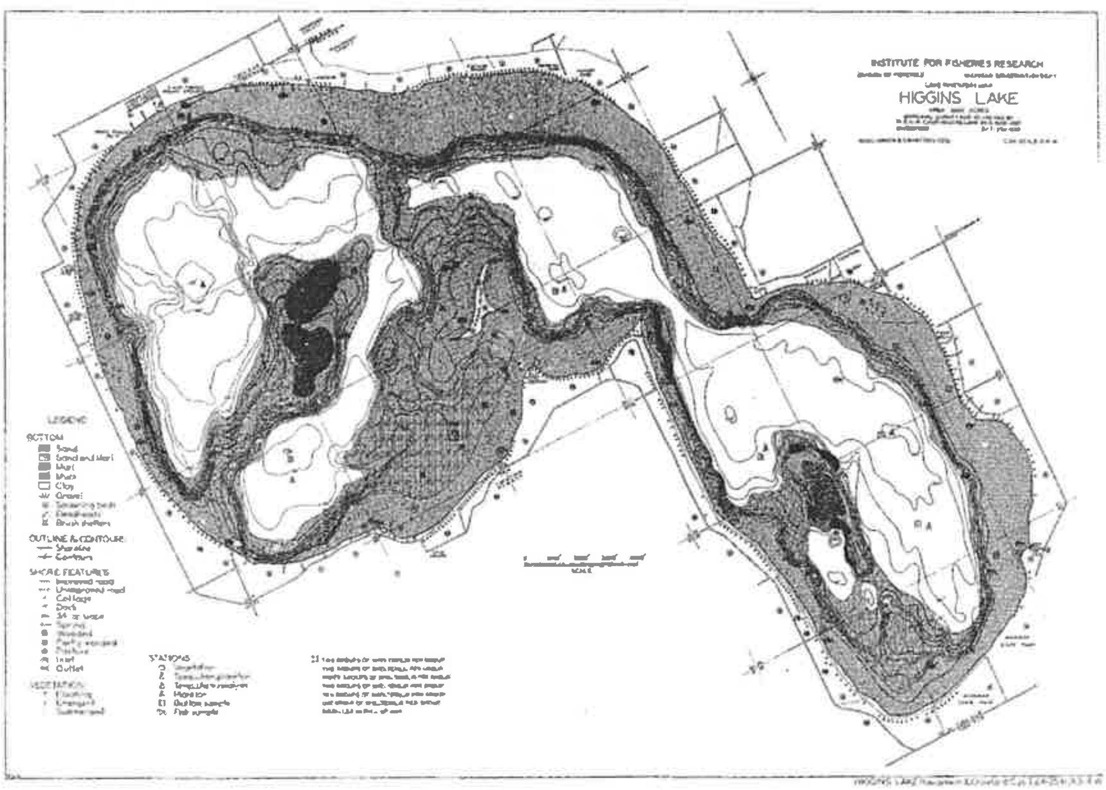


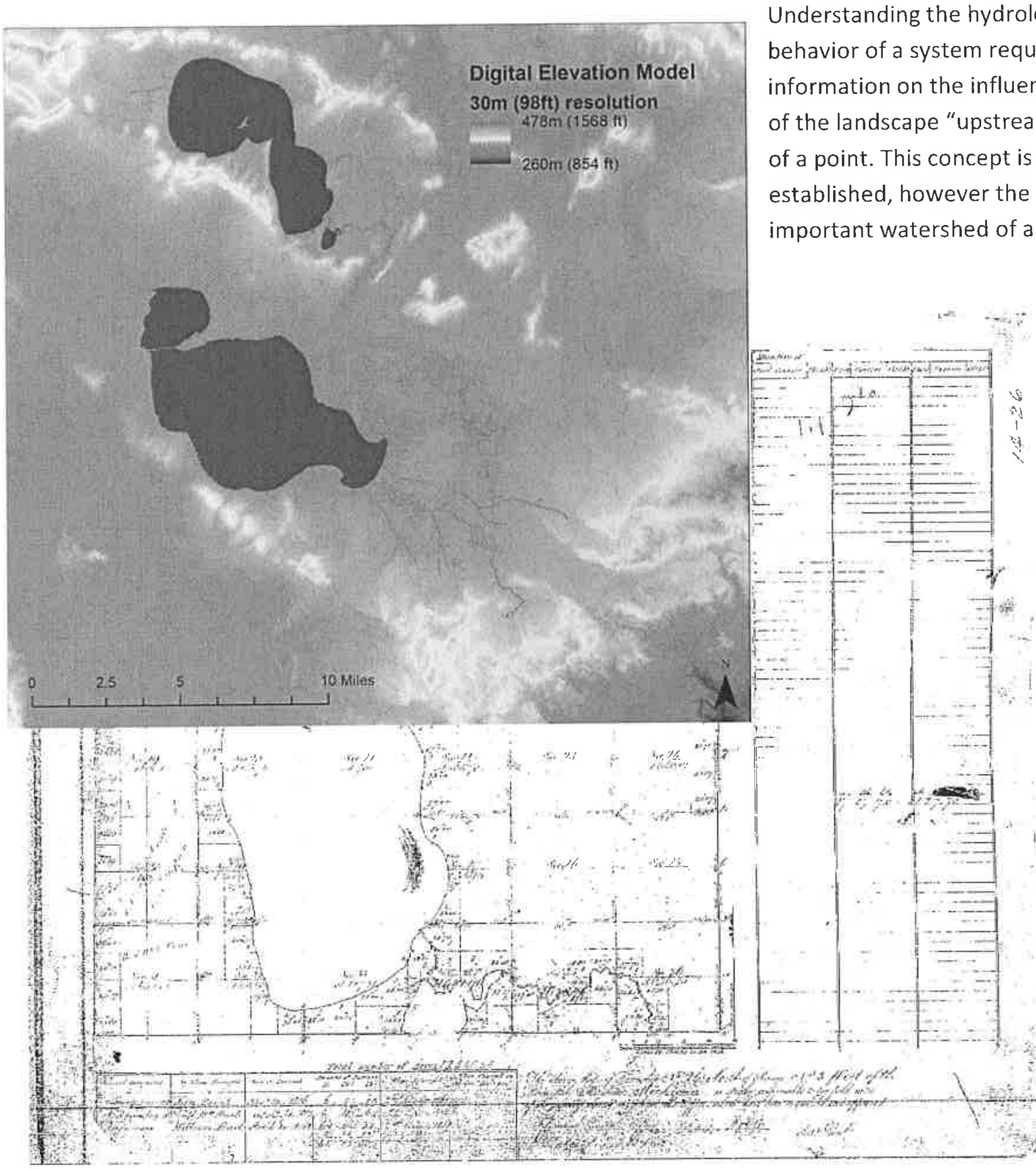
Figure 1.4.1. Original Division of Fisheries, Michigan Conservation Department bathymetric map of Higgins Lake, published in 1939. A higher resolution copy is available online from the Michigan Department of Natural Resources.

1.5: Historical Outlet Position/Depth

The Cut River was mainly used during the timber boom for the transport of logs; as stated in the *1956 Higgins Lake Level Control, Roscommon and Crawford Counties* report, the river was dredged to allow timbers to freely float to Houghton Lake. Any remnants of dredging during the late 1800's were not observed by MSU and UM field teams while performing the Cut River survey. According to the Public Land Survey Plat map of 1852 (Figure 1.5.1) the outlet has remained relatively in the same position to the present, even with many dam restructuring projects, including the latest in 1995. According to the 1956 report, the stream channel elevation was 1151.0 ft, which is difficult to confirm as the original unaltered channel bottom due to multiple modifications through time. According to correspondence with the Michigan DNR and DEQ in 2015, the agencies provided a letter from The Higgins Lake Property Owners Association, dated 1/3/1952. According to the written testimony of the acting president, Paul H. Bruske, during the 1950 reconstruction of the dam, Roscommon County removed "perhaps 100 tons of rock out of the inlet". The permit for the most recent modification of the lake level control structure in 1995, did not specify a channel bottom elevation at that time. Specification by the Michigan DEQ of the flow through section of the level control structure was to be open to the elevation of the river channel bottom. However, the contractor never supplied an elevation of the channel bottom to the state to allow for comparison of historical elevations.

Figure 1.5.1. Public Land Survey map from 1852, accessed through the Michigan DNR General Land Office Plats Website.

1.6: Surface and Ground Watersheds



Understanding the hydrologic behavior of a system requires information on the influence of the landscape "upstream" of a point. This concept is well established, however the only important watershed of a lake is generally considered to be the area of the land surface that drains overland to a lake. **Figure 1.6.1**.

Connected hydrologic features from the Higgins, Cut, Backus, Houghton system overlain atop the National Elevation Dataset (NED) 1 arc-second Digital Elevation Model (DEM). This DEM has approximately 100 foot spatial resolution.

Figure 1.6.2. Map of the surface watersheds generated from the 1 arc-second NED DEM of Higgins Lake, the Cut River above the confluence with Backus Creek, Backus Creek and the Cut River below their confluence, and Houghton Lake

For this investigation, we extend this concept to encompass the region of groundwater drainage to the lake, hence the term groundwatershed.

Tools are widely available to calculate the surface watershed of lake, using detailed maps of surface elevations known as Digital Elevation Models (DEMs). Using a DEM, the flow direction of each map point is established, which are then summed to calculate the watershed. Figure 1.6.1 shows the Higgins/Houghton Lake system within a DEM. One can gain an intuitive understanding of watershed dimensions using the DEM alone, but a more detailed calculation can produce some surprises.

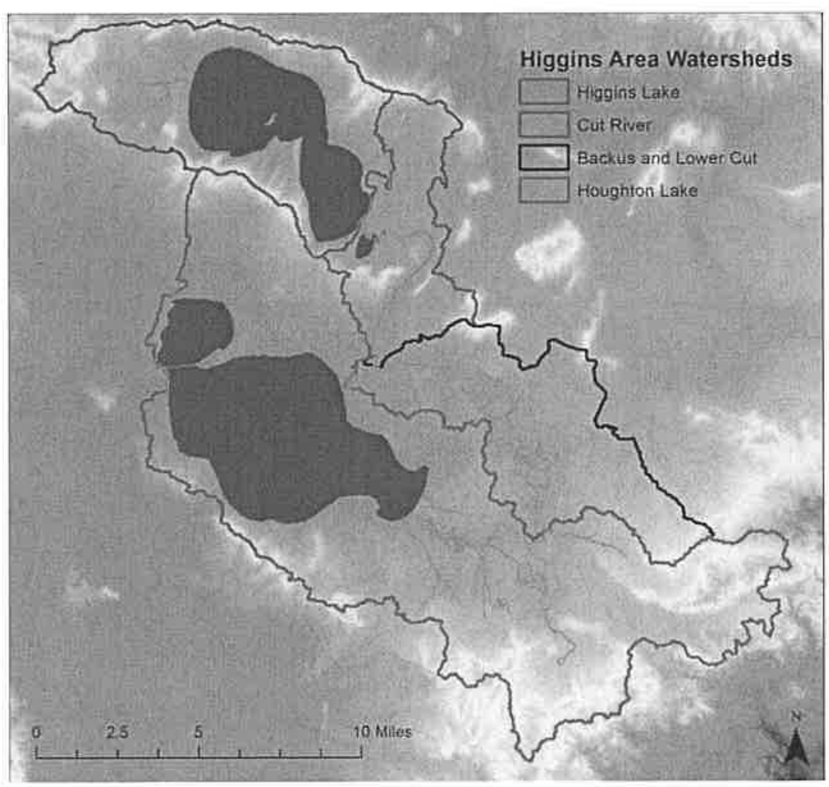


Figure 1.6.2 maps the surface watersheds calculated using the D8 flow direction algorithm in ArcGIS. Note that Higgins Lake has essentially no surface watershed on its southeast edge, proximal to its outlet. Also, the surface watershed areas in this map are somewhat exaggerated due to a simplifying assumption in the D8 flow algorithm. All internally-drained regions are removed prior to watershed calculation. The portion of the Cut River watershed north of the Higgins Lake outlet is actually drained by a wetland that connects only at much higher levels than typically occur in

most years. Thus, in general, the Cut River has a functionally small watershed until its merger with Backus Creek near Houghton Lake.

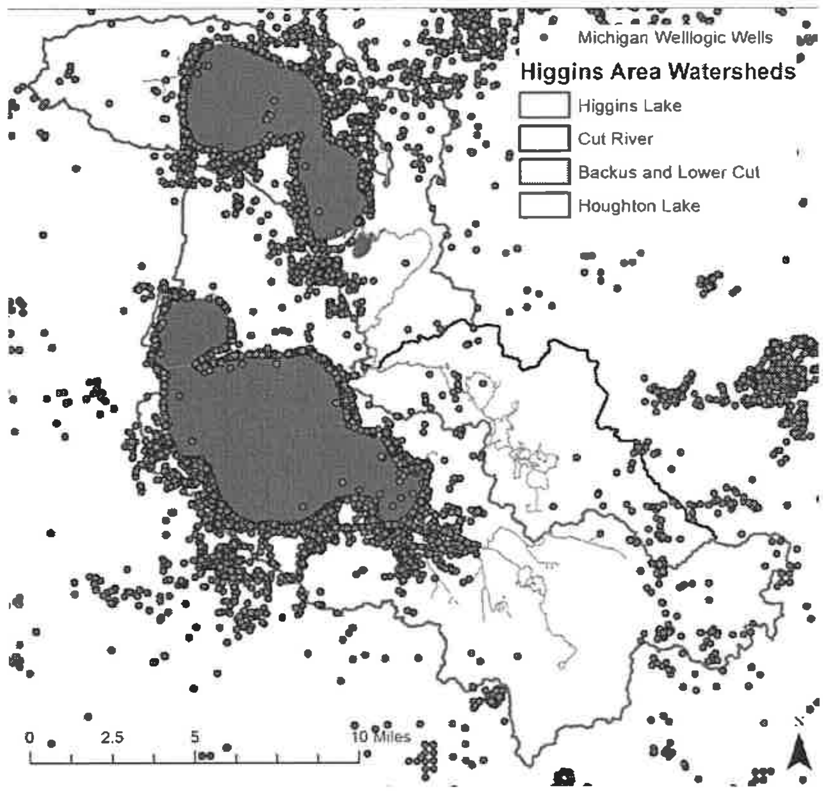


Figure 1.6.3. Map of drinking water wells retrieved from Michigan's Well Logic database for the Higgins Lake Area. Locations of wells are taken directly from database attributes and may contain some errors that are later addressed via filtering.

To map the groundwatershed, which is the source area of groundwater that flows into a water body, an equivalent of the surface DEM is needed: a water table elevation map. This can be obtained either through a groundwater model, or by interpolating a map of water levels using available measurements. The latter approach was selected here, and a database of drinking water wells was downloaded from the State of Michigan. Each of these wells has a measurement of static water level at the time of installation, which varies from the late 1960s to present day. The wells in this region are shown in Figure 1.6.3. There are a approximately 6,400 wells surrounding the lakes in this view of the lakes, and in some of the surrounding developed areas, while fewer are available in the less populated areas surrounding the lakes.

A variety of methods are available to create a map of water levels using these measurements. We chose a method known as Simple Kriging, which is an unbiased linear estimation method that uses the correlation between each measured value and its neighbors as a function of separation distance to produce a weighting map for how strongly each measurement impacts the the value at all other locations. As a first step before kriging, all wells in Michigan were downloaded, over 500,000 in 2015. These were filtered to remove water table estimates that were outside of 3 standard deviations from all others within a 1000 meter radius. This iterative outlier removal was repeated 3 times. These filtered data were then fit to a Stable semi-variogram model in ArcGIS, which produced a map of water tables for the entire Michigan Lower Peninsula. The Higgins/Houghton region of this map is shown in Figure 1.6.4.

Given this interpolated water table map, the D8 flow direction method could then be applied to calculate groundwatersheds for each of the hydrologic systems in the region. Separate groundwatersheds were calculated for Higgins Lake, Cut River, Backus Creek and the Lower Cut, and Houghton Lake. These are overlain on a map with the surface watersheds to show how the two systems differ. Note that Higgins Lake has a groundwatershed that is roughly 89% larger than its surface watershed. Given the significant northwestern extent of the groundwatershed, we would expect this portion of the lake to be a strongly groundwater gaining section. In contrast, the southeast portion of the lake has essentially no groundwatershed, thus we would expect this area to be a location of groundwater loss from the lake. This may be a region where groundwater loss feeds wetlands to the east of the lake.

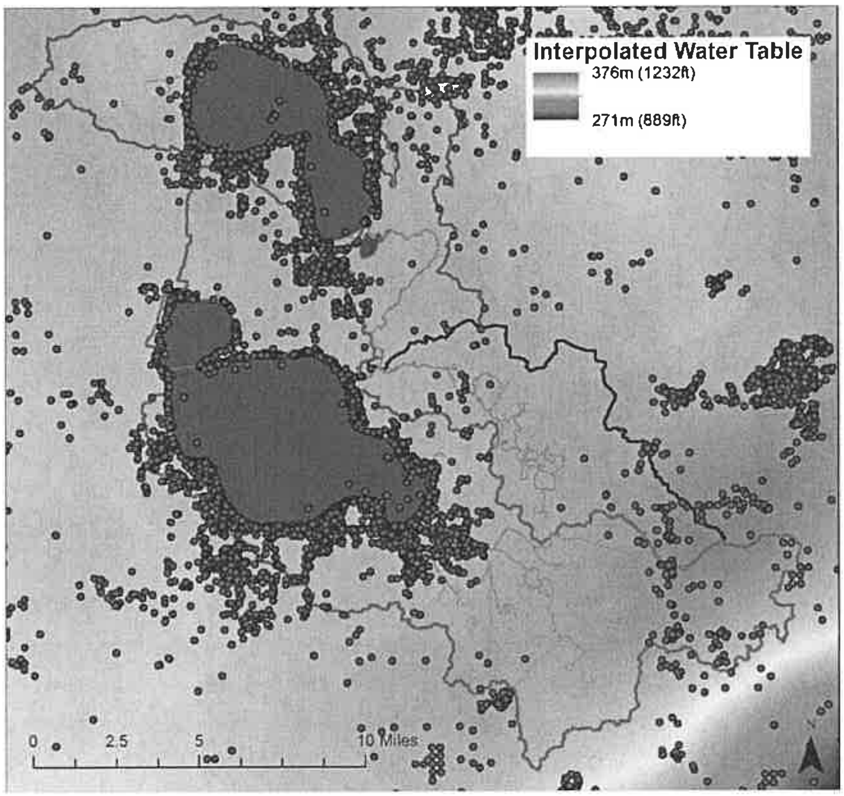


Figure 1.6.4. Map of interpolated water table elevations created using kriging.

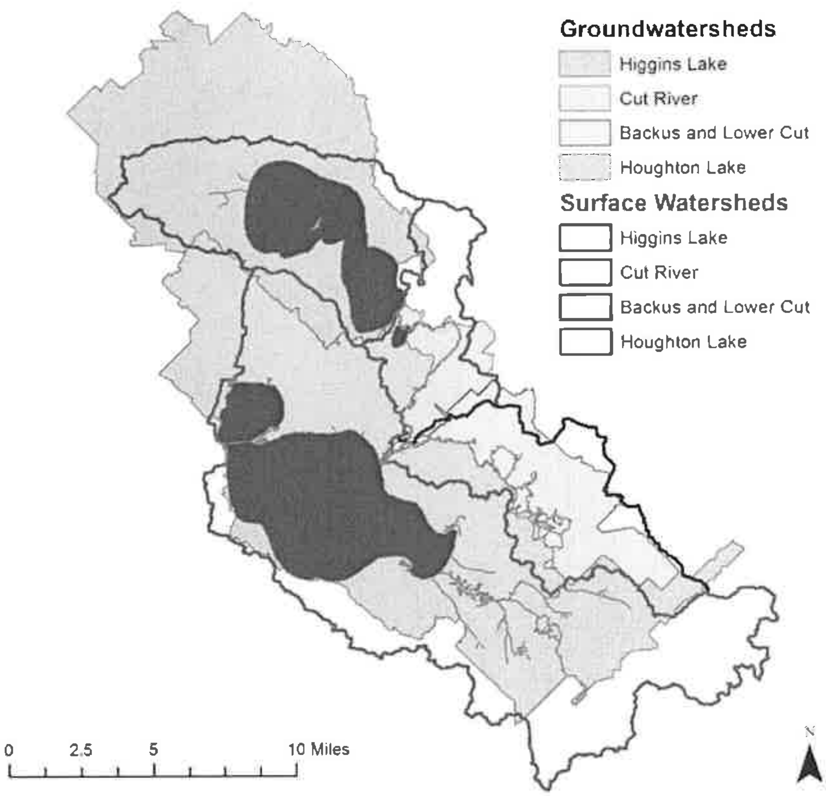


Figure 1.6.5. Map of groundwatersheds and surface watersheds for Higgins Lake, Cut River above the confluence with Backus Creek, Backus Creek and the Lower Cut River, and Houghton Lake. Note that there are large discrepancies between surface watershed and groundwatershed divides.

Another important observation from the groundwatershed and surface watersheds are that the upper Cut River has essentially no groundwatershed, and no functionally significant surface watershed. Thus we would expect that surface water inputs from Higgins Lake would dominate Cut River flows in the upper portion. Note too that Marl Lake is split down the middle in terms of its groundwatershed, where the eastern section of the lake is fed by groundwater while the western section likely loses groundwater toward Houghton Lake to the southwest.

1.7: Historical Weather and Climate Data

Hydrologic systems exist in dynamic balance with their landscape and the weather that ultimately drives the movement of water within them. To better understand the trajectories of the Higgins Lake region, we downloaded historical air temperature and precipitation data from NOAA's Global Historical Climatological Network (GHCN), which is a network of co-operative gauges maintained for at least 100 years. Precipitation shows little trend through time (Figure 1.7.1). On average, there is approximately 30 inches of precipitation per year, with a minimum near 20 inches and a maximum near 40 inches.

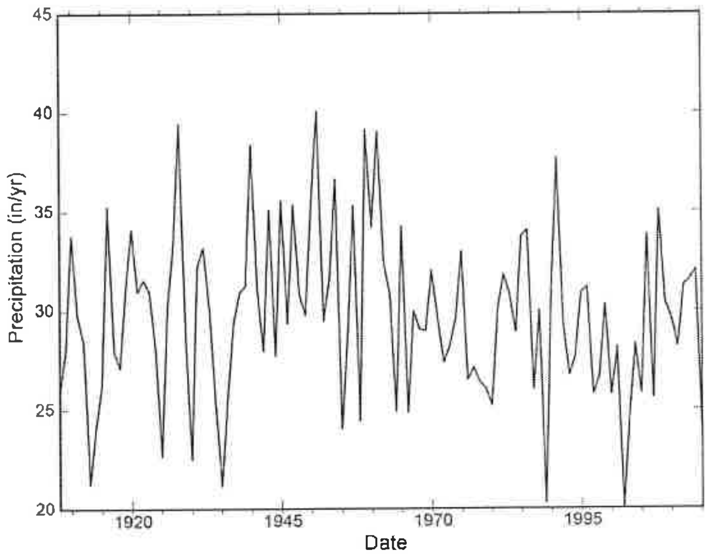


Figure 1.7.1. Plot of historical annual precipitation data from NOAA weather stations in Roscommon county, from 1908 to 2015. There is no significant trend in this dataset.

In contrast, average annual temperatures (Figure 1.7.2) show a strong warming trend over the last 108 years of record. Temperatures at the turn of the 20th century averaged approximately 42 degrees F, while the last decade has seen temperatures closer to 44 degrees. A linear trendline fit to these data has a slope = 0.25 degrees F/decade (significant at $p<1\%$). These temperature trends are consistent with regional trends across the Great Lakes Basin during the same period.

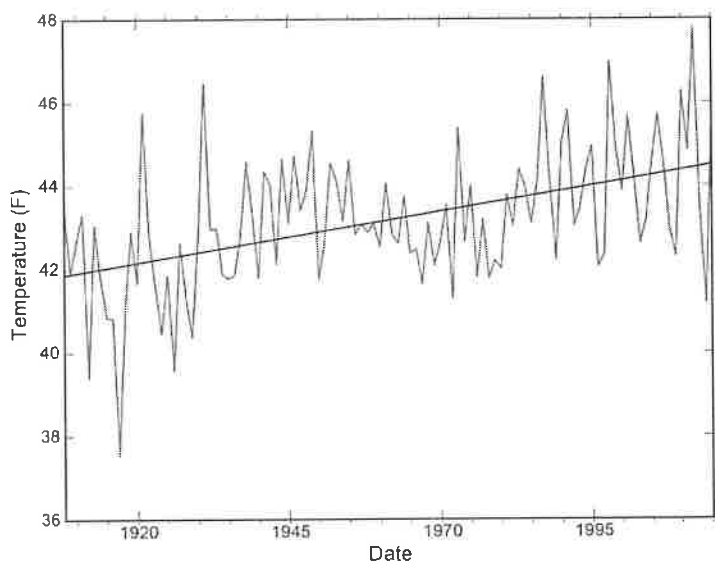


Figure 1.7.2. Plot of historical daily average temperatures from NOAA weather stations in Roscommon county, from 1908 to 2015. A linear trendline is plotted in black.

Our period of investigation will focus on the latest 15 years of this period, but these longer term trends are shown to provide context for how systems behave within a longer time period.

1.8: Aerial Photo Synthesis, Shoreline and Cut River Channel Analysis

A significant effort was made to use historical aerial imagery to quantify changes in shoreline and Cut River position through time. Michigan has collected aerial imagery roughly each decade across the entire state since 1938; these photos are archived at Michigan State University.

The oldest view of the Higgins Lake region is provided by General Land Office surveys from the the 1850s. These maps were scanned and georeferenced (points on the map related to known points on the land surface, typically section lines that match current roads and intersections) and overlain on modern maps of the lake. Clearly, the lake is roughly the same dimension now as it was over 150 years ago (Figure 1.8.1). In particular, the shallow shelf that characterizes much of Higgins Lake recreation and shoreline concerns is not a product of human intervention, but is clearly a natural occurrence.

Figure 1.8.1. The original Higgins Lake survey from the Michigan public land survey plat maps from the mid 1800's. The plat map was georectified using aerial imagery underlay, provided by the USDA, taken on August 31 and September 1, 2012.

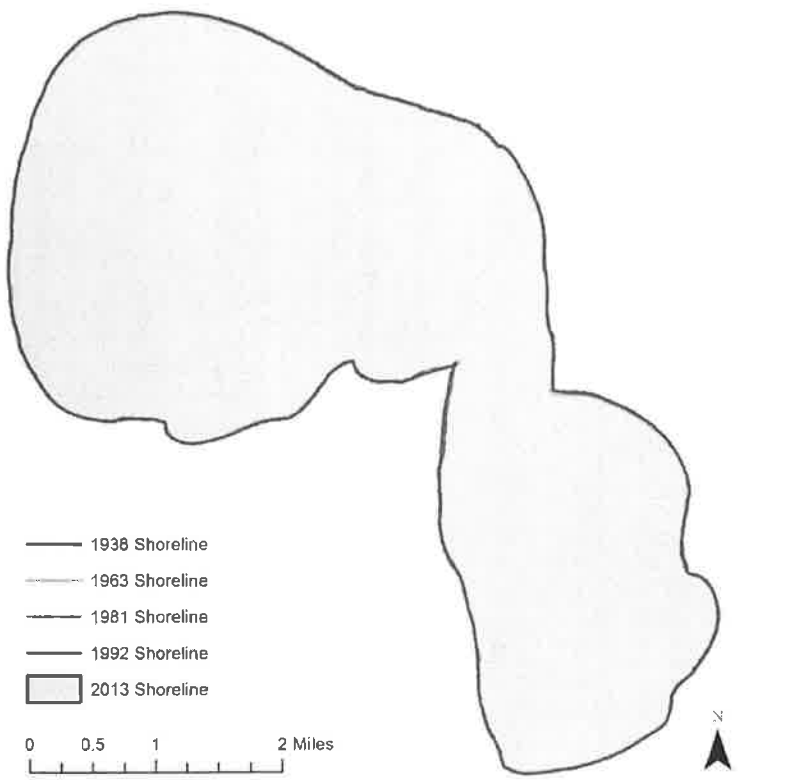
Each aerial imagery series consisted of multiple photos, which were scanned, contrast adjusted, georeferenced, and then mosaiced to produce a single image. Figure 1.8.2 shows the outcome of this process for the 1938 aerial imagery series.

Figure 1.8.2. Mosaiced historical aerial imagery (1938) showing the separate images, with green outlines for each image.

Other series included 1952/1953 (incomplete), 1963, 1981, and 1992. High resolution satellite imagery is then readily available starting in the mid 2000s.

Using those aerial images, the shoreline of Higgins Lake was manually traced for each series (Figure 1.8.3). Note that at the large scale, very few changes are visible in the shoreline position. However, some areas across the lake have been consistently receding (eroding) shorelines through time, as visible in zoomed in portions of the region. For instance, Figure 1.8.4 shows a section of the northern part of the north basin of the lake. With the exception of the 1981 series (which has position errors across the lake) there is a consistent trend of erosion visible.

Figure 1.8.3. Map of shorelines manually digitized from historical aerial imagery. Note very few differences in shoreline position are notable at this scale.



To more systematically examine whether the imagery series provide evidence of shoreline change, a series of lines perpendicular to the shoreline were overlain along the perimeter of the lake. Intersecting these lines with the historical shorelines provided a direct measurement of shoreline change at each line (which were located 250 meters, 820 feet, apart). For each line, a linear regression of change relatively to the 2013 position was calculated, and used to quantify shoreline erosion rates. However, uncertainties in the imagery locations are significant enough that this information should be used as qualitative evidence for shoreline change rather than accurate estimates of erosion rates.

The uncertainty in location of the georeferencing position was assumed to be ~30 feet (10 meters). Then, total change in shoreline position since 1938 greater than 30 feet was assumed to provide evidence of significant erosion occurring, while rates between 0 and 10 were viewed as being evidence of low to moderate erosion, while shoreline erosion values of less than 0 (which would be migration of shoreline into the lake, which is likely not occurring on a broad scale) were assumed to have low likelihood of erosion. These were then mapped as Figure 1.8.5.

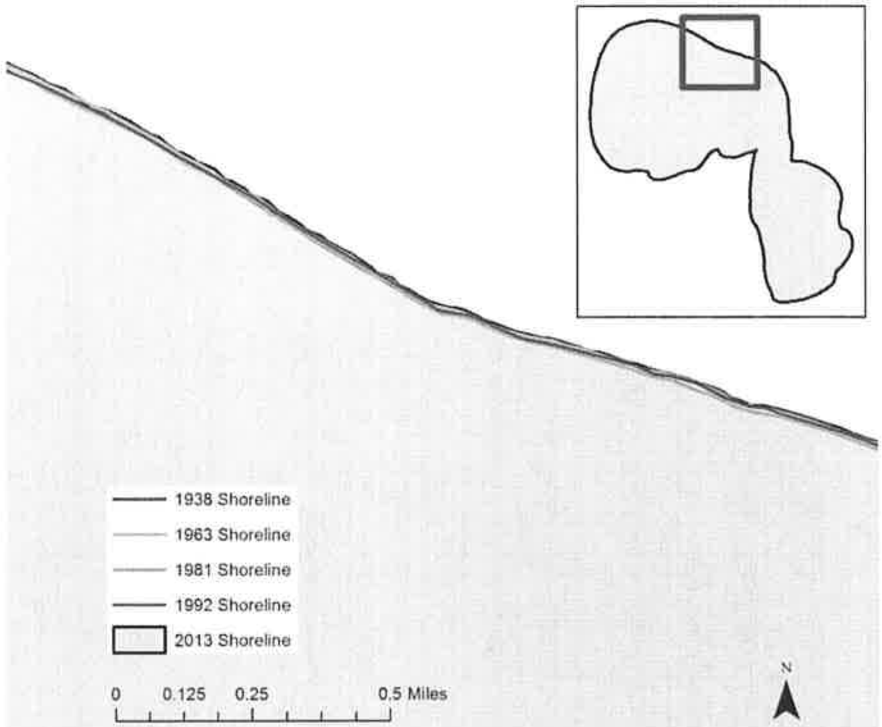


Figure 1.8.4. Zoomed map of a portion of the northeastern Higgins Lake Basin showing trends in shoreline position. An exception is the 1981 shoreline, which appears to be relatively offset across much of the lake area.

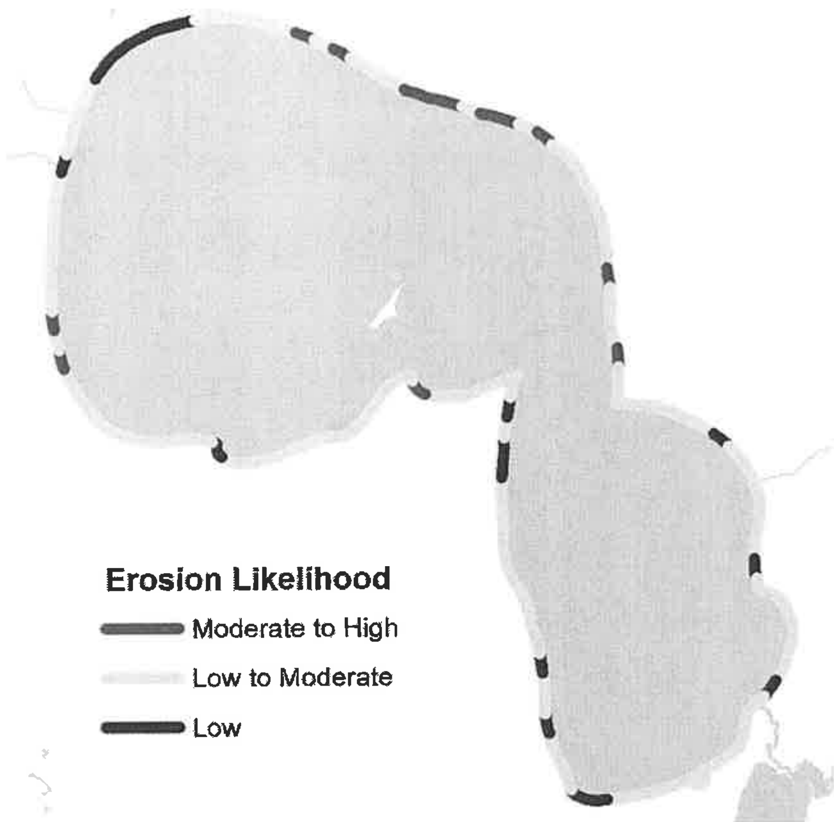


Figure 1.8.5. Figure of the erosion likelihood, mapped using thresholds of uncertainty established by georeferencing the historical aerial imagery.

Evidence of moderate to high erosion rates are present in four sections of Higgins Lake, on the eastern and northern sections of the North basin, the lower western section of the North basin, and a small strip of the southern portion of the North basin. Evidence of low to moderate erosion is present across much of the rest of the North basin, except for the northwestern portion where shorelines appear stable. The South basin also appears to have more stable shorelines.

Changes in the position of the Cut River channel were also mapped through time. These images were more problematic to georeference due to the relative lack of roads adjacent to the river. Thus, position uncertainties are relatively high, but shape of channel within a series is robust. Figure 1.8.6 shows the five time series overlain with few changes visible at this scale (with a few exceptions).

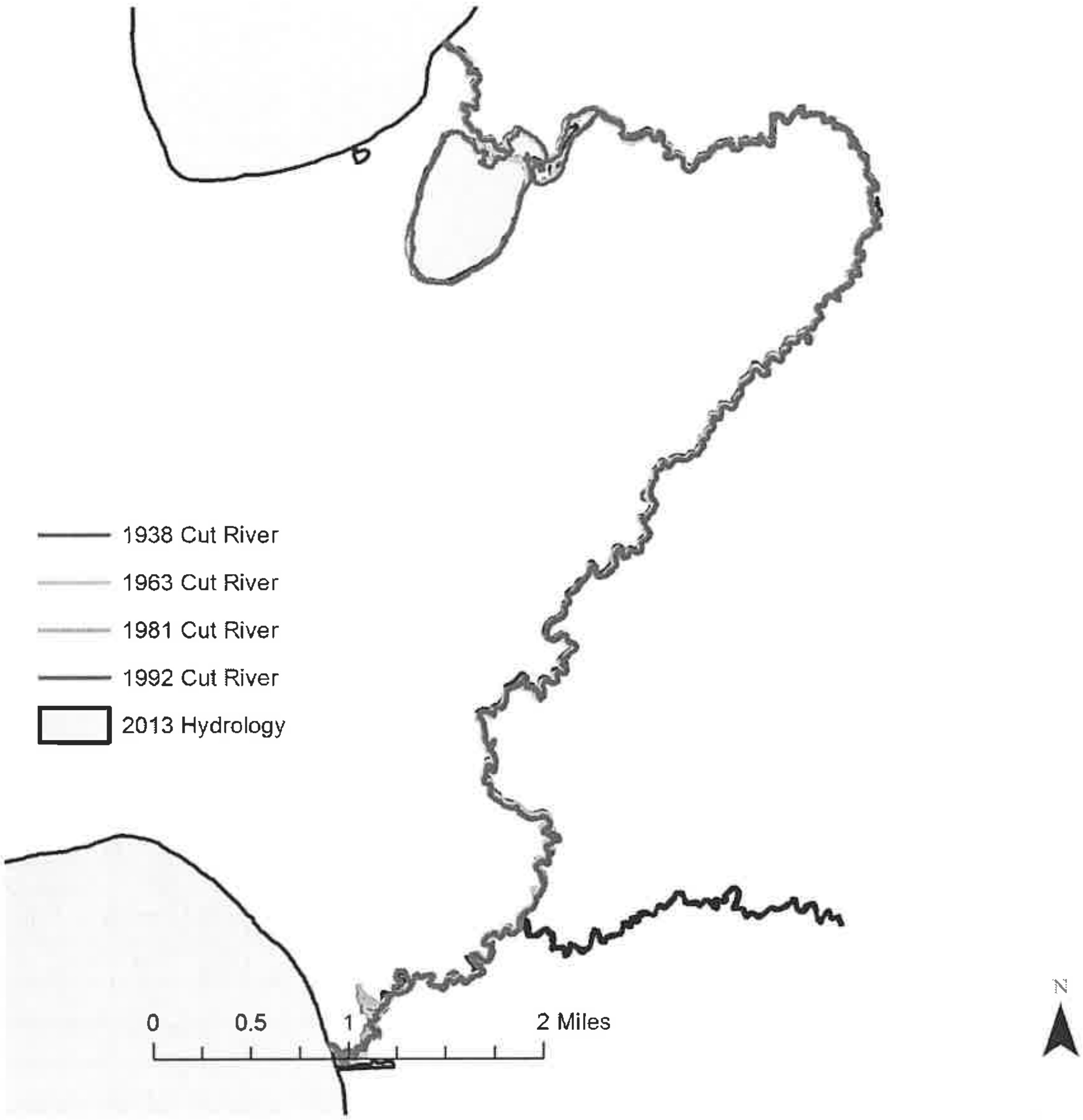
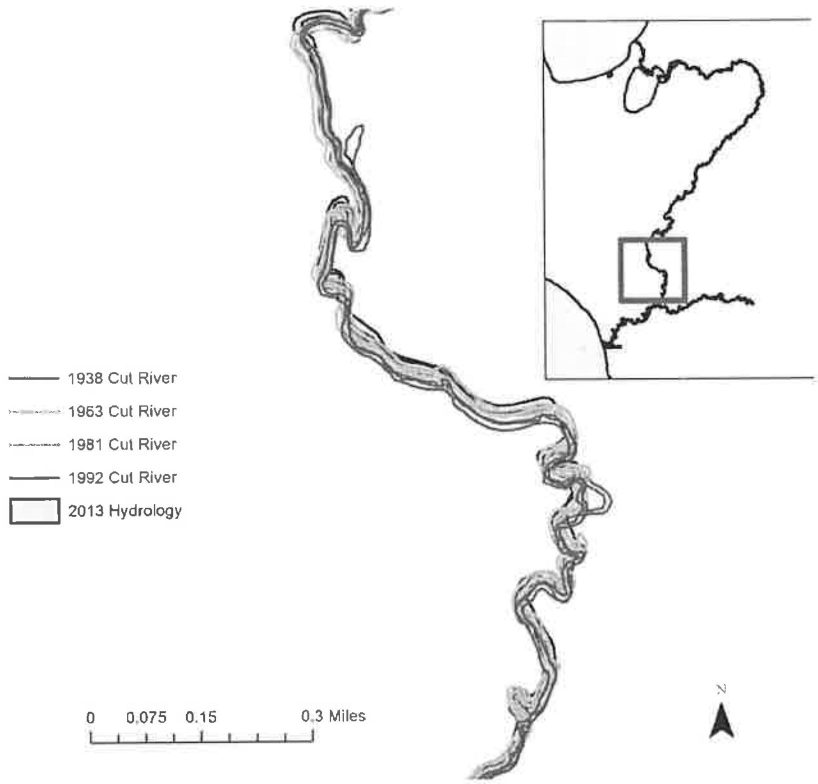


Figure 1.8.6. Map of Cut River stream banks manually delineated from digitized aerial imagery. Note few changes are visible at this scale.

Figure 1.8.7 provides a zoomed in view of a section of the lower Cut River above Backus Creek that shows some interesting changes in the meandering course of the channel, with changes visible on the roughly decadal scale intervals between these aerial imagery series. It is clearly an actively meandering channel, but has changed little in its bulk course since 1938.

Figure 1.8.7. Zoomed map of one section of the Cut River showing observable changes among the aerial imagery series. Note, general parallel shifts in channel position are related to inaccuracies in georeferencing, not channel shifts. Changes including production of new meanders and cut-offs, visible in the lower half of the zoomed channel, are genuine changes in Cut River morphology.



1.9: Lake Level Scenarios to Be Considered

The hydrological and ecological teams came together to establish a series of lake level change scenarios that would allow for a wide range of issues to be investigated such as fishery habitat loss or increase; vegetation loss or increase; shoreline position change; as well as the effects of groundwater elevation. The lake elevations that were used to investigate the ecological and hydrological effects on the lake and its surrounding environment include: 1154.11 ft amsl (legal summer level), 1153.61 ft amsl (legal winter level), 1153.78 ft amsl (4 inch lowering), 1153.36 ft amsl (9 inch lowering), 1153.027 ft amsl (13 inch lowering), 1152.61 ft amsl (18 inch lowering), 1152.443 ft amsl (20 inch lowering). The decrease of 18 inch and 20 inch in lake level is an assumed maximum reduction if the lake level control structure were to be permanently opened or removed respectively. Initially, the 6 inch drop scenario was assumed to be the smallest change that would be considered, however following analysis of Task 5.4 we added a scenario with a 4 inch lowering of lake level due to the lower than expected simulated lake level declines.

Task 1 Findings Summarized

- No evidence of different outlet position in recorded history
- No evidence of significantly deeper outlet or within-lake approach historically
- Little change in bulk position of shorelines over time: lake area largely unchanged
- Evidence of significant shoreline erosion in some regions, particularly the NE and W quadrants of the North basin.

- Lake level scenarios between 4 and 20 inch drop defined for further analysis in Tasks 2, 5, and 6 (separately reported).

Task 2: Bathymetric and Shoreline Surveys

This Task encompasses data collection efforts on Higgins Lake during the summers of 2012 and 2013. These included collection of both depth data and photos for characterizing shoreline character (i.e. armored, not-armored) as well as a comprehensive count of numbers of docks on the lake.

2.1: Shoreline Character and Docks Survey

During the shoreline bathymetric surveys, described in Task 2.2, an extensive photographic survey was conducted. These photos were taken with a GPS-integrated digital camera following standard procedures: 1) take the photo while facing directly toward the shoreline, so that the GPS location can be readily mapped to the shoreline location, 2) take a photo of each transition of shoreline character, 3) take a single photo for each dock, even if multiple docks are in the same field of view. In total, over 2,000 photographs were taken providing a thorough inventory of both docks and shoreline character. The docks dataset is described below in Task 2.2.

Even though the camera included a internal GPS, the accuracy was only to within 10 meters. However, by matching the timestamp of the photographs allowed a more accurate differential GPS unit on the Acoustic Doppler Current Profiler (ADCP, described below) being used for bathymetric data collection, the GPS coordinates to be updated to an accuracy of +/- 1 meter. Using the georeferenced images the research team was able to manually classify shoreline characteristics as armored, natural vegetation/beach, or cobble riprap. From these classified images, a total percentage of armored shoreline was calculated for each 250 meter (820 foot) section of shoreline (FIgure 2.1.1).

The presence of shoreline armoring is likely indicative of past erosive activity, which is supported by the fact that the areas of the lake with the highest percentages of armoring have less likelihood of active erosion (Figure 1.8.5). In particular, the western edge of the South basin shows this inverse relationship. Another potential explanation for this relationship is that the addition of seawalls to areas that are not otherwise needed may actually result in unintentional erosion of adjacent property owners as wave energy is concentrated at the edges of the armoring. This may therefore cause the perceived necessity of armoring to propagate along the shore.

A literature review published by the U.S. Army Corps of Engineers titled *The Effects of Seawalls on the Beach*, (Kraus, N., 1988) underscores the complexity of shore armouring. Below is a summary of four different questions Kraus asked and answered in their review:

- *What is the maximum scour depth at a seawall?* The depth of scour is dependent on the occurrence of waves, wave duration, the reflectivity of the wall, and the initial beach morphology. In general wave height within deep water appears to be a good estimate. However, scour depth is decreased if the reflection coefficient of the seawall is reduced.
- *Is the amount of sand scoured equal to the amount eroded across the adjacent beaches without structures?* The volume of material scoured at a seawalls have similar magnitudes and variations as the volume of the adjacent non-armored shores, but the data is highly variable due to

nearshore beach morphology and offshore bathymetry which affects the attenuation of wave energy.

- *Do seawalls accelerate or enhance erosion?* Ways that a seawall can enhance erosion to adjacent non-armored shore are by acting as a groin on the updrift side and impounding sand and causing the waves to flank the sides. Other erosive properties of seawalls include an increase in turbulence from wave reflection and enhancement of transport by short crested wave systems from reflected waves.
- *Is it beneficial to design seawalls to be "softer"?* Studies have concluded that slanting permeable seawalls have smaller reflecting coefficients and suffer less local scour than vertical or near vertical walls. These softer structures appear to mitigate local scour and allowed the beach to respond in a similar way as natural beaches.

The photo database collected for this project provides a baseline assessment to examine future changes in shoreline condition. This provides a valuable resource to organizations working to improve the reflection coefficients of existing armoring, and provides for best practices in the event of newly installed seawalls.

Another potential future use of this data would be to assess the impacts of shoreline armoring on property values. Indeed, studies have shown that armoring can have a negative effect of property values for the entire lake community including the non-waterfront property owners (Kriesel and Friedman, 2003). Kriesel and Friedman find that at first, the few individual waterfront owners that install shore stabilization have a substantial initial increase in property value. However, as more waterfront property owners install seawall stabilization the values drop to original levels. The study also concludes that if erosion of the shore is left unabated, the non-waterfront property has the potential to lose 23% of the value. But this same study also concluded that if the shore is primarily armored this also leads to an overall decrease of property values and a decrease in public use of the lake.

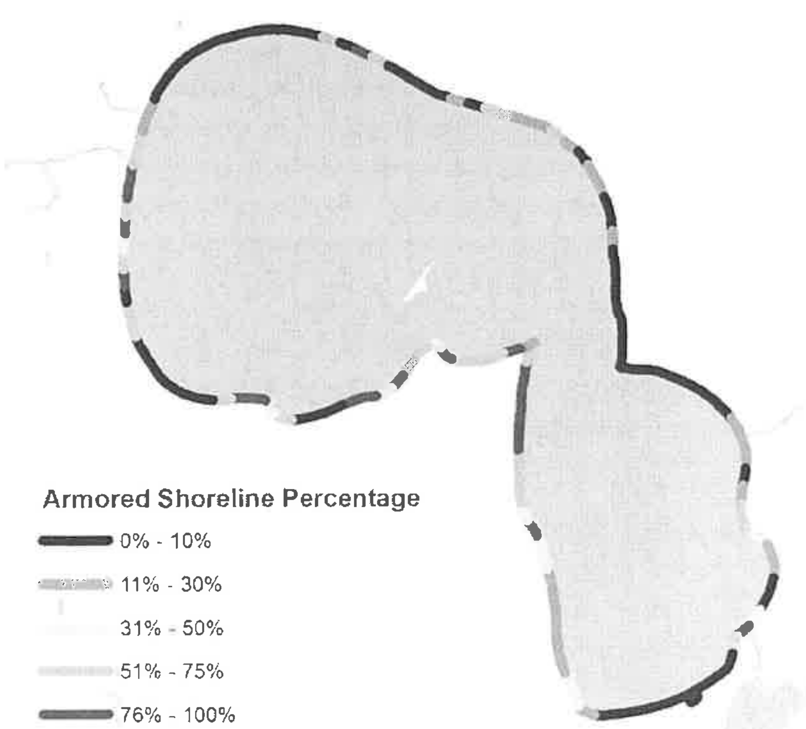


Figure 2.1.1. Map of shoreline armoring percentage averaged

within 250 m (820 ft) sections of shoreline.

2.2: Bathymetric Survey

One of the primary products of this project is a new near-shore bathymetric survey conducted primarily within the first 10 feet of lake depth. As noted in Task 1.4 above, this section of the lake has no further bathymetric detail provided by the 1930s map, yet is the portion of the lake most sensitive to changes in lake level, due to either natural fluctuations or changes in dam management.

Additionally, for the purposes of the ecological assessment conducted for Task 6, a new deep basin and drop-off (the region between the shallow shelf and the deep basin) bathymetric survey was needed. As part of this survey, new instruments would provide not just depth but sediment characteristics (sand, gravel, or soft sediment).

To conduct a near-shore bathymetric survey with accuracy within the first two feet of lake depth, several novel methods were applied: 1) multiple lake level transducers would be installed around the perimeter of the lake to capture bulk fluctuations in lake elevation due to wind-driven seche, 2) a new very high frequency depth sounder would be used that can accurately obtain depth measurements down to approximately 20 centimeters, and 3) a filtering method would be used to remove the effect of waves from the dataset.

As a final product, the near-shore survey and the deeper survey would then be stitched together. This required applying a novel interpolation scheme that captures the unique structures of each of the three lake bathymetric regions: the shallow shelf, the drop-off, and the deep basins.

Spatial Lake Level Analysis

Figure 2.2.1. Photo of water level logger installation.

The MSU field crew, assisted by the UofM field crew installed 6 pressure transducers (FIgure 2.2.1) around the perimeter of the lake shore, at locations shown in Figure 2.2.2. The crews chose to place the transducers onto dock posts to allow easy access and minimal disturbance. At each location the crews used a Trimble GPS to measure the water level for a starting reference of the pressure data. The transducers recorded pressure in millimeters, which relates to the height of water above the unit. The water elevation from the locations were to be used to investigate the lake's surface relief from the north basin to the outlet.

The data was also collected to link the 6 regions to the bathymetric survey based on their spatial relationship.

These transducers recorded lake level data every 3 minutes for the duration of the bathymetric survey, approximately 4 days. We assessed the data from this deployment and determined that: 1) our data collection took place primarily during periods of relatively calm water, where no significant differences in levels between the gauges were observed, and 2) the accuracy of vertical positioning was not sufficient to determine if wind-driven seche was present during times of rougher water. Although two of the transducers failed to record data, these failures did not affect our overall task of linking lake elevation to the new bathymetric data. The USGS lake elevation gage located at the South Higgins State park records elevation every 15 minutes, which proved to be sufficient to link the depths recorded during the bathymetric surveys to actual water level elevations.

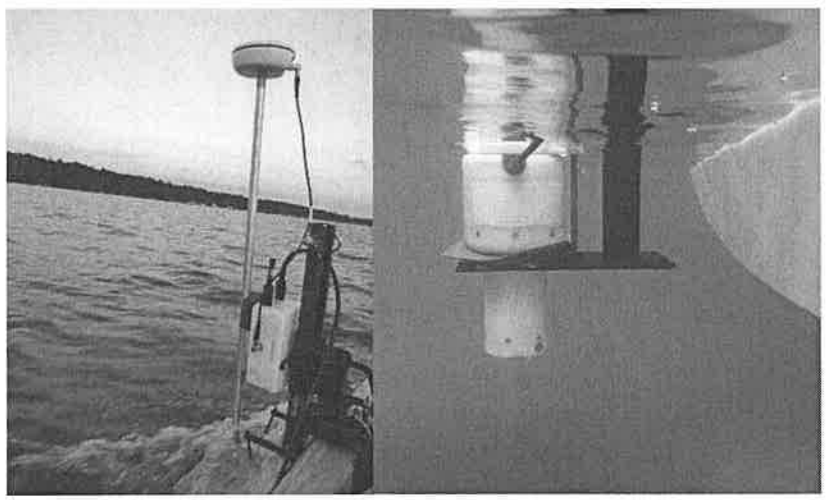
Figure 2.2.2. Map of water level loggers deployed around the lake.

Shallow Bathymetric Survey Methods

The shallow bathymetric survey was conducted using a Sontek S5 RiverSurveyor Acoustic Doppler Current Profiler (ADCP), a device that records depth, current velocities beneath the instrument, velocity relative to the lake bed, and with an integrated GPS provides either 1-meter accurate GPS, or optionally a 1-cm accurate GPS with the deployment of a secondary base station. All data were logged on the instrument at a rate of 1/second (1 Hz). The ADCP was mounted on a custom designed boat mount fabricated by the MSU Physics Machine Shop (Figure 2.2.3). The mount was capable of lowering and raising to best position the ADCP within the water column but with minimal drag. This allows for greater boat speeds, increasing the overall rate of data collection.

Figure 2.2.3. Image of MSU's boat deployment of Sontek RiverSurveyor S5 ADCP with an integrated differential GPS . The image on the left shows the instrument during data collection. The photo on the right shows an underwater view of the instrument while at rest. When the boat was in motion the instrument rose further up in the water.

The ADCP was attached to the starboard (left) side of a 14 foot tri-hull Boston Whaler. During the 2012 survey, MSU's average boat speed during data collection was approximately 4.5 mph (3.9 knots). The following year, MSU's field crew used kayaks towing the ADCP on a small foam boat to measure near shore depths as shallow as 7 inches. This single kayak survey involved involved close to 7 days of field effort.



We designed a custom survey pattern to efficiently cover the shallow shelf area. This "warp and weft" pattern included four survey lines, 3 roughly parallel warp transects followed the 0.5, 1.5, and 3 meter depths contours, and a 4th zig-zag weft line to provide greater detail about the depth variation across contours (Figure 2.2.4). The presence of docks and the draft of the boat limited the shallowest line in some cases. In addition to the main shoreline, the central island, known as "Treasure Island" in the North basin and the submerged island within the southern basin were surveyed. Real time depths were referenced by the use a transom mounted Garmin Fish Finder. The fishfinder was also used to navigate our route during data collection. A fifth survey line was added in 2013 for the kayak traverse, with the goal of recording the shallowest depths the instrument could record around the entire perimeter of the lake. This was conducted during summer, thus additional depth data were collected as the kayak was forced to trace an outline of essentially each dock around the lake.

Figure 2.2.4. The warp and weft pattern employed for shoal allowed for optimal data collection.

Following data collection, the data were filtered using two methods: 1) all depth data values of 0 were rejected, and 2) a spectral low-pass filter (Butterworth filter) was designed to remove the effects of waves and boat pitch from the depth data. This spectral filter successfully removed the high-frequency "noise" and produced a clean series of depth along the boat track. The filter parameters were carefully tuned such that peak depths were not excessively smoothed (Figure 2.2.5).

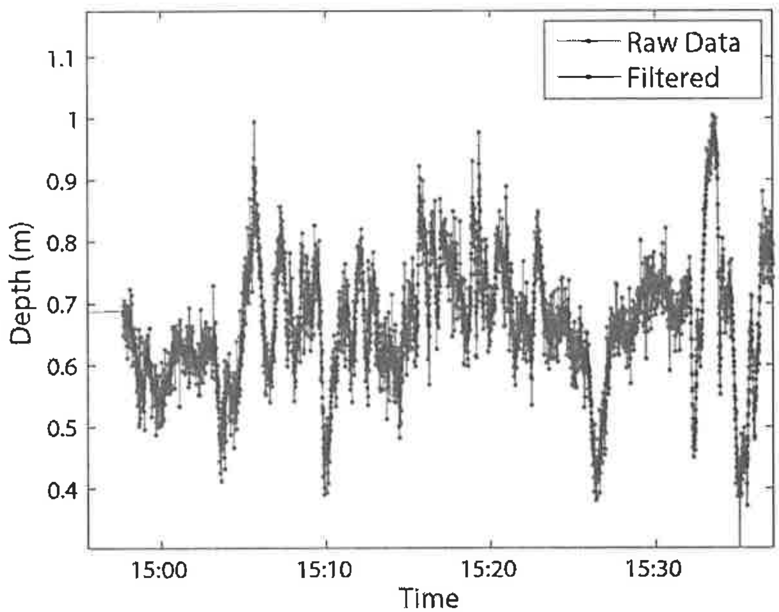


Figure 2.2.5. Raw and spectral-filtered bathymetric data.

Deep Basin Bathymetric Survey Methods

The UM personnel performed the off shore deep basin (>3 meter) data collection using multiple instruments including a Navitronic's Lowrance HDS-8 sonar unit with an integrated WAAS enabled GPS, a Imagenex Yellowfin tow behind side scan sonar. The survey patterned was conducted within a typical survey grid spacing of 400 meters. The average speed for the deep basin data collection was approximately 4 mph. Further details are provided about this survey in the Addendum report for Task 6.

Interpolation of Whole-Lake Bathymetry

When both groups completed their portion of the data collection there was a total of more than 779,000 depth points. But before the two data sets could be merged, the groups needed to first process the data in a similar way. MSU's data were spectrally-filtered as described above, while the UofM team did not need to use these methods as the depths recorded were significantly greater than the high frequency noise due to waves or other noise sources during data collection. The merged depth dataset, which contained roughly 642,000 points after rejecting 0 depth data and merging duplicated depth data, were transformed to bottom elevations adjusted to the varying lake levels by using the 15 minute sampling interval USGS gauge.

During the initial data collection MSU and UofM each survey overlapped in a zigzag pattern along the 3 meter depth shoal-slope zone. This was an integral step to perform a quality assurance and quality control of the separate data sets. The merged dataset was imported into ArcGIS ArcMap (Figure 2.2.6) to begin the interpolation.

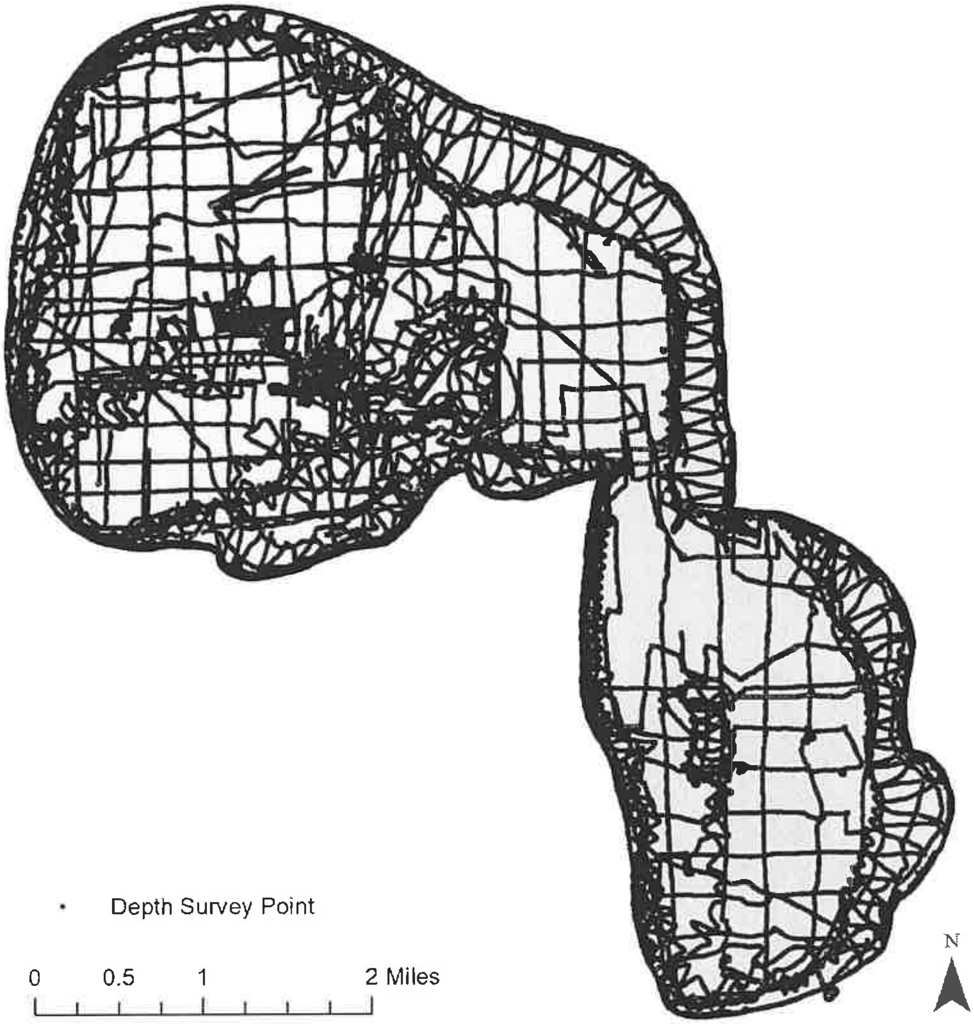


Figure 2.2.6. Map of all points included in the interpolation, a total of 642,902 points remained after quality control was completed.

Interpolation Techniques

Due to the complex nature of the Higgins Lake bathymetry, interpolating three data across all three lake zones proved exceptionally difficult. Methods that smoothly interpolated the deep basin with the drop off tended to underpredict shallow shelf depths, for instance, this is known as the Gibbs phenomenon. MSU researchers tested methods including: Spline, IDW, Kriging and finally Zonal Kriging.

- Spline interpolation works by estimating grid cells values by fitting a minimum curvature line through each of the data points. Spline interpolation works best when the data does not include extreme geomorphological features and the data set is relatively small.

- Inverse distance weighting, known as IDW, interpolates by averaging the data values of nearby points. The closer the neighboring data point is to the estimated cell, the more weight it is given. IDW is usually more appropriate when large sets of data that does not include steep drop offs and the data set is known to represent maximum and minimum values. This method will average the data to create an overall smooth surface.
- Kriging is similar to IDW, as it forms weights from the surrounding data values to predict the unmeasured locations. Unlike IDW, kriging weights are derived from a semivariogram as described above in Task 1.6 that takes into consideration the spatial structure of the data. Predictions are made based upon the semivariogram and the arrangement of the nearby measured values.
- Zonal Kriging is an adaptation of Kriging that allows for separate interpolation within distinct zones, in this case depth bands that defined the shallow shelf, drop-off, and deep basin. Then, the three zones need to be merged in a way that preserves continuity across the boundaries.

A literature review of zonal kriging methods resulted in a range of guidance in terms of how to construct the zones, and in particular how to handle the region where the zones come in contact. To define the zones, we analyzed the depth data to determine the locations where slopes became significantly different. In particular, the drop-off zone is characterized by very steep slopes, whereas the shallow shelf is quite flat, and the deep basin in between. Cutoff depths were determined from this analysis, and are shown in Figure 2.2.7. A preliminary whole-lake kriged map was constructed to define the depths of the zones, while depth values were used to subselect data that would be included in each zonal krig.

To handle the overlap region, we created a weighting map that is then multiplied by each zonal kriging estimate. This weighting map smoothly interpolates between each zone krig map. The width of the overlap zone was adjusted to minimize the difference between the observed values and the interpolated values, as well as visually to minimize interpolation artifacts that can arise.

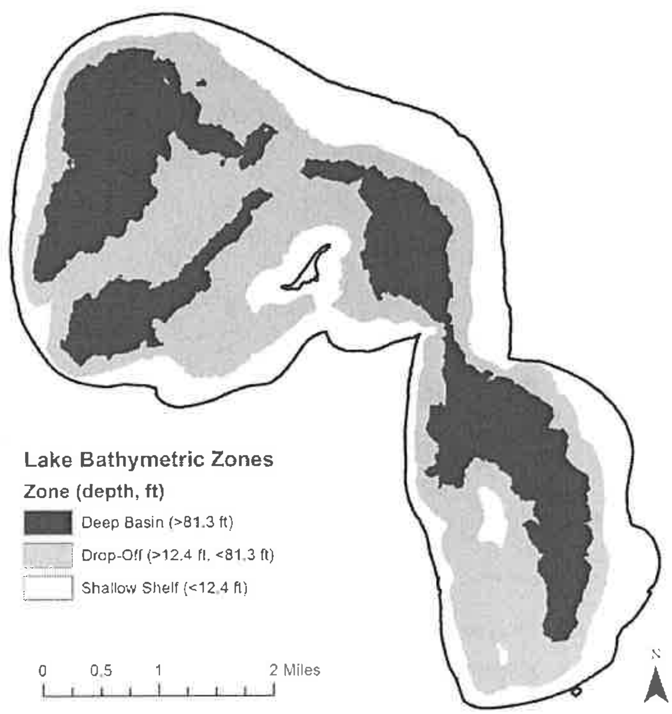


Figure 2.2.7. Map of the lake bathymetric zones used for the zonal kriging method.

The final output from the zonal kriging method is shown as a relief map in Figure 2.2.8. This new map provides an unprecedented level of detail, both in the shallow region of particular interest to this study, as well as in the steep drop-off of critical ecological importance, and in the deeper basins as well. This data could also be used to provide better navigational data for the lake, particularly for highlighting hazards that arise due to lake level fluctuations. Furthermore, it can be used as a baseline dataset to assess future changes in lake bathymetry that might result from continued shoreline erosion, or lake level changes.

For the sake of comparison, contours were generated from the new map (FIgure 2.2.9) that match those in the original 1939 dataset (Figure 2.2.10). While making direct inferences between these two maps should be done carefully because of the errors in the original map dimensions, there are some notable differences in positions of the 10 foot contour (Figure 2.2.11). In particular, the new 10 foot contour is almost always located toward the deep basin relative to that in the 1939 map. If differences between the two maps were random this would not be the case. Furthermore, there are several areas of distinct differences, which in comparison to the erosion likelihood map (Figure 1.8.5) show commonalities. Together, these are suggestive, though not definitive evidence for, shoreline-erosion induced changes in the location of the 10 foot contour resultant from the movement of sediment eroded from the shoreline.

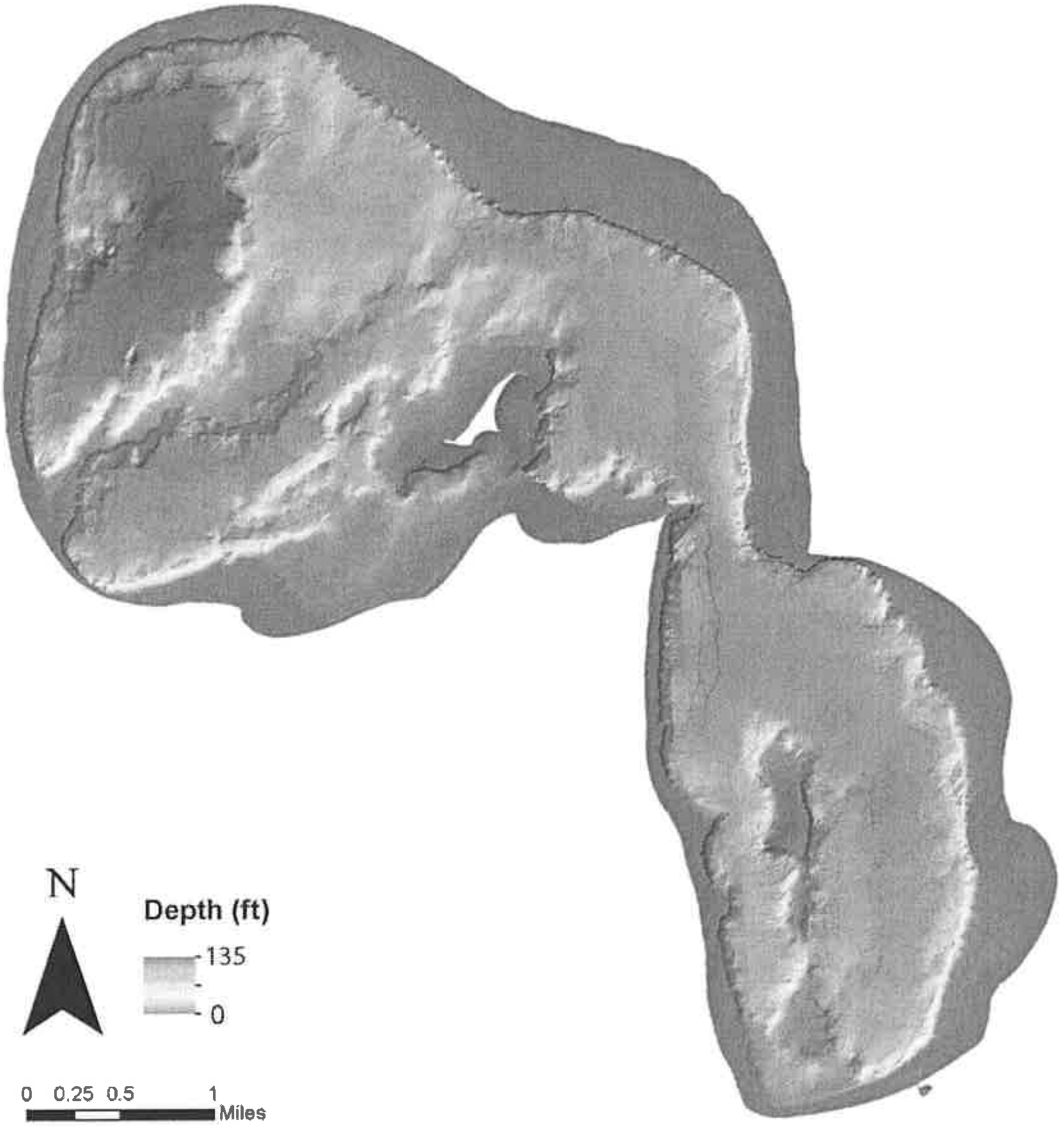


Figure 2.2.8. Relief Map created using the bathymetric data collected by UM and MSU during 2013 and 2014. The image is constructed using a 3x3 meter cell size.

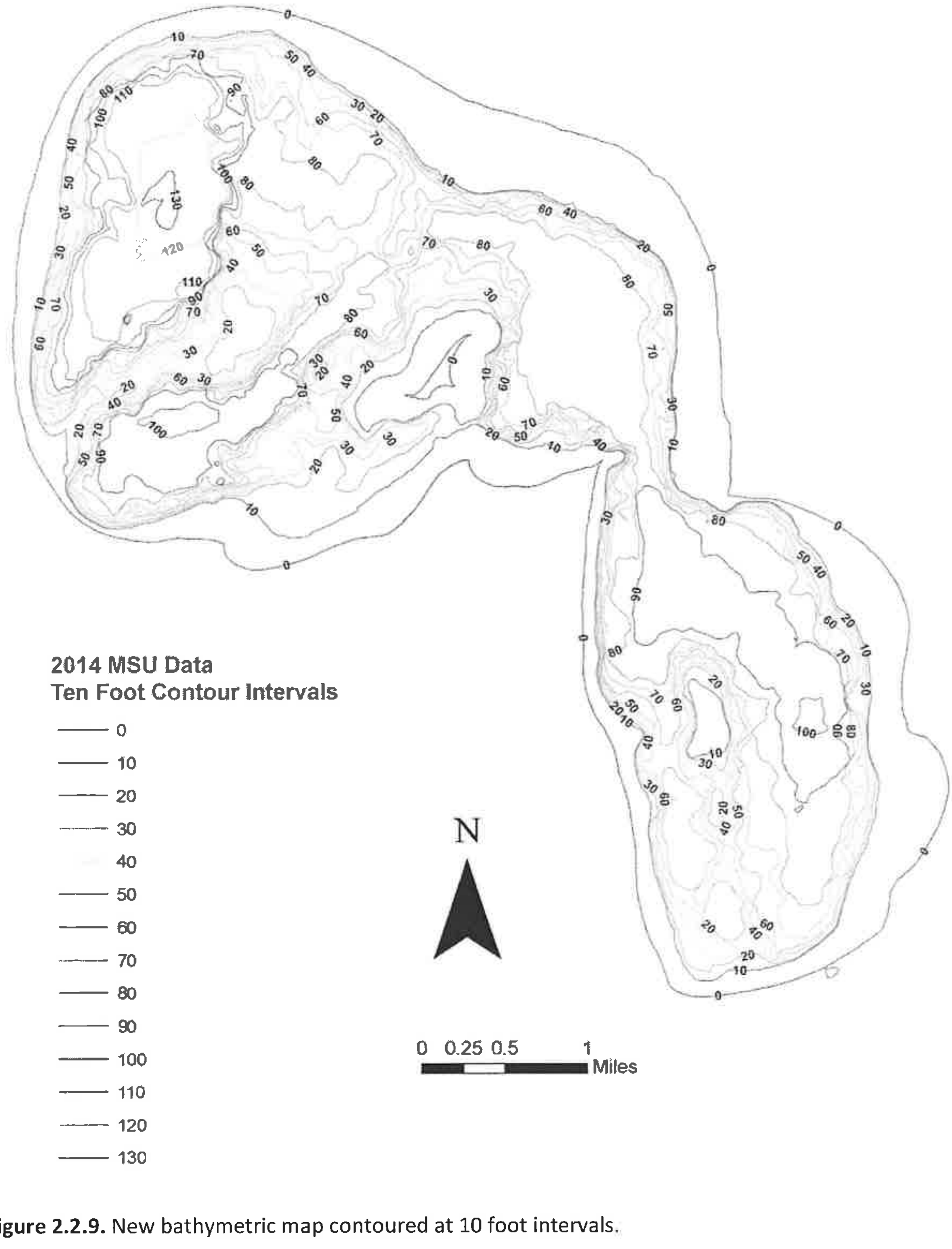


Figure 2.2.9. New bathymetric map contoured at 10 foot intervals.

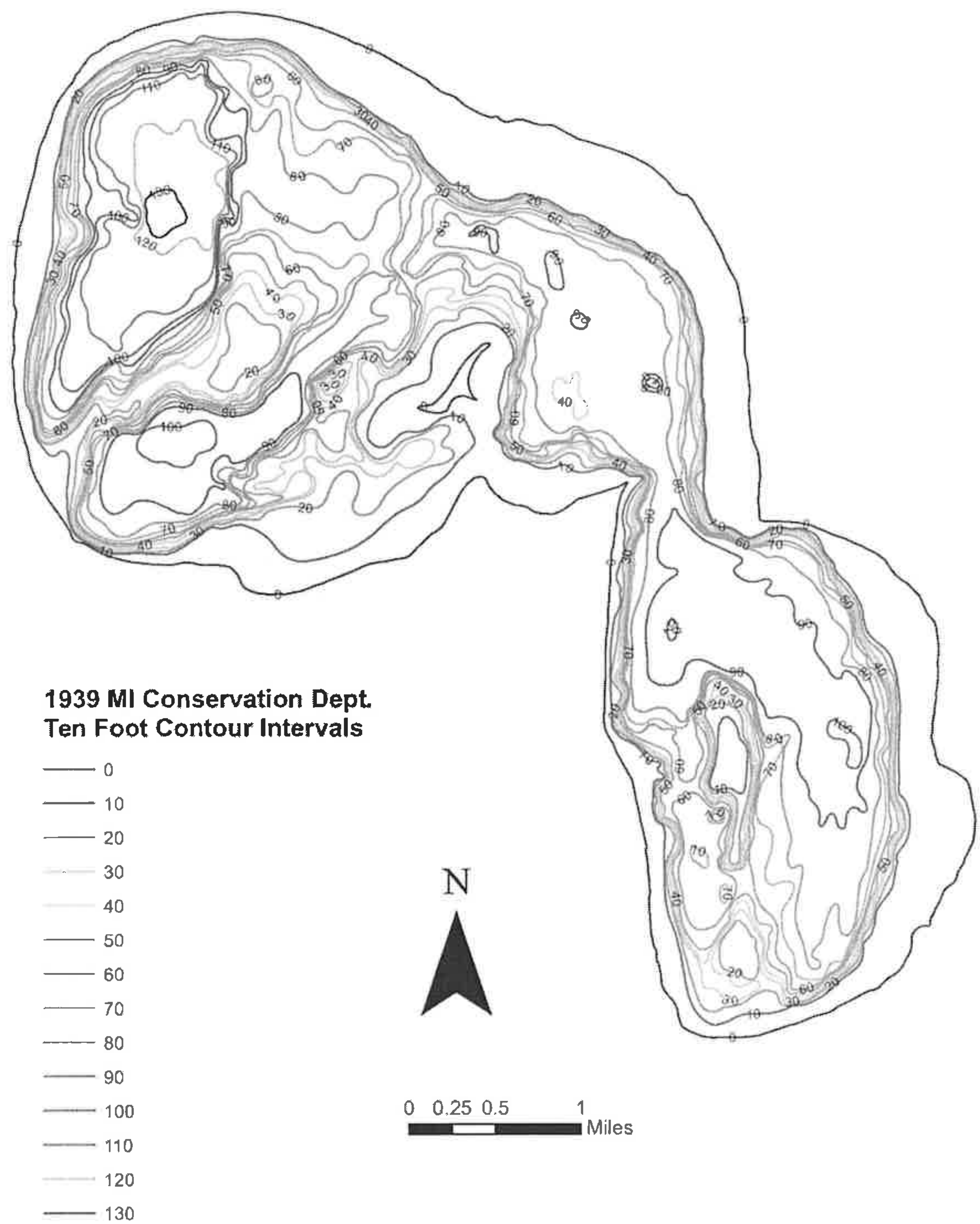


Figure 2.2.10. The original 1939 Michigan Conservation Department bathymetric map digitized and displayed in the same color scheme as the new contour map.

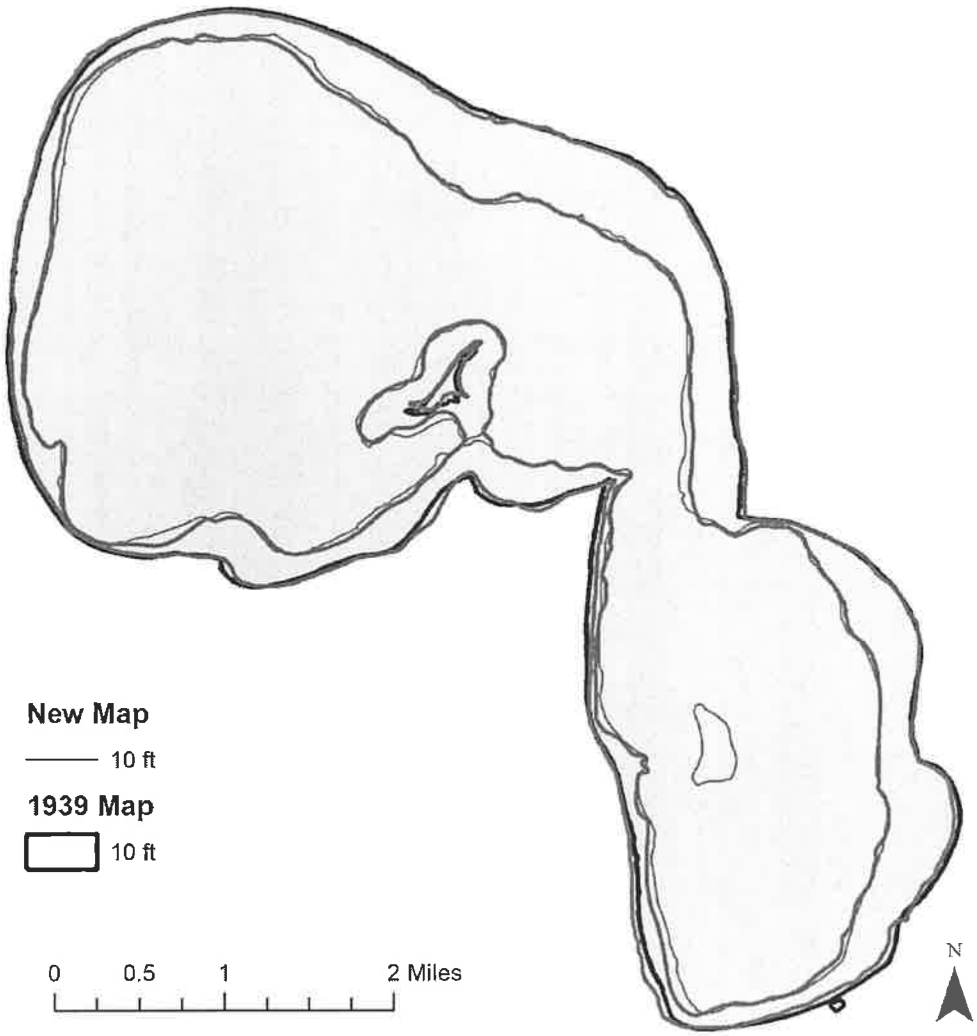


Figure 2.2.11. Map comparing the new 10 foot contour (red) to that of the original 1939 map (blue). Note that the outer blue ring should overlap the black lake outline, where it does not there are errors in the original map dimensions and care should be taken in interpreting differences between the new and old 10 foot contours.

2.3: Evaluation of Lake Level Scenarios

Now that a comprehensive digital map of Higgins Lake bathymetry is available, the impacts of changed lake levels can be assessed on a variety of important areas: 1) changes in shoreline position (and lake area), 2) dredging that would be necessitated at lake access locations and marinas, and 3) changes in dock length by residents of the lake.

Changes to Shoreline Position and Lake Area

Perhaps no impact of changed lake level is as significant as changes in shoreline position. This impact would be felt most directly in terms of increasing the length of beach between the lake and property owners, providing a buffer from erosion and in some cases substantially increasing property sizes. Lake area would decrease in direct proportion to the increase of riparian landowner property area, with all of the changes occurring in the shallow shelf region.

Contours were created at depths of 4, 6, 9, 13, 18, and 20 inches relative to the current summer legal lake level (Figure 2.3.1). These contours show some areas where shoreline changes would be significant across the more extreme scenarios, particularly in the North Basin and in the South Basin adjacent to South Higgins Lake State Park. We assumed that a new shoreline would form at approximately the location of the depth contour representing that lake level drop (i.e. a 6-inch drop shoreline forms at the 6-inch depth contour).

To more quantitatively assess how shoreline positions change, shoreline changes were averaged within polygons encompassing 250 meters (820 feet) of Higgins Lake shoreline--the same analysis sections used in the erosion likelihood map (Figure 1.8.7), and armoring percentage map (Figure 2.1.1). While each scenario was assessed, only the 4-inch and 9-inch drop are displayed. These were chosen because they represent the mean conditions of two altered dam-management strategies (keeping the dam open at all times, and removing it) discussed in greater detail in Task 5.4.

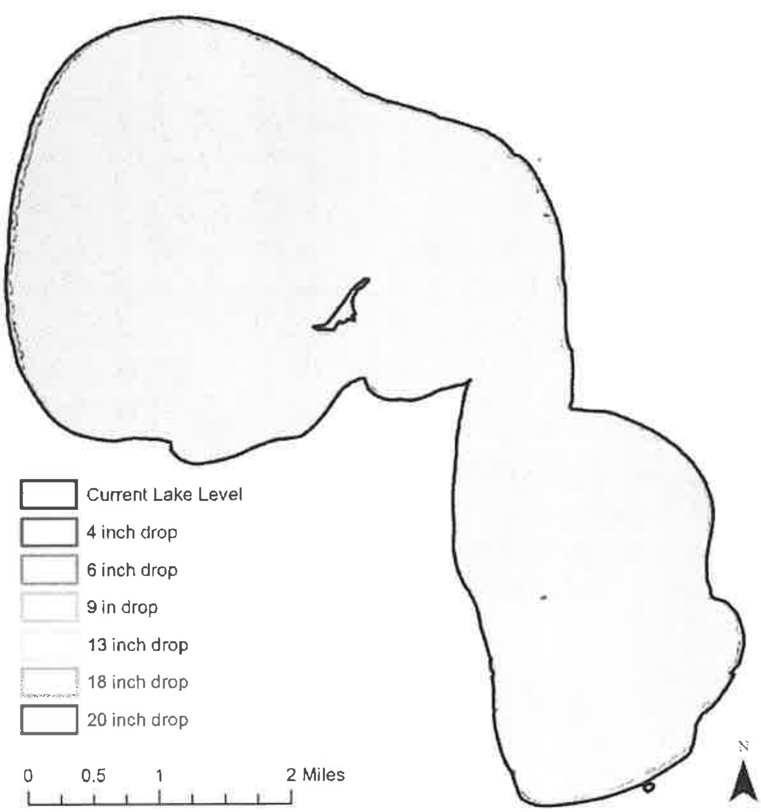


Figure 2.3.1. Map of shorelines overlain from each lake level drop scenarios.

In Figure 2.3.2 below, the 4-inch lake level drop scenario is shown. The area of most significant change is on the western edge of the North basin, while the area with least change is on the western edge of the South basin. Changes ranged from 9.3 feet to as much as 24.6 feet, on average across the 820 foot wide polygons. These numbers represent a recession of the shoreline away from the current lakeshore toward the center of the lake, thus increasing the buffer between properties and increasing total dry property dimensions.

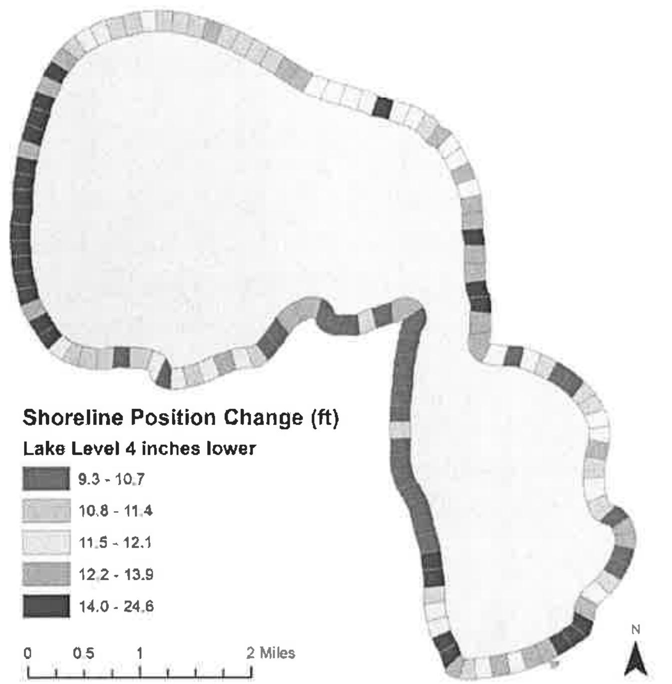


Figure 2.3.2. Map of shoreline position changes (toward the center of the lake) under a 4-inch lake level drop scenario. Colors indicate 20% quantiles of

shoreline position changes across analysis polygons.

A similar map for the 9-inch lake level drop is shown in Figure 2.3.3, with similar patterns of change but larger overall magnitudes. Here changes range between 15.7 and 62.9 feet.

Figure 2.3.3. Map of shoreline position changes (toward the center of the lake) under a 9-inch lake level drop scenario. Colors indicate 20% quantiles of shoreline position changes across analysis polygons.

Averaging across all lake polygons for each scenario produces Table 2.3.1. From this table we see that on average shoreline position migrates lakeward by 12.3 feet in the 4-inch drop scenario, and as much as 83.6 feet in the 20 inch drop scenario. It should be noted here, however, that the lake level modeling in Task 5.4 shows that the more extreme scenarios are highly unlikely to occur, *even in the absence of any lake level control structure.*

Shown in Table 2.3.2 is the change in lake area as a result of each scenario. For the 4- and 9-inch drop scenarios, lake area decreases by 25 and 69 acres, respectively (0.3 to 0.7% decline). The extreme scenarios show declines of as much as 2% or more of lake area, again with the caveat of high unlikelihood that these scenarios would ever occur. Note that all of the land lost by the lake is gained by riparian property owners.

Table 2.3.1. Shoreline position changes (toward the center of the lake) averaged across the analysis polygons for each of the lake level drop scenarios investigated.

Lake Level Drop Scenario (in)	Average Change in Shoreline Position (ft)

4	12.3
6	17.0
9	25.3
13	45.1
18	64.1
20	83.6

Table 2.3.2. Lake area for all scenarios, along with percent change in lake area calculated relative to current area.

Lake Level Drop Scenario (in)	Lake Area (acres)	Change in Area (%)
Current	10,258	
4	10,223	-0.3
6	10,210	-0.5
9	10,189	-0.7
13	10,140	-1.1
18	10,088	-1.66
20	10,043	-2.1

Changes to Depth in Dredged Areas

Several locations around Higgins Lake are currently dredged for boat passage and mooring, five of which are shown in Figure 2.3.4. These locations would be directly affected by any lake level change, and the need for dredging would increase.

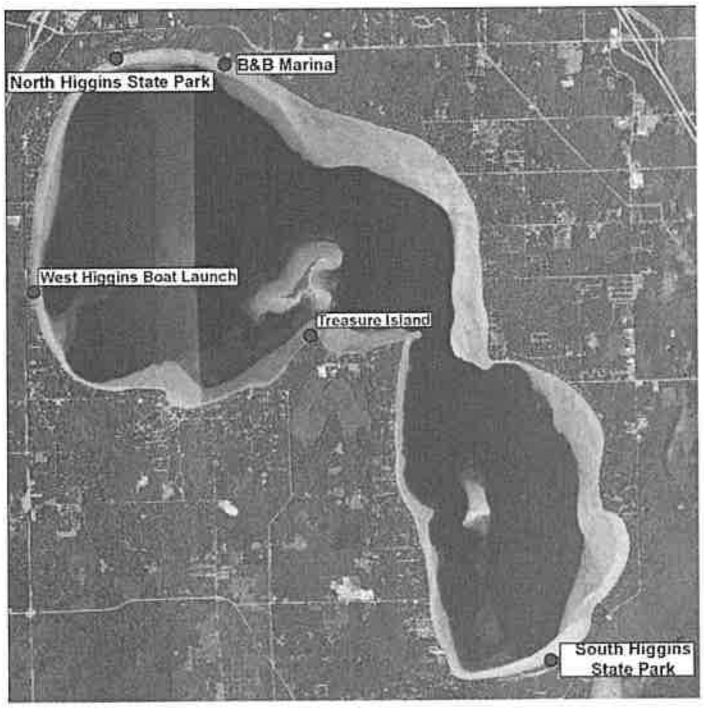


Figure 2.3.4. Locations of the dredging volumes calculated. Areas were selected based upon the feasibility and reliability to delineate either boat launches or marinas via aerial imagery.

Using the scenarios for change in lake levels, researchers calculated the volume needed to be dredged to maintain a 3.3 ft depth within the boat launches and marinas. This depth was used out of simplicity since the original measurements were in meters and due to regulations for boat launches requiring a depths between 3 and 4 ft.

Because of the higher resolution needed for this assessment, a different methodology was needed to assess dredging requirements. First, by using the collected depth data from the Sontek ADCP of the nearshore and overlaying a grid, the areas of sparse data was manually interpolated. From these data points of each area of interest Thiessen polygons were constructed within ArcGIS. These polygons divide the area of interest into regions within which each known point is the nearest neighbor for interpolation. The Thiessen polygons were then used to calculate the surface area of each data point grid cell. Each grid cell was evaluated to determine the depth required to remain in compliance with navigational water regulations of 3.3 ft water depth.

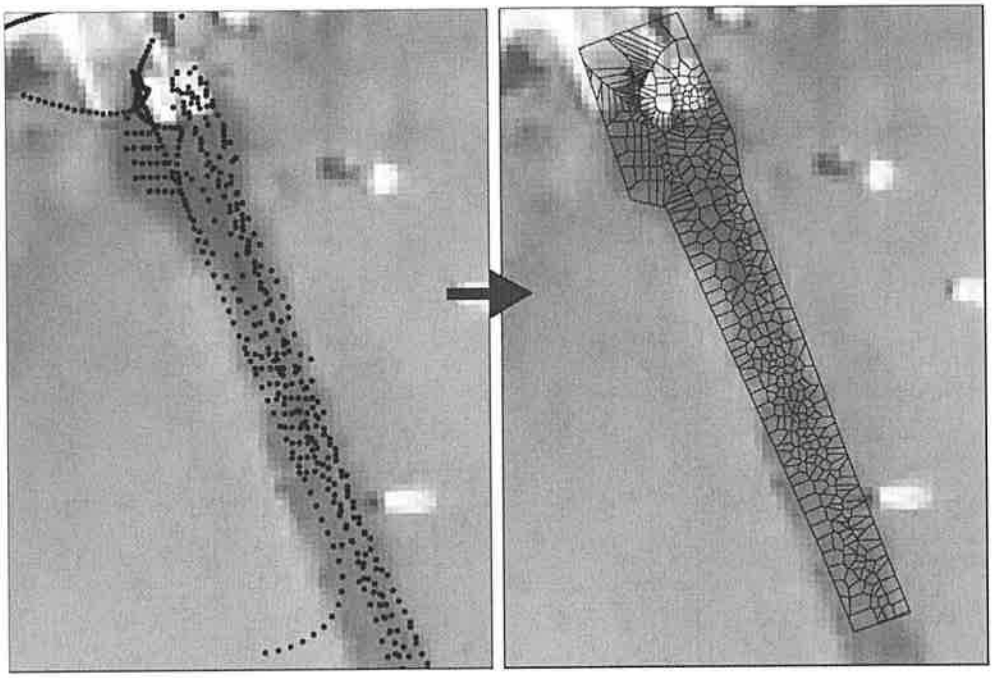


Figure 2.3.5. Graphic illustrating the workflow of calculating the dredging volumes of North Higgins State Park's boat launch. Black dots indicate the data points used to construct Thiessen polygons to calculate area

Note, not all marinas and launches met this current requirement, thus we quantified the dredging need under lake level change scenarios and subtracted out the current need (a dredging backlog, effectively). This isolates the changes caused by the lake level scenarios alone.

Table 2.3.3 lists the volumes for each area of interest and for each scenario. Clearly, South Higgins Lake State Park and B&B Marina would incur the greatest impacts in terms of dredging due to lake level changes. The other three areas of interest have approximately an order of magnitude less requirements. Note again here that the more extreme scenarios should be considered highly unlikely to occur, as mentioned above as well and below in Task 5.4.

Table 2.3.3. Dredging volumes for all lake level scenarios

Lake Level Drop Scenario (in)	Dredged Volume (cubic yards)	Marina/Boat Launch
4	914	B&B Marina
6	989	
9	1480	
13	2133	
18	3282	
20	3283	
4	45	North Higgins State Park
6	54	
9	72	
13	113	
18	195	
20	243	
4	89	Treasure Island
6	109	
9	141	
13	182	
18	234	
20	255	
4	53	West Higgins Boat Launch
6	75	
9	138	
13	251	
18	446	
20	533	
4	854	South Higgins State Park
6	1312	
9	2058	
13	3133	
18	4563	

20	5147	

Changes in Dock Length

Another direct impact of lake level changes would be in altering the lengths of docks required for adequate depths at the dock ends. This subtask quantifies those potential changes.

Dock presence was calculated in two ways: 1) Every dock was visually identified and photographed with a GPS-enabled camera during the 2012 bathymetric survey, and 2) All docks visible in satellite imagery from 2011 were drawn on a map. The two surveys produced different numbers of docks: 1207 (including approximately 30 potential duplicates) were photographed during the July in-lake survey, while 934 docks were identified from the June 21, 2011 satellite imagery. Potential sources for this discrepancy (about a 20% undercount from the satellite imagery) include variable times of dock installation by lake residents, as well as possible missed dock features (however the satellite imagery were very high resolution and docks were clearly identifiable).

Nevertheless, the satellite data were needed for quantitative analysis of dock length changes under different lake level scenarios. Figure 2.3.6 shows a zoom of the central portion of Higgins Lake with the manually digitized docks in that region. To quantify dock length changes independently of the exact dock count, as well as to increase the accuracy of the overall analysis, dock length changes under varying lake levels were analyzed within 250 meter (820 foot) shoreline polygons, rather than on individual docks.

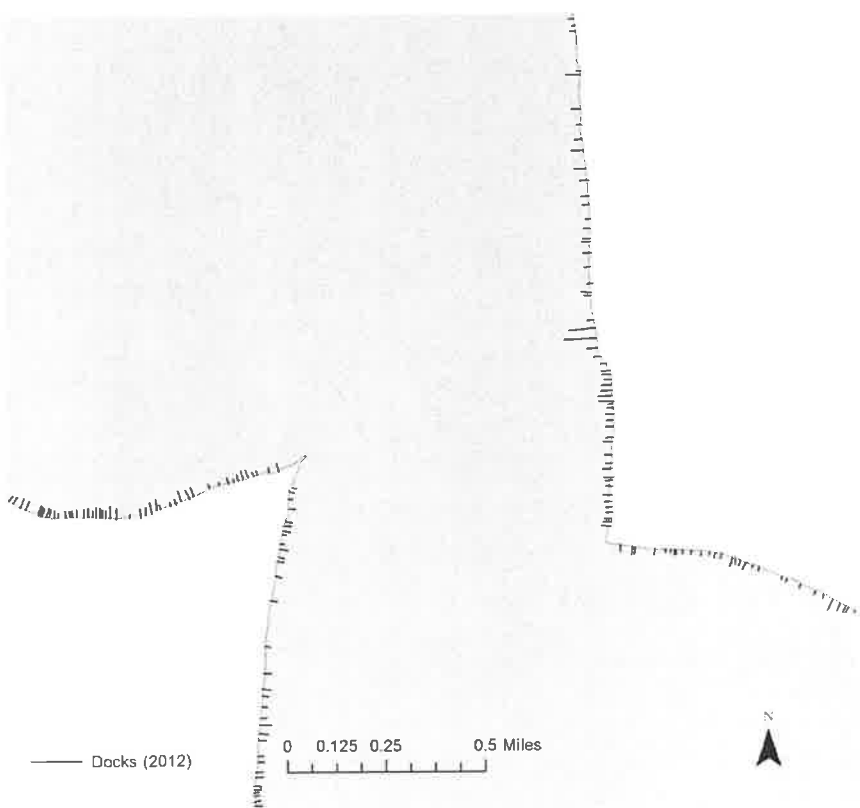


Figure 2.3.6. Map showing docks manually digitized from satellite imagery from 2011. Each black line is a single dock in this map. This map is zoomed to the central portion of the lake to enhance detail of individual docks.

Before deciding on a method to quantify dock length changes, the researchers consulted the literature on how nearshore depth profiles change as a result of water level changes. The outcome of this literature review was that the issue is extremely complex, and beyond the scope of this study. Nevertheless, we developed a conceptual model for how dock lengths would change as the nearshore profile evolves in response to lake level changes. This model is drawn in Figure 2.3.7.

Step 1 of this graphic shows the current situation, where the lake depth quickly increases very near the shore and then slows to a more gradual increase with greater distances. A dock located at this point has a depth presumably set to allow navigation for a particular watercraft or recreational use.

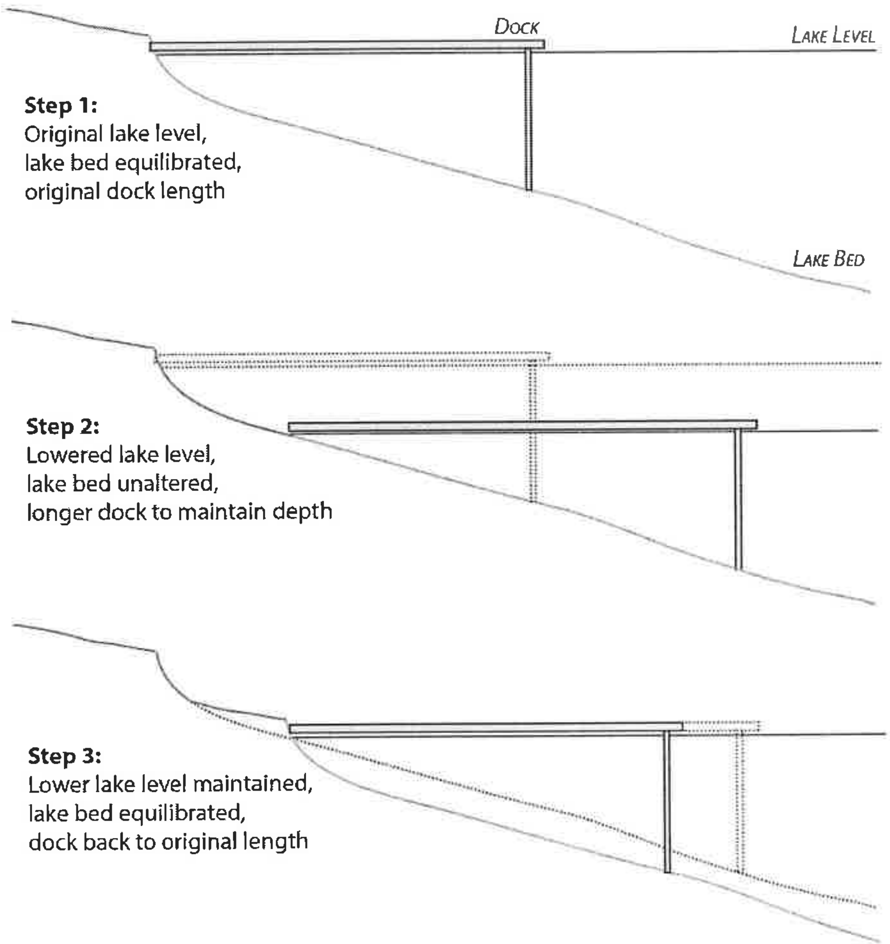


Figure 2.3.7. Conceptual diagram of how the lake bed profile might evolve in response to lowered lake level.

Step 2 shows the immediate aftermath of a significant lake level decline. The lake bed has not had time to adjust, the dock is moved outward to the new shoreline location, and lengthened in order to maintain adequate depth at the end of the dock.

Over time, however, as the lake redistributes sediment in response to the lowered depth, the profile will likely evolve to something approximating the original profile. This profile is controlled by two factors: sediment supply, and wave energy. Assuming no change in armoring status, neither factor will be greatly affected.

Step 3 then displays the outcome of the evolution back to the original profile, where the dock can return to its original length, only now it is located lakeward of its original position.

With this conceptual model then, eventual dock lengths would likely be similar to their current lengths. These lengths are summarized in the now-familiar 250 meter (820 foot) analysis polygons. Dock lengths average between 42 and 206 feet across these polygons.

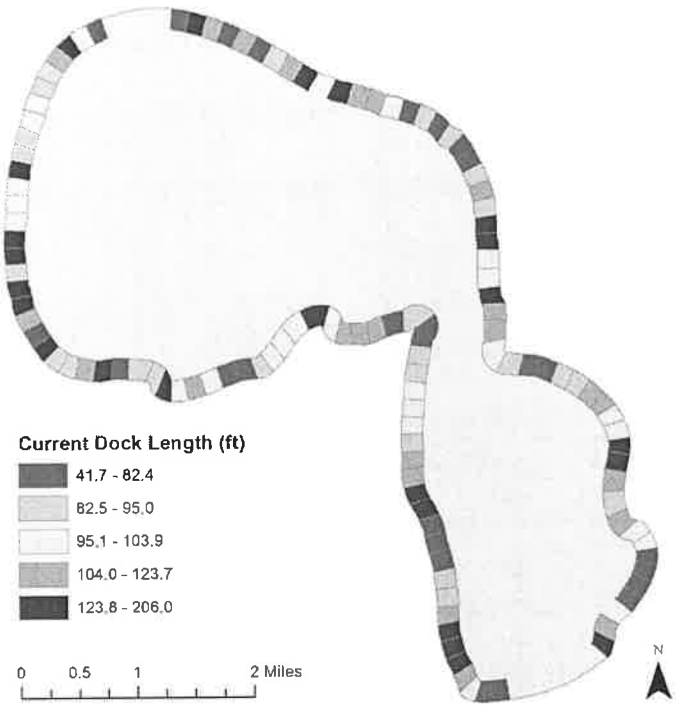


Figure 2.3.8. Map of current dock lengths averaged within polygons each covering 250 meters (820 feet) of shoreline. Only polygons with docks at the time of the analysis are shown. Colors indicate 20% quantiles of dock length.

The actual procedure to calculate the changes in dock length within each polygon proved to be somewhat complex. Each polygon was allowed to have its own average dock-end depth, which necessitated creating a whole series of contours of depth across the lake, intersecting them with polygons, and then looping over the scenarios.

The outcome of this analysis should be considered a *temporary* change in dock length that would be produced only if the lake level were dropped over a very short time period. A more careful management strategy would assess changes in depths that occur in response to both lake level lowering and subsequent sediment redistribution, particularly following ice-free storm events.

Figure 2.3.9 shows the changes in dock length calculated with this method for the 4-inch drop scenario. Changes in length ranged from essentially 0, to as much as 257 feet in at least one polygon. These changes are not randomly occurring around the lake, and fall particularly heavily in the western section of the North basin.

Shown in Figure 2.3.10 are the changes for the 9-inch drop scenario. These are similar in pattern to Figure 2.3.9, only more extreme.

The across-polygon averages are detailed in Table 2.3.4. On average, dock lengths would increase under this method by 73 feet for the 4-inch drop scenario, and 155 feet for the 9-inch drop. More extreme scenarios have greater average changes, with the same caveats as above. A second caveat with this analysis is added that this method is fairly simplistic, and does not account for the dynamic lake processes that shape the bathymetry of the shallow shelf zone.

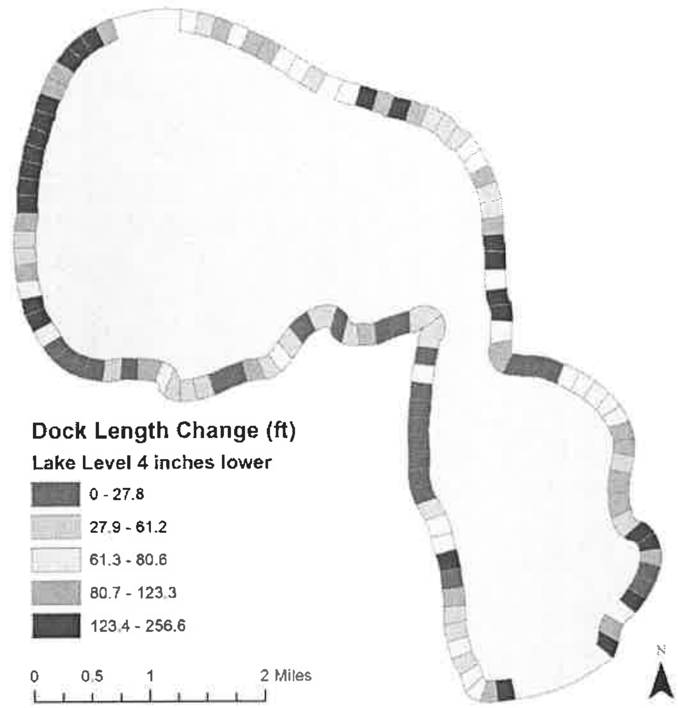


Figure 2.3.9. Map of dock length change (scenario - current) under a 4-inch lake level drop scenario. Colors indicate 20% quantiles of dock length.

Figure 2.3.10. Map of dock length change (scenario - current) under a 9-inch lake level drop scenario. Colors indicate 20% quantiles of dock length.

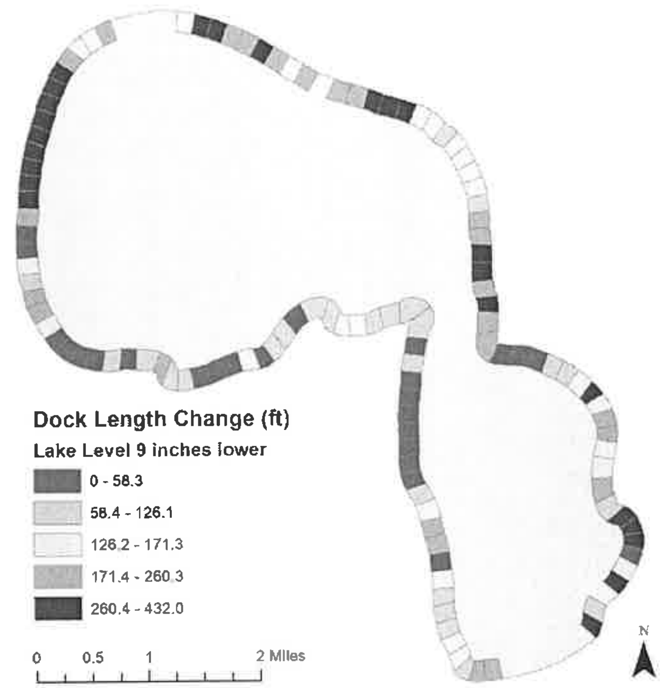


Table 2.3.4. Dock length changes averaged across the analysis polygons for each of the lake level drop scenarios investigated.

Lake Level Drop Scenario (in)	Average Change in Dock Length (ft)
4	73.0
6	108.1
9	154.7
13	186.7
18	244.5

Task 2 Findings Summarized

- A single lake level gauge proved sufficient for translating lake depths to bottom elevations in a multi-day, multi-team survey.
- New methods were pioneered to produce a highly accurate bathymetric map in the deep basins, steep drop-offs, and shallow shelves of Higgins Lake.
- The new map provides unprecedented detail of Higgins Lake bathymetry.
- Evidence of change in position in the 10-foot contour between 1939 and 2013 is suggestive of sediment transport due to shoreline erosion.

- Shorelines change significantly under the most likely 4- and 9-inch drop scenarios, receding lakeward by 12.3 and 25.3 feet on average under these two scenarios respectively.
- Erosion impacts would be significantly lower under the lowered scenarios due to the increased land buffer and greater distance from structure and trees.
- South Higgins Lake State Park and B&B Marina would require dredging approximately 900 cubic yards of sediment under the 4-inch drop scenario, and 2000 and 1500 cubic yards in the 9-inch drop scenario. Other areas of interest saw lower declines.
- With ample caveats, dock lengths would need to increase significantly in the short term if lake levels were abruptly lowered, but over the long term would likely remain similar to those in use now.

Task 3: Cut River Morphological and Flow Surveys

This Task entails a detailed characterization of the morphology (channel shape and position) of the Cut River and how streamflow changes along its length in response to groundwater inputs.

3.1: Stream Profile Data Collection

In May of 2013, the MSU and UofM teams floated the entire length of the Cut River in order to characterize the depth of the channel, its habitat diversity, and flow changes along its length. The plan was to traverse the Cut River during a period of baseflow and before leaf out to ensure GPS coverage. During this process, the MSU crew towed the same Acoustic Current Doppler Profiler (ADCP) used for the lake shelf bathymetry survey behind a canoe while following a zig-zag path down the channel. The ADCP simultaneously records location (X,Y) with an onboard GPS, total depth (down to approximately 15 feet), flow velocity beneath the unit at multiple depths, movement relative to the stream bed, and a number of other parameters. Thus, it can be used to build a complete profile of stream channel depth. The instrument records each parameter once per second. The ADCP setup is shown in Figure 3.1.1.

Figure 3.1.1. Field setup for collection of stream profile data, with an ADCP towed behind a canoe.

The Cut River was floated during a two-day float, stopping at West Lansing Road at the end of Day 1 (May 23rd, 2013), returning for the remainder of the channel on Day 2. A map of all non-zero depth measurements from the ADCP is shown along the boat track in Figure 3.1.2. At the end of Day 1, due to battery issues, the onboard GPS cut out, and the position was inferred using the bottom track position alone--which can accumulate errors. This accounts for the mismatch between the boat track and the channel position beginning midway between the stream gauges HL-CR-4 and HL-CR-2 (described in Task 4). After the batteries were recharged overnight, GPS signal was maintained for the remainder of the float. In general, median track depths were approximately 2.1 - 2.2 feet, shallowest track depths of approximately 0.7 feet and deepest of 8.1 feet.

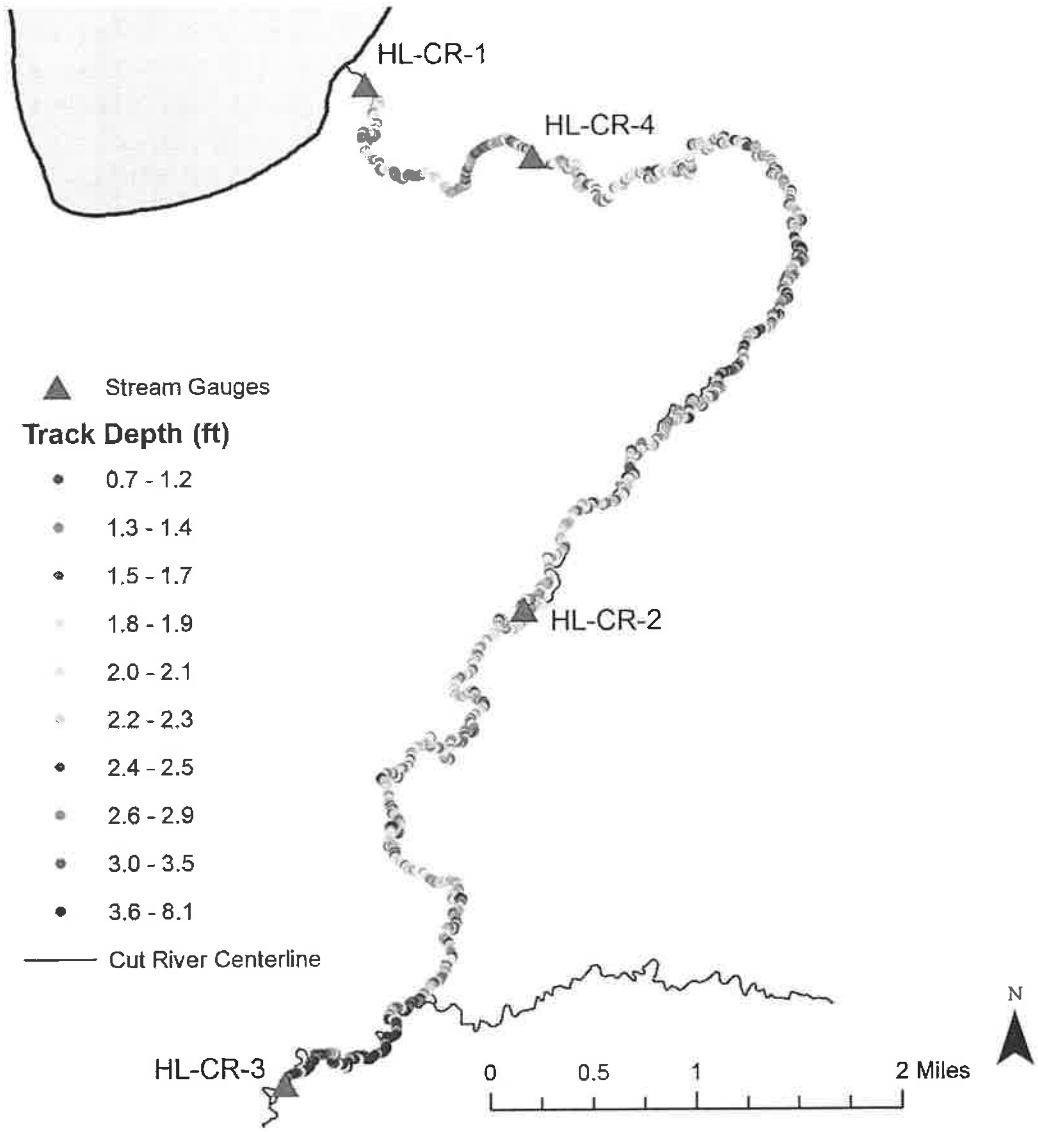


Figure 3.1.2. Map of continuous depth measurements made along the Cut River and through Marl Lake. Note some deviations from the main channel due to discontinuous GPS data above HL-CR-2. Colors represent 10% quantiles of channel depth.

To better understand how the data collected along the zig-zag boat track correspond to average channel depth (an important ecological habitat parameter), the measurements were matched to the channel position, and then averaged along each 50 meter (164 foot) length of channel. Average depths in the channel are shown in Figure 3.1.3. There are clearly bulk sections of the channel that are shallower (including Marl Lake), and in proximity to HL-CR-2, as well as deeper sections, mid-way between HL-CR-4 and HL-CR-2, and then again downstream of the confluence with Backus Creek. In general, median channel depths were approximately 2.3 - 2.4 feet, with shallowest average depths of approximately 0.9 feet and deepest of 7.2 feet.

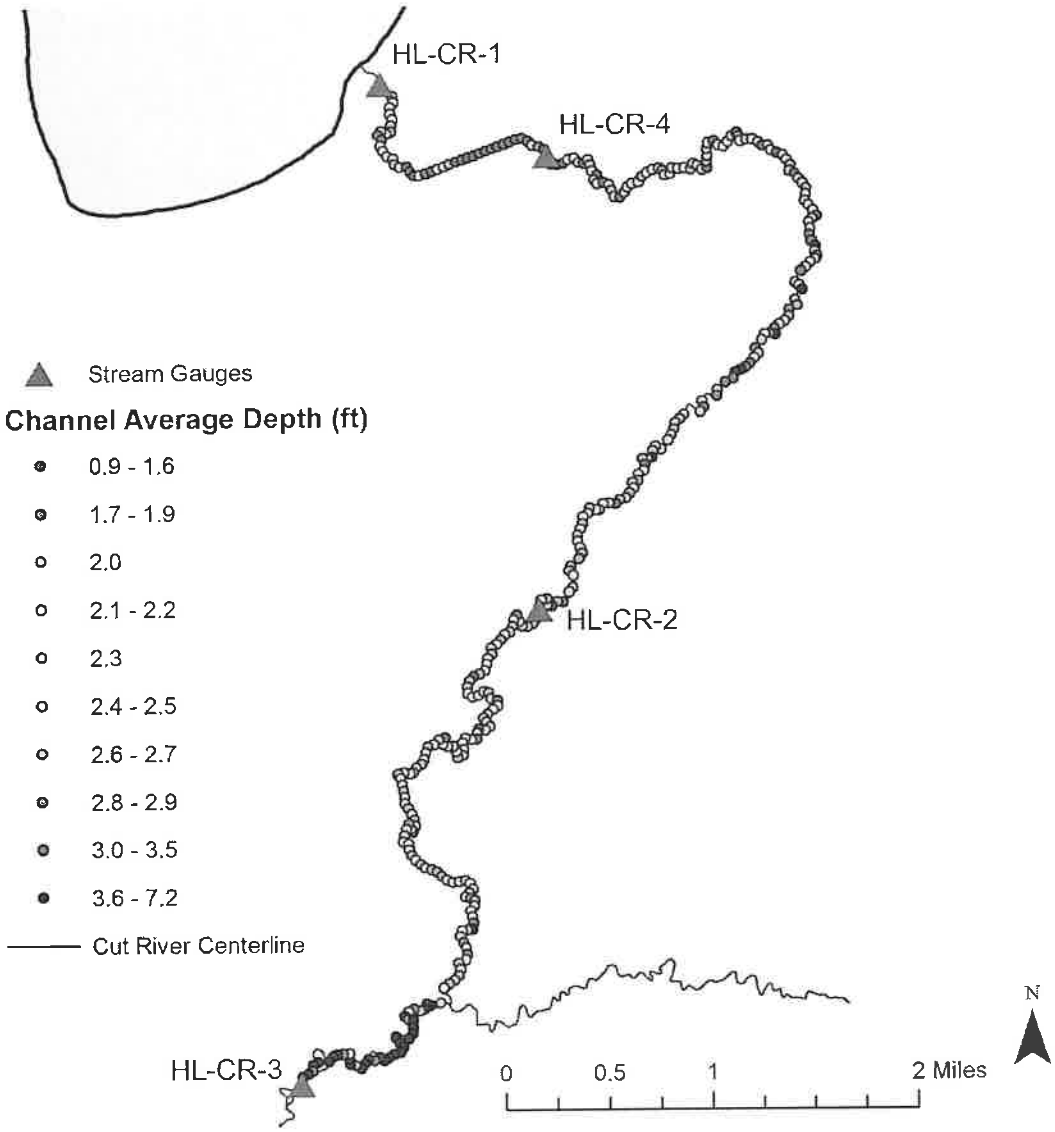
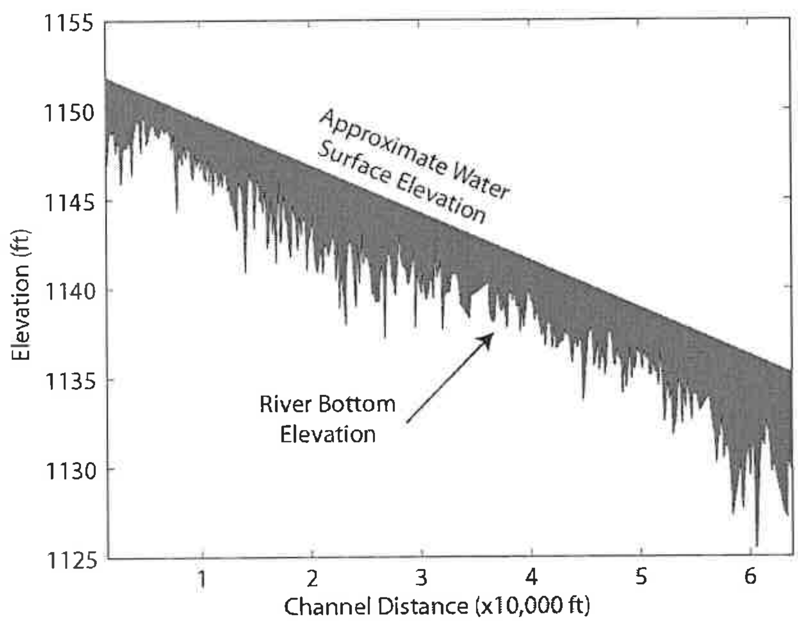


Figure 3.1.3. Map of depth measurements averaged along the stream channel. The actual boat track followed a zig-zag pattern down the channel, thus this represents rough averages along each 50 meter (164 feet) channel section. Colors represent 10% quantiles of channel depth.

Viewed another way, Figure 3.1.4 plots the deepest portion of each 50 meter segment, also known as the channel thalweg, as elevation down the channel. Due to discrepancies in channel elevation data among the multiple sources collected for this project, approximate linear water surface elevation is shown instead, roughly matching the elevations of Higgins and Houghton lake at the upstream and downstream ends, respectively. Clearly, after the confluence with Backus Creek, flow is hydraulically restricted by the channel depth and proximity to Houghton Lake. This is a historical consequence of the elevation of Houghton Lake and the subsequent flooding of the surrounding area. This region of the river is unique, with multiple winding distributary channels and deep, slow, river flows. Above that, however, the stream has a moderate gradient, with minimally impeded flows.

Figure 3.1.4. Plot of approximate river thalweg (deepest point in the channel cross-section) versus channel distance, starting at the gauge HL-CR-1 and ending at HL-CR-3.



3.2: Cut River Longitudinal Flow Profile

During the float, the crew paused intermittently to collect cross-sectional flow and velocity measurements of the channel. One such measurement is shown, taken just upstream of the HL-CR-2 (West Lansing Road) gauge site (Figure 3.2.1). In this procedure, the ADCP is attached to ropes and pulled laterally across the stream by people at either bank. This is repeated multiple times and the resultant flow measurements averaged to better quantify the true flow, as well as estimate flow uncertainties. Channel flows are complex, and non-uniform. The ADCP provides an unprecedented view into how these flows vary across the channel and with depth.

In total, the crew stopped to measure 17 flows during the two day float. The float began immediately after three gates on the dam were opened, sending a flood wave downstream. The first four stops all had flows in excess of 100 cubic feet per second. Across Marl Lake however, flow was back down to roughly 49 cubic feet per second, showing the role of Marl Lake in buffering flood wave progression downstream. Because of this, the team decided to install a fourth gauge, HL-CR-4 (on May 28, 2013), at a point just downstream of the Marl Lake outlet to better understand its role hydrologically.

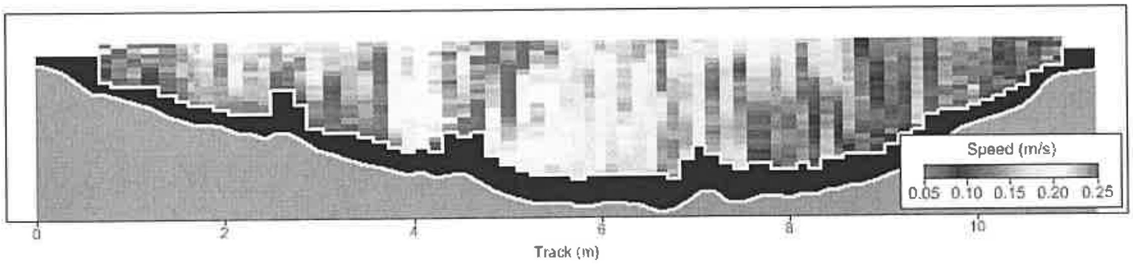


Figure 3.2.1. Example ADCP cross section showing channel depth and width with flow velocity as colors (from site HL-CR-2).

As Marl Lake acts a retention pool for the water it also has the potential to acts as a sediment trap. Local fisherman repeatedly complained about how Marl lake has become a "mud hole" and the depth has been becoming shallower. This fisherman also stated that the fish diversity has changed over the years. This could possibly be due to annual variability but, since UM or MSU did not perform a bathymetric survey of Marl Lake, it is unknown if or how changes have occurred.

From the Marl Lake outlet to West Lansing Road, the Cut River gained approximately 15 cubic feet per second in flow. A repeat measurement at the same point showed that flow had increased little due to the flood wave upstream by the start of the second day. Continuing downstream to a point shortly before the Backus Creek confluence, flow increased by only 8 cubic feet per second (cfs), but then added another 30 cfs after joining with Backus Creek. The system continued strongly gaining flow for the remainder of its short traverse to Houghton Lake, suggesting a strong groundwater input at this section.

Overall, by the time the Cut River reaches West Lansing Road, flow from the outlet of Higgins Lake accounted for approximately 77% of the flow in the channel. By the confluence with Backus Creek it was down to under 50%, and by the time the Cut River reached Houghton Lake the flow from the outlet of Higgins Lake accounted for under 33% of the total channel flow.

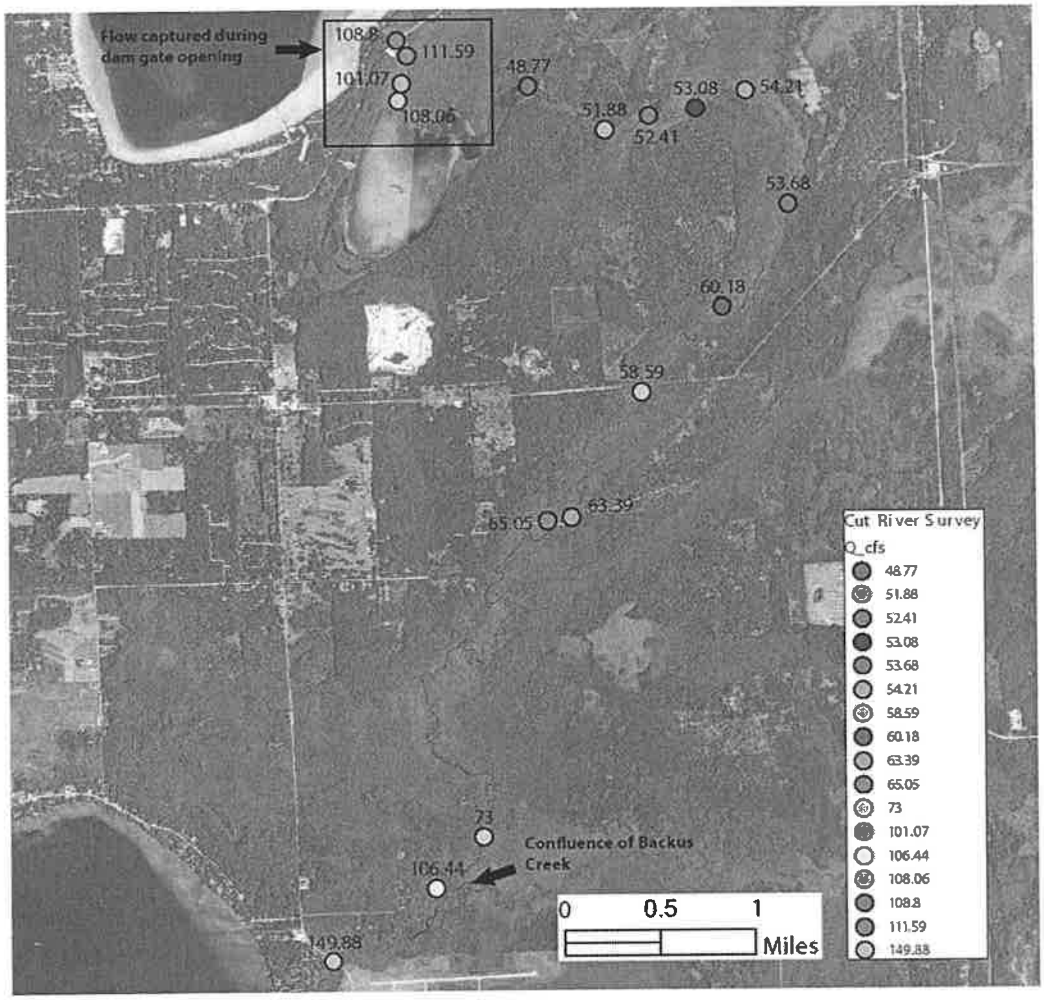


Figure 3.2.2. Map of all ADCP flow cross sections (late May 2013 flow cross sections)

Task 3 Findings Summarized

- The Cut River is in most places approximately 2.3 feet deep on average, and flows relatively swiftly during moderate flow periods.
- Downstream, near Houghton Lake, the Cut River is backed up due to the flooding of the land that formed the present day Houghton Lake. These are where depths in the channel are greatest.
- The Cut River is a beautiful and ecologically significant stream, flowing unimpeded through miles of wetland and stream habitat. Its diversity provides an excellent recreational resource as well.
- More than 75% of the flow for the Cut River upstream of West Lansing Road comes from Higgins Lake during baseflow periods.
- Additional flows from surface water and groundwater downstream of Backus Creek significantly reduce the impact of Higgins Lake outlet flows on Houghton Lake inputs.

Task 4: Install Flow Monitoring Equipment on Cut River

Continuously monitoring streamflow provides an excellent data source to more fully understand the hydrologic function of a system. This Task describes the installation and maintenance of four water depth recording gauges, and how those gauges can be used to quantify streamflow and learn about system behavior in response to dam management.

4.1: Gauge Installation and Maintenance

On July 28th, 2012, the MSU crew installed three automated data logging pressure transducers and temperature probes. These probes recorded data every 30 minutes. Figure 4.1.1 shows two photos of these gauges and their installation. The procedure consists of installing a gauge inside of a PVC housing attached to a fence post driven into the streambed. At that time, streamflow is measured across the channel, and the height of the water is recorded both by the instrument as well as on a manual water level gauge attached the the outside of the housing.

Figure 4.1.1. Installation of a stream gauge and discharge measurement on the Cut River at West Lansing Road (Site HL-CR-2).

Figure 4.1.2 shows the locations of the first three sites installed on July 28th: HL-CR-1 at East Higgins Lake Road, HL-CR-2 on West Lansing Road, and HL-CR-3 on East Houghton Lake Drive (M-100). These gauges were maintained until July 2015, when they were retrieved with their housings left intact for later redeployment if desired.

A fourth site, HL-CR-4 was added immediately downstream of Marl Lake after the role of Marl Lake in buffering flows was made evident in Task 3.

At the times of installation, a survey-grade GPS was used to measure gauge height and establish a local datum for each gauge-allowing for elevation corrected streamflows to be calculated.

Figure 4.1.2. Map of gauge locations, with dates of installation.

4.2: Rating Curves and Stream Flow

The gauges record water height above the gauge, which must be transformed to stream discharge via a rating curve. The rating curve defines a functional relationship between recorded stream height, and measured stream flows during specific site visits. In general, establishing a rating curve takes more than 4 measurements at various points along the curve, and further confidence is gained via repeat visits at a variety of stages.

During each visit, streamflow was measured using either the ADCP, or a cross-sectional wading method conducted with an OTT Acoustic Digital Current Meter (ADCM). Each are state-of-the-art measurement tools with interfaces that quantify the quality of stream discharge measurement and uncertainties in them.

Following the fourth site visit, rating curves were first established, that were then updated for each subsequent visit, provided that the flow measurement met the criteria for inclusion (an issue primarily impacting the HL-CR-3 site, which is hydraulically affected by Houghton Lake). The final curves after the latest visit are shown in Figures 4.2.1 and 4.2.2. R^2 values for these curves are all quite high, between 97.5% and 98.6%.

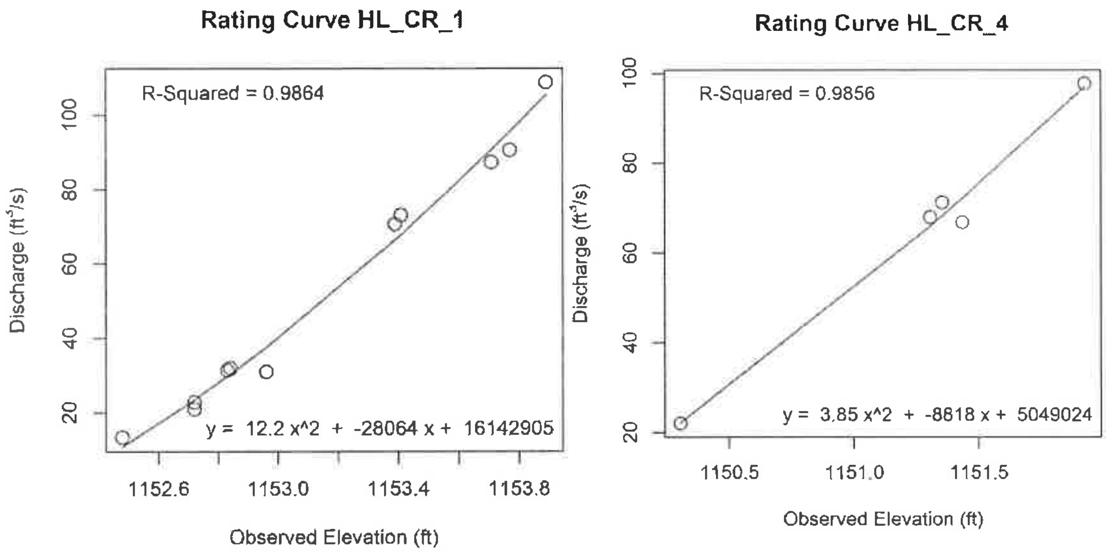


Figure 4.2.1. Rating curves for HL-CR-1 and HL-CR-4

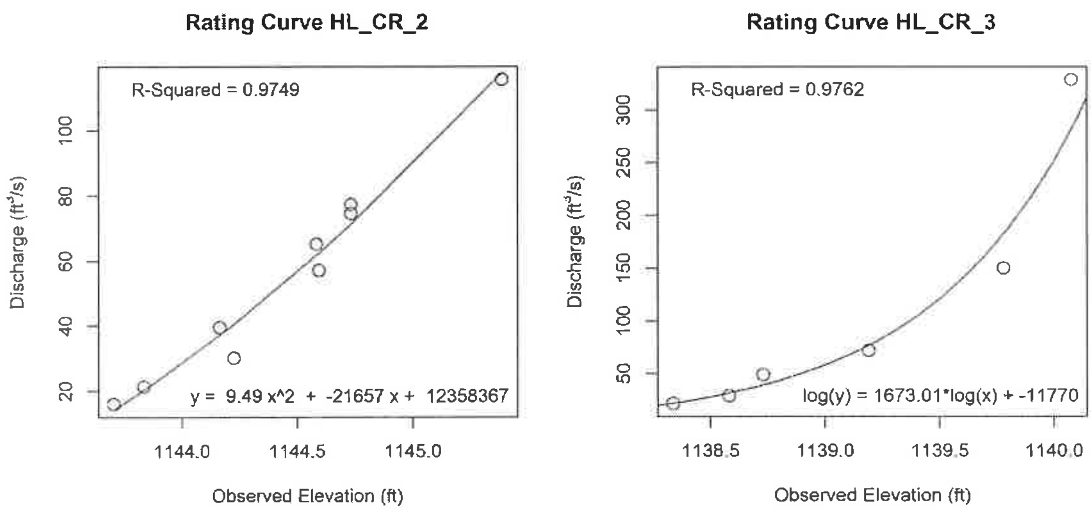


Figure 4.2.2. Ratings curves for HL-CR-2 and HL-CR-3.

Using these rating curves, and after transforming recorded stream stage to elevations using the surveyed site datum, continuous hydrographs for each site were developed (Figure 4.2.3). Significant gaps in the record occurred at sites HL-CR-2 and HL-CR-3 due to instrument and battery failures. All instruments were retrieved in July of 2015.

Site HL-CR-1 is clearly impacted by the management of the Higgins Lake outlet dam, where flows are abruptly discontinuous whenever gate configurations are significantly altered. For gate openings, the stream requires approximately 1 hour to fully equilibrate by the time it reaches HL-CR-1. Flows range between approximately 5 cubic feet per second to over 120 cubic feet per second at this gauge.

Flows at HL-CR-4 vary across roughly the same range as HL-CR-1, suggesting little to no gain in flows between them. Rather the highest flows are damped by Marl Lake. Responses to the dam configuration changes are muted in time due to Marl Lake, and examined further below.

The discontinuous record at HL-CR-2 (West Lansing Road) limits some of the conclusions that might be reached about relative flows, nevertheless peaks are significantly higher, approximately twice as high, than the upstream gauges. Though in lower flow periods the flows are roughly equal. HL-CR-3 shows significant gains in flow during wetter periods, commensurate with its larger surface and ground watersheds.

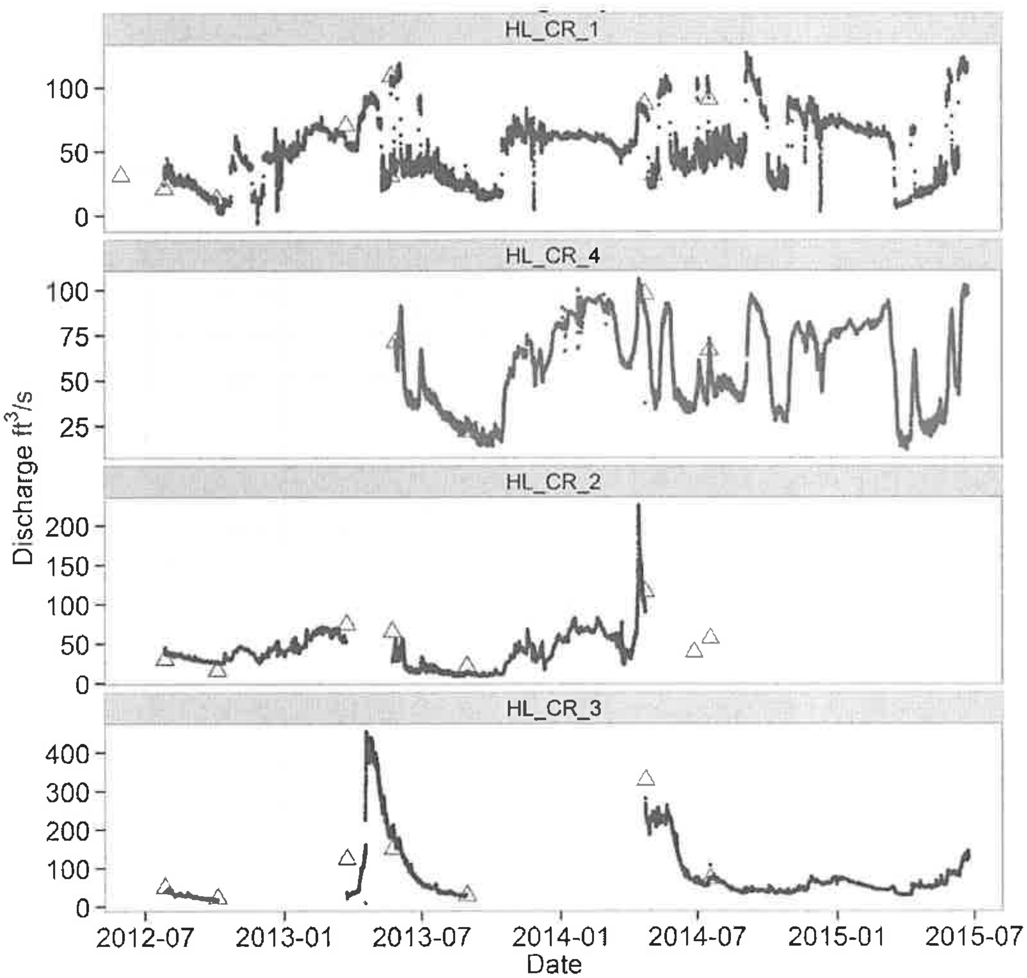


Figure 4.2.3. Rated discharge at all sites for the complete period of record. Observed flows are shown in similarly-colored open triangles.

To better compare relative streamflows, the four gauges are plotted for the most continuous segment in Figure 4.2.4. Here, the role of the downstream surface and groundwatersheds is obvious in determining total flow into Houghton Lake, particularly during high flow periods. During low-flow periods, Higgins Lake outflows account for a much larger proportion of streamflow entering Houghton Lake. Groundwater provides a significant boost in flows for gauges HL-CR-4 and HL-CR-2 downstream of Higgins Lake. Note that this occurs during the months and a year where net groundwater contributions from Higgins Lake are particularly negative (Figure 5.3.4), suggesting that the stream and Marl Lake may capture some of the groundwater lost from the lake during that period. 2013, a year with less groundwater loss from Higgins Lake, shows less of a flow increase.

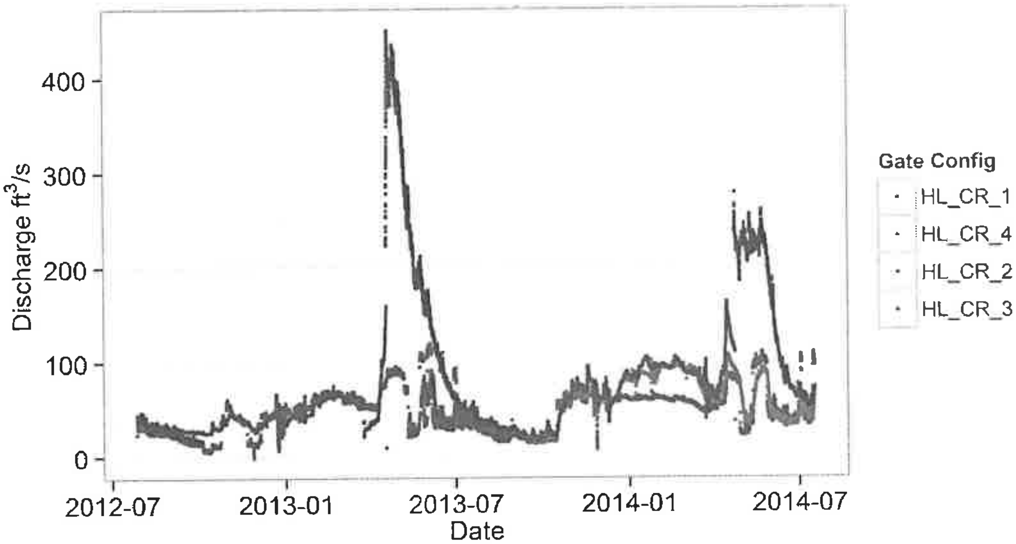


Figure 4.2.4 Rated discharge overlain for a two year period to show site flows relative to each other.

4.3: Dam Configuration Rating Curve

A significant unintended benefit of monitoring flow on the Cut River so close to the Higgins Lake outlet was the development of stage-discharge rating curves for various configurations of lake outlet dam gates. Using meticulous records kept by the Roscommon County Commission, and made available through the HLPOA website, data for the years 2012-2014 were digitized. The average daily flow was then classified based on the dam gate configuration, and outliers (which occurred on days where the gate configuration changed mid-day) were then removed. The result is Figure 4.3.1, which shows highly linear behavior of Cut River flows as a function of both Higgins Lake Elevation and outlet gate configuration.

In Figure 4.3.2, each gate configuration on Figure 4.3.1 was then regressed, producing four separate stage-discharge rating curves. These allow for much greater specificity in the role of the dam in managing lake levels, and should provide a benefit to the Roscommon county commissioners. With the exception of the dam fully closed rating curve, the R^2 for each of these regressions were quite good.

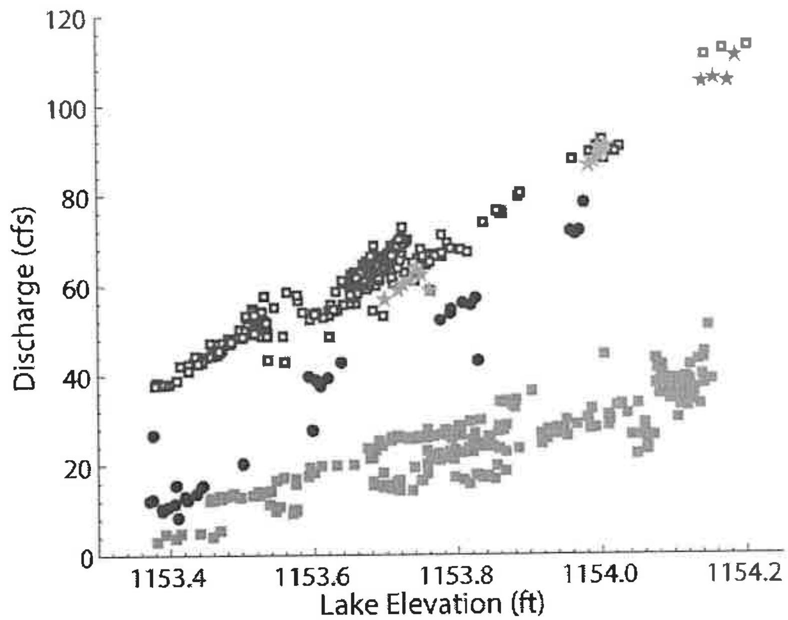


Figure 4.3.1. Discharge at the Higgins Lake Outlet (measured at HL-CR-1) as a function of lake elevation and dam Configuration. Data from 2012-2014. **Red Open Box**: All Flop Gates open; **Blue Box**: All Flop Gates Closed; **Slate**: One Flop Gate Open **Gold Star**: Two flop Gates Open; Flop gate 6 and the combination of Gates 4 and 5 were rarely used.

One interesting observation from Figure 4.3.1 is that for this three year period, the dam has largely been managed as "all closed" or "all open" with little use of either a single gate or two gates. Within this report, designation of "All Open" or "All Flop Gates Open" pertains to the tilt/flop gates 4, 5, and 6 of the lake level control structure. The scenario of "All Closed" or "All Flop Gates Closed" also only pertain to tilt/flop gates 4, 5, and 6. This is likely in response to the limited information available to the dam manager about how the dam should be operated to achieve specific level targets and over what time that target can be expected to be met and maintained.

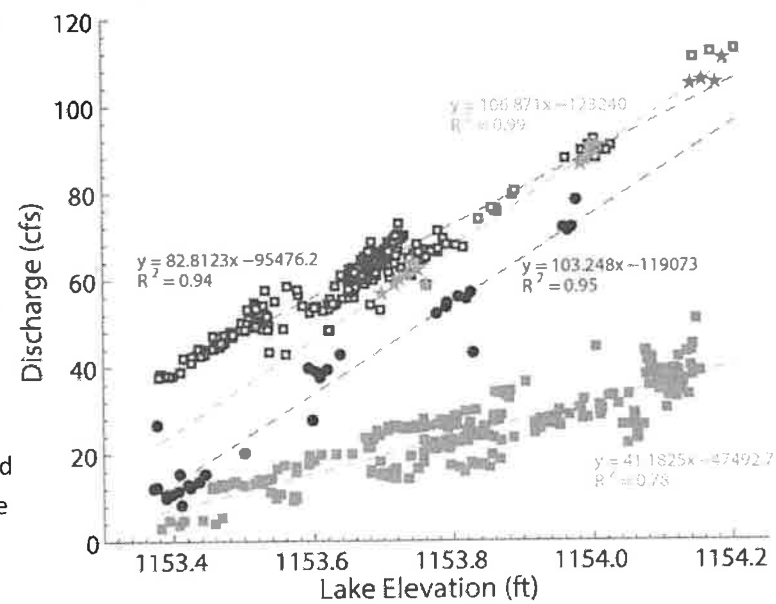


Figure 4.3.2. Rating curves of for each dam configuration. **Red Open Box**: All Flop Gates open; **Blue Box**: All Flop Gates Closed; **Slate**: One Flop Gate Open **Gold Star**: Two flop Gates Open; Flop gate 6 and the combination of Gates 4 and 5 were so rarely used we were unable to generate a realistic stage discharge relation.

4.4: Impacts of Outlet Control Structure Management on Cut River Flow

Operating a dam such as this results in discontinuous flows, and the passage of both flood and stage drop waves downstream. Figures 4.4.1 and 4.4.2 illustrate a portion of the spring of 2013 and 2014, with changes in dam configuration overlain atop measured changes in discharge. Clearly evident is how quickly flow responds at HL-CR-1, typically within an hour flow can more than triple. This flow takes significantly longer to reach downstream, however, due to Marl Lake.

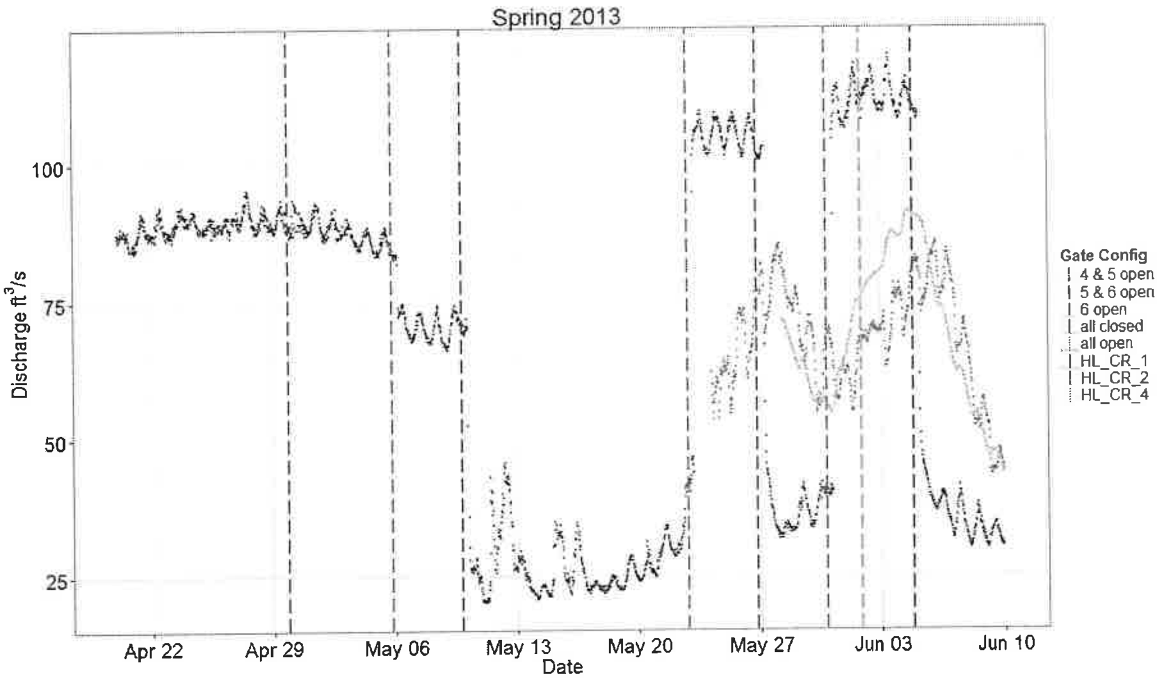


Figure 4.4.1. Plot of rated stream flows at HL-CR-1, 2, and 4 along with dam gate configurations for the Spring of 2013.

The damping effect of Marl Lake can be best seen in May of 2014, in Figure 4.4.2. Two events, first a drop in flows at HL-CR-1 due to dam closure in late April, and then a rise due to dam gate opening in mid-May have a significantly time-lagged impact at HL-CR-4, just downstream of Marl Lake. In general, Marl Lake buffers the response time by nearly two weeks, having both a positive and negative impact on stream flows, but helping to reduce the variability in the flows downstream. In June, following gate closure for the summer, the drop is more rapid, with a buffer of only about one week. This is likely due to reduced groundwater inputs to Marl Lake later in the season.

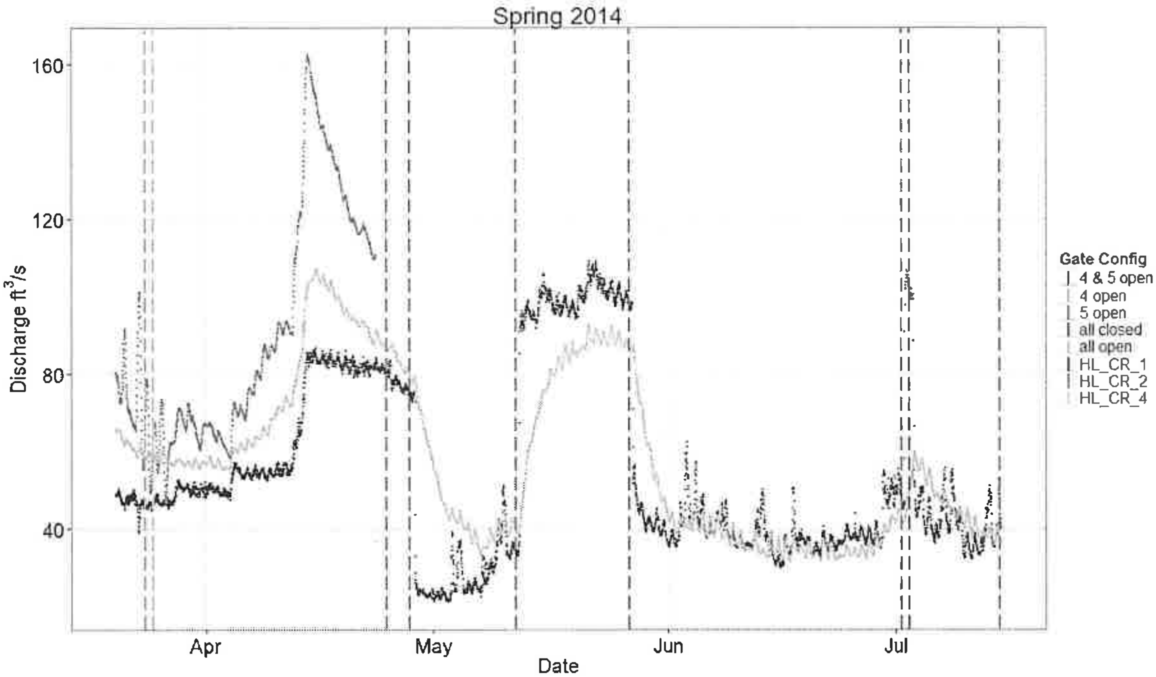


Figure 4.4.2. Plot of rated stream flows at HL-CR-1, 2, and 4 along with dam gate configurations for the Spring of 2014.

Task 4 Findings Summarized

- Water level and temperature was monitored continuously at three locations for nearly three years, with some missing sections, and fourth for approximately two years.
- Good rating curves for each site were developed.
- These data provide further evidence that the Cut River gains relatively little flow for much of the year from groundwater.
- The placement of a gauge just downstream of Marl Lake shows its influence in moderating flows further down the Cut River, particularly during times of rapidly fluctuating flows such as the spring.
- Good dam configuration rating curves will provide managers of the outlet control structure better tools to manage lake levels.

Task 5: Hydrologic Modeling

This task includes applying simulation models to predict the hydrologic (flow and storages of water in the environment) and hydraulic (movement of water in response to pressure gradients) behavior of Higgins Lake, the Cut River, and their watersheds. Specifically, three types of models are applied:

1) HEC-RAS, a hydraulic model that predicts streamflow and stage (height) in actual stream channels in the presence of flow obstructions such as dams, bridges, or culverts for a given input upstream stage.
2) The Landscape Hydrology Model (LHM), an integrated surface and subsurface hydrologic model that predicts water movements across the landscape and through the subsurface through time, in response to climate inputs.
3) A novel water-balance model for Higgins Lake that integrates weather data, historical dam management behavior, and LHM outputs to offer predictions of lake level response to changes in the environment or dam management.

The specific applications of each of these models are detailed in the sections below.

5.1: Hydraulic Modeling of the Cut River Outlet

In Task 5, we have applied HEC-RAS to simulate the flow conditions in the Cut River immediately at the Higgins Lake outlet. The model encompasses a section immediately downstream of the Higgins Lake control structure, through the culverts for East Higgins Lake Drive, and continuing downstream for approximately 1000 feet. The configuration of the model is shown in Figures 5.1.1 and 5.1.2 below. The model was built using GPS-surveyed cross sections, which were then interpolated to a series of more closely spaced virtual cross sections. Dimensions of both the dam outlet and culvert geometries were explicitly measured as well.

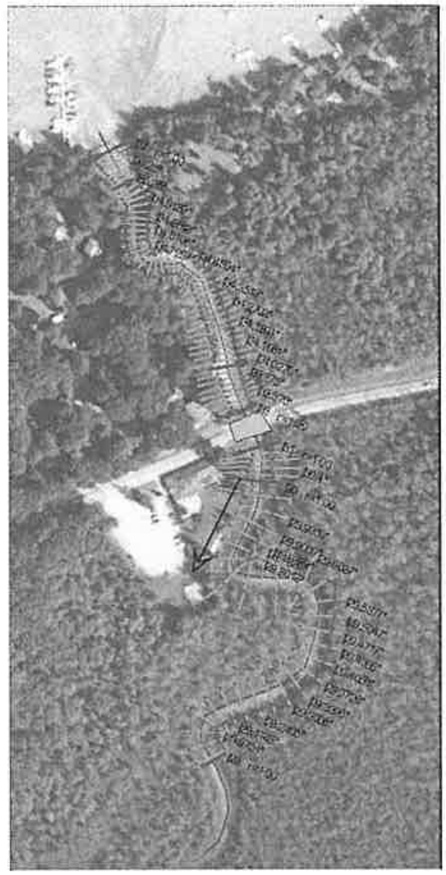


Figure 5.1.1. Overview of the HEC-RAS stream geometry cross sections overlain on a satellite image showing the dimensions and extent of the model. Measured cross-sections are shown in green, while interpolated virtual cross-sections are shown in orange. The culverts under East Higgins Lake Road are indicated as a grey box.

The model was calibrated by adjusting channel and floodplain roughness (a parameter with general value ranges for a specific channel/floodplain type), as well as the degree of sediment build up within the three culverts. The calibration adjusted parameters to better match simulated and observed water levels for flow data we collected at the HL-CR-1 location (immediately upstream of the culverts; See Figure 5.1.3). The calibration successfully captured both the low and higher flow behavior of the stream channel. Additionally, it provided a reasonably robust prediction of the flow behavior of the Higgins Lake outlet section of Cut River under higher flow conditions than those we observed for the creation of our stage/discharge rating curves (Figure 4.2.1).

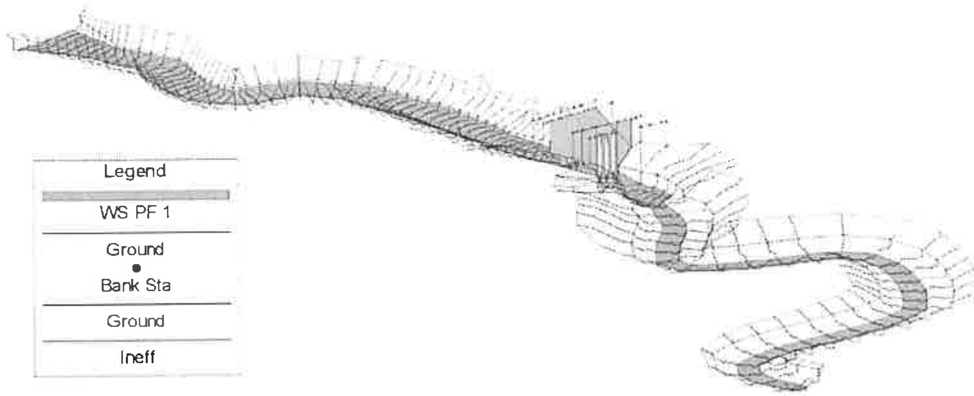


Figure 5.1.2. Three dimensional view of the Cut River outlet HEC-RAS model. The vertical relief in figure was exaggerated by a factor of 30 to more clearly illustrate bank height and channel morphology. The water level shown in blue illustrates a hypothetical minimum discharge of 0.35 cfs before becoming stagnant.

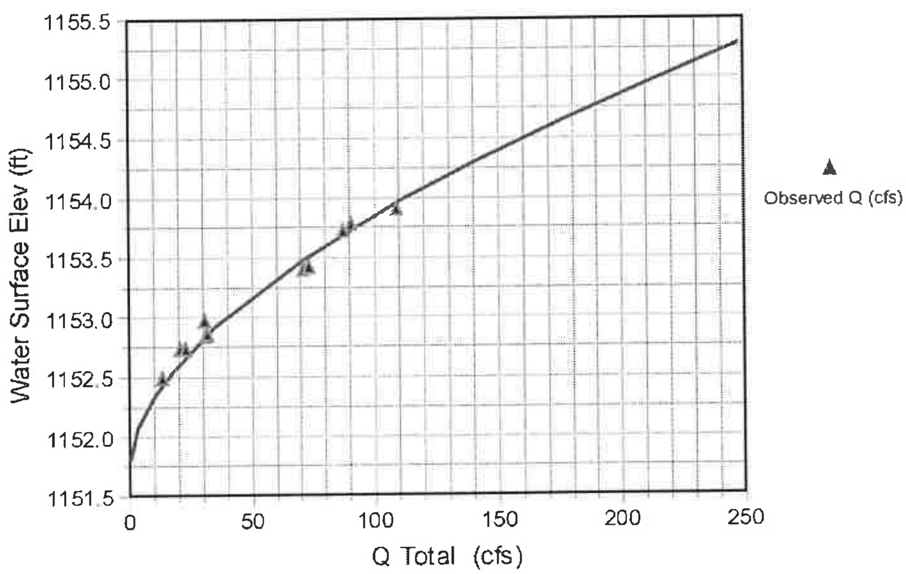
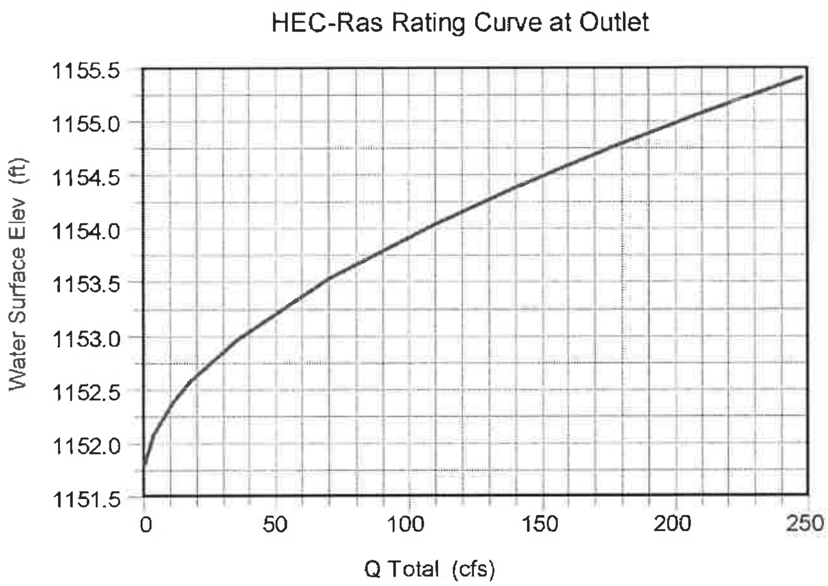


Figure 5.1.3. Rating Curve HEC-Ras Modeled of HL-CR-1. The Hec-Ras Model was calibrated using the observed discharge and water elevation data collected during site visits by MSU personnel.

The primary application of this model was to obtain a prediction of the stage/discharge relationship of this section of the Cut River in the absence of an outlet control structure (the No Dam scenario). The observed stage/discharge rating curves under various dam gate configurations developed within section 4.3 can inform all other lake level scenarios, but the HEC-RAS model is required to understand how the lake will respond were the outlet control dam to be removed.

For this, the farthest upstream cross section in the HEC-RAS model was queried to determine its stage/discharge behavior (Figure 5.1.4). Note the differences between the rating curve for this upstream section and that at the bridge just 750 feet downstream. For instance, at 100 cubic feet per second of flow through the channel, the upstream cross section is at an elevation of ~1153.86 feet (Figure 5.1.4) while for the same flow at the culverts, the stage would be ~1153.80 feet (Figure 5.1.3), a significant difference for lake level predictions where differences in scenarios are on the order of 4 inches, or 0.33 feet.

Figure 5.1.4. Rating Curve HEC-Ras Modeled Immediately downstream of Dam. The rating curve is representative of a non-obstructed outlet from Higgins Lake.



5.2: Lake Groundwater Discharge and Evaporation Predicted with the Landscape Hydrology Model

The Landscape Hydrology Model (LHM) was chosen to simulate the regional hydrology surrounding Higgins Lake. This project leveraged two existing LHM models: one built for an expanded region surrounding the Muskegon River Watershed (EMRW), and another for the Lower Peninsula of Michigan (LPMI). These two model boundaries are shown in Figure 5.2.1 below.

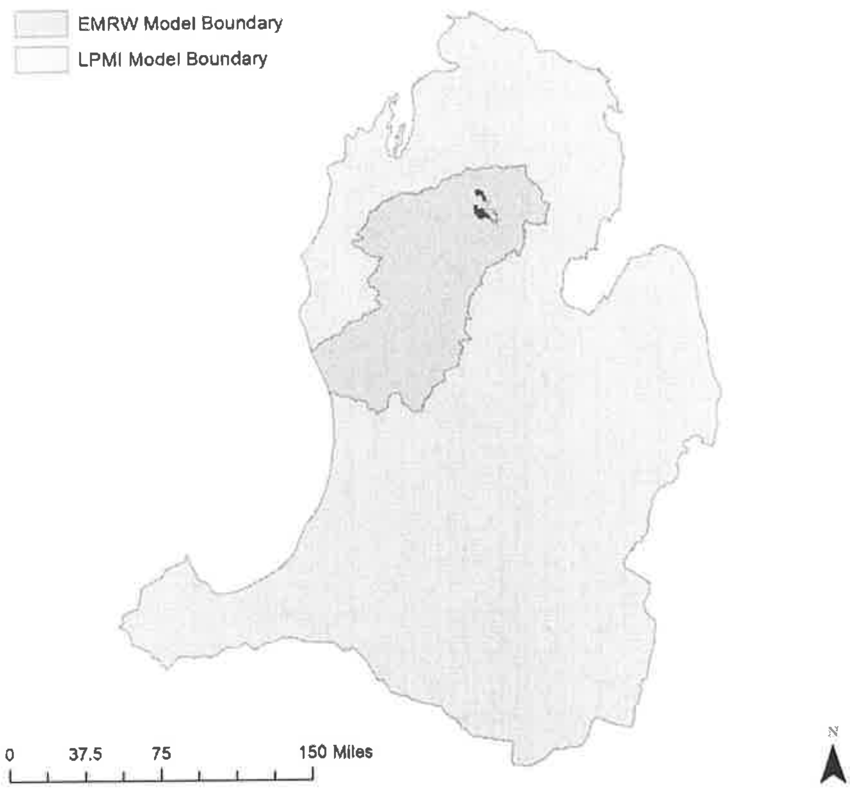


Figure 5.2.1. Map of the EMRW (orange) and LPMI (grey) model boundaries with the Higgins-Cut-Houghton watershed system overlain.

LHM simulates the entire terrestrial hydrologic cycle on an hourly basis, driven by weather data inputs, and parameterized using soil and sediment data from maps, over a region discretized into grid cells. Within each grid cell, equations dictate the movement (or fluxes) and storage of water. This type of model is called a spatially-explicit, process-based model. Figures 5.2.2 and 5.2.3 below illustrate the different components of the water cycle simulated, and how LHM discretizes the landscape.

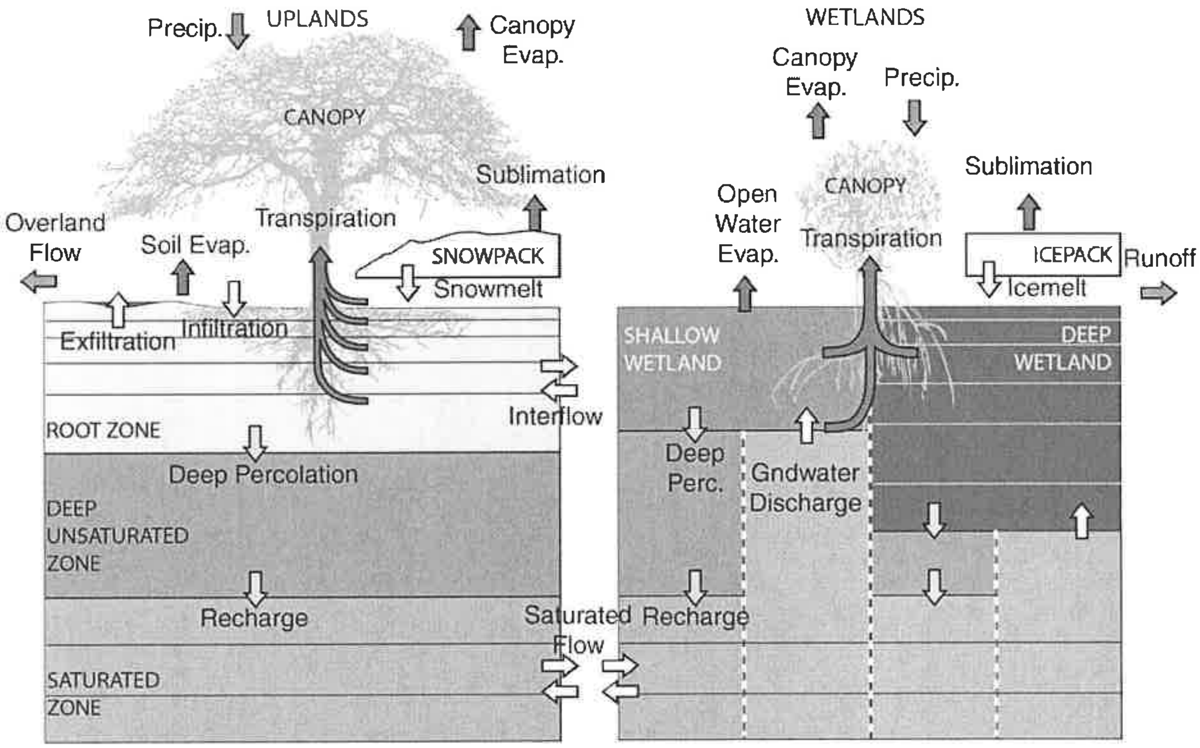


Figure 5.2.2. Conceptual model of hydrologic fluxes simulated by LHM.

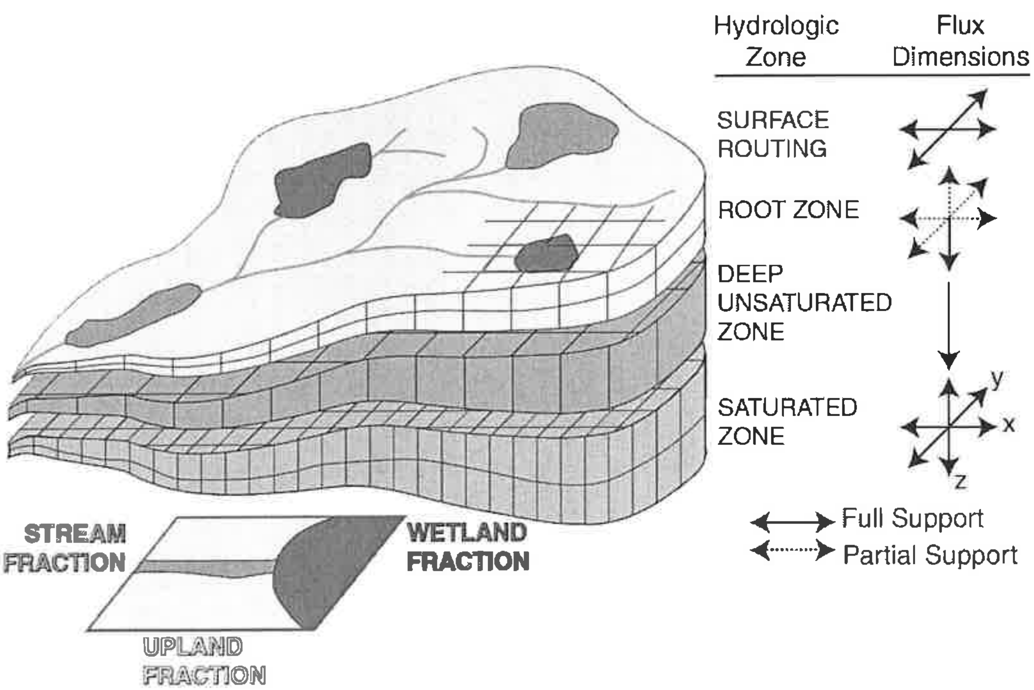


Figure 5.2.3. Conceptual model of the landscape discretization scheme in LHM.

The EMRW model grid cells have a surface resolution of approximately 425 meters on a side, while the groundwater model uses 106 meter cells; the model simulates the 1980 to 2007 period. The LPMI model cells have a surface resolution of 500 meters, and simulates the period of 2000 - 2014. However, the LPMI model does not have a groundwater simulation linked at the time of this report.

This project requires a simulation period similar to the LPMI model, but also a description of groundwater inputs to Higgins Lake for the whole period. The EMRW model has all of the necessary components, but does not extend to 2014. To bridge this gap, we decided on an approach referred to as process-inferred statistical modeling. That is, we used a statistical model to represent the more complex physical processes of the full LHM simulation. We then applied this statistical model to simulate a flux we didn't have (groundwater inputs to Higgins Lake for the full period) using something we do have (groundwater recharge simulated by the LPMI model for that period).

For this approach, simulated groundwater inputs to Higgins Lake (represented in cubic feet per second) for the full 1980 - 2007 period (Figure 5.2.4) were decomposed into two components, annual average inputs (Figure 5.2.5), and monthly average inputs to Higgins Lake (Figure 5.2.6).

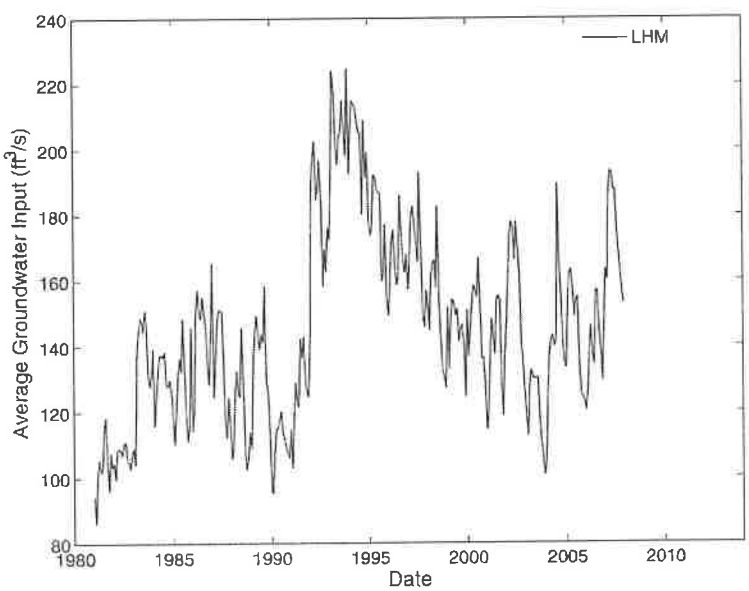


Figure 5.2.4. Monthly LHM-simulated groundwater input (inflow) to Higgins Lake for calendar years 1981 - 2007, expressed in cubic feet per second.

Annually, LHM-simulated average groundwater inputs to Higgins Lake varied between approximately 110 and 210 cubic feet per second, with significant multi-year year cycles. Much of the 1990s decade saw higher inputs than either the 1980s or early 2000s.

To better understand how fluxes into the lake vary by month, Figure 5.2.6 plots inputs as a percent of total annual input--this is essentially the seasonality of input. As expected, fluxes were highest in the spring months following snow melt and prior to the growing season for plants. Also shown as a shaded range is one standard deviation of monthly fluxes, essentially a measure of how much these monthly fluxes varied across years. During the spring, fluxes varied approximately 0.5% of the total input from the mean, while during the late summer and fall this variability increased to as much as 1% of the total annual input. Capturing this variability is important to simulating particularly "wet" or "dry" months in terms of groundwater inputs to the lake.

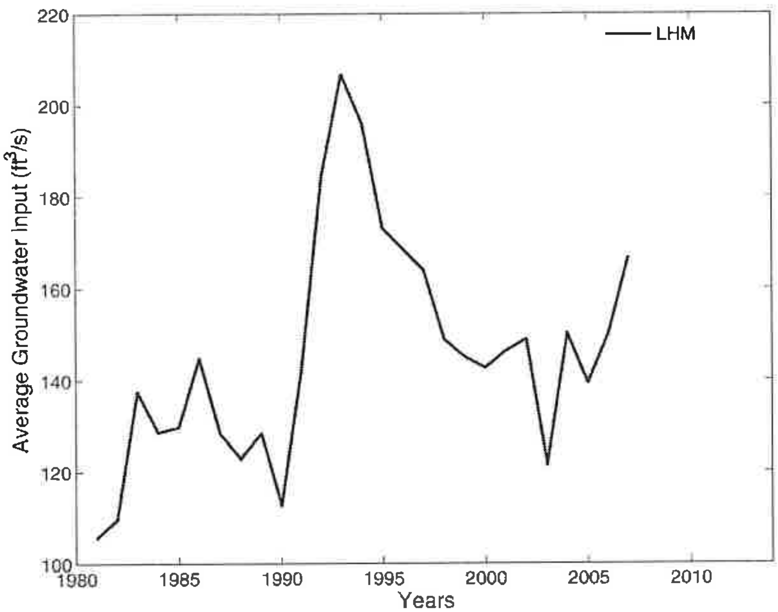


Figure 5.2.5. Plot of LHM-simulated groundwater inputs to Higgins Lake for the calendar years 1981 - 2007, expressed as an average flux rate in cubic feet per second.

Two statistical models were created to describe both the annual total input to the lake, as well as the seasonal cycle of inputs. The annual model is a distributed lag regression model, in which water year (October - September) groundwater recharge within the Higgins Lake *groundwatershed* is summed and used to predict the time lagged calendar year (January - December) groundwater inputs to the lake. This analysis showed that calendar year inputs are sensitive to groundwater recharge up to three water years prior. In other words, according to the LHM simulation of the EMRW, the Higgins Lake groundwater system has a roughly 3 year "memory" of groundwater recharge. Thus, four parameters were used in the regression: current water year groundwater recharge, along with 1-year, 2-year, and 3-year lagged recharge. This statistical model provided a very good fit to annual LHM-predicted values (Figure 5.2.7), with a coefficient of determination (R^2) of 94% (100% would indicate a perfect model fit), and an average error of only 3.4%.

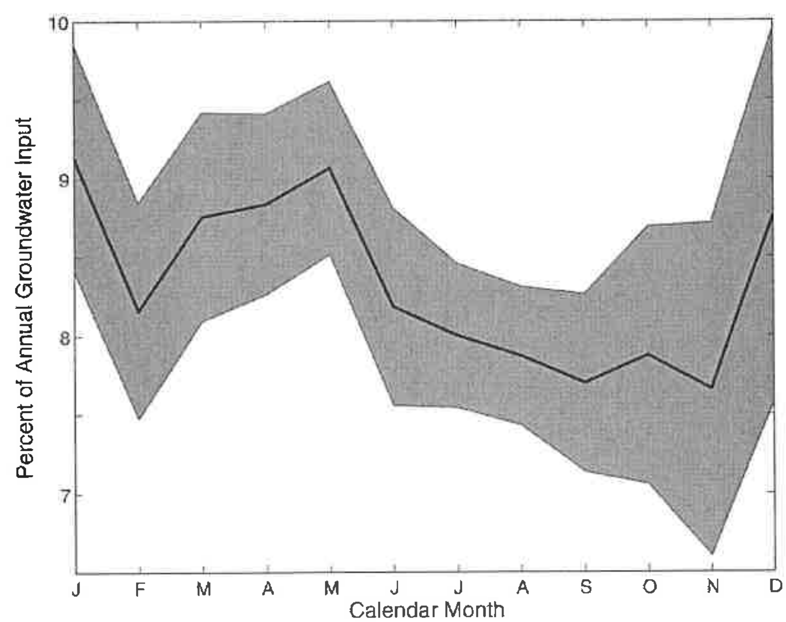


Figure 5.2.6. Plot of monthly averages of model-simulated groundwater input to Higgins Lake from 1980 - 2007 as a percent of annual simulated input. The blue line indicates the mean simulated flow for that month across years, while the shaded area includes +/- 1 standard deviation from the mean.

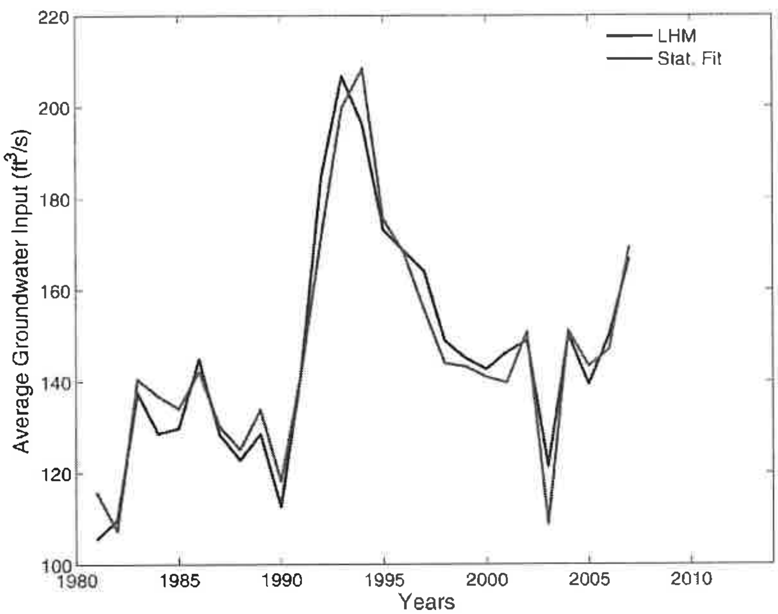


Figure 5.2.7. Plot of LHM-simulated and statistically-fit annual groundwater inputs to Higgins Lake. for the calendar years 1981 - 2007.

Statistically modeling the monthly variability was somewhat more complex. The chosen model structure was to sum the average monthly input to the lake (Figure 5.2.6) and a modeled "anomaly", or a departure from normal, predicted using LHM-predicted *groundwatershed* recharge. First, annual normal groundwater recharge was calculated for all years. Monthly recharge values were then divided by annual totals to calculate the monthly recharge anomalies relative to normal. This anomaly was then regressed against a similarly-calculated anomaly for LHM-simulated groundwater input to the lake. This allowed for groundwater recharge alone to the predict the anomaly for groundwater input to the lake. This model-predicted anomaly was then added to the average monthly cycle of groundwater input, which was finally multiplied by annual average groundwater input (Figure 5.2.7). The final result is shown in Figure 5.2.8. This model of monthly groundwater input to Higgins Lake is derived solely using LHM-simulated recharge, and compared to LHM-simulated groundwater inputs had an R^2 of 81%, and mean monthly error of 6.7%, and a Nash-Sutcliffe efficiency (a measure of model goodness-of-fit commonly used by hydrologists, with values of 1 meaning a perfect fit, and anything above 0 meaning a model that does better than simply using a single average value) of 0.81.

With the combined annual and monthly statistical models calibrated, they were then applied to calculate annual (Figure 5.2.9) and monthly (Figure 5.2.10) groundwater discharge into Higgins Lake for 2000 - 2014 using only the LPMI simulation of groundwater recharge in the Higgins Lake groundwatershed. The annual model predicting 2000-2014 discharge provided similar predictions to the model fit to 1980 - 2007 discharge, although the monthly model was not quite as accurate. The LPMI and EMRW simulations differ in two key aspects: weather and soils data. These differences mean that the LPMI model predicts a somewhat different seasonal cycle of recharge than does the EMRW model. Nevertheless, the model provided reasonable predictions of the groundwater input on a monthly basis to Higgins Lake.

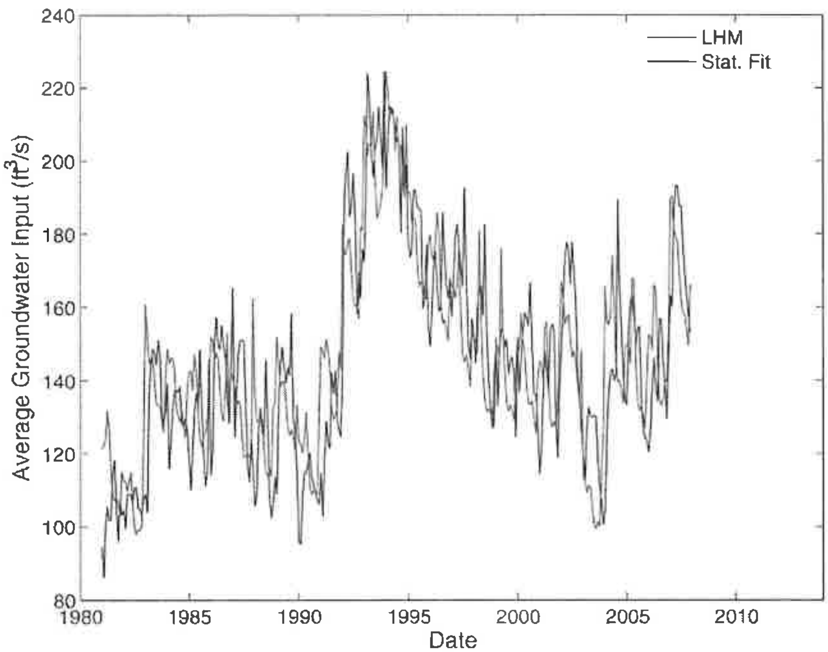


Figure 5.2.8. Plot of LHM-simulated and statistically-fit monthly groundwater inputs to Higgins Lake. for calendar years 1981 - 2007.

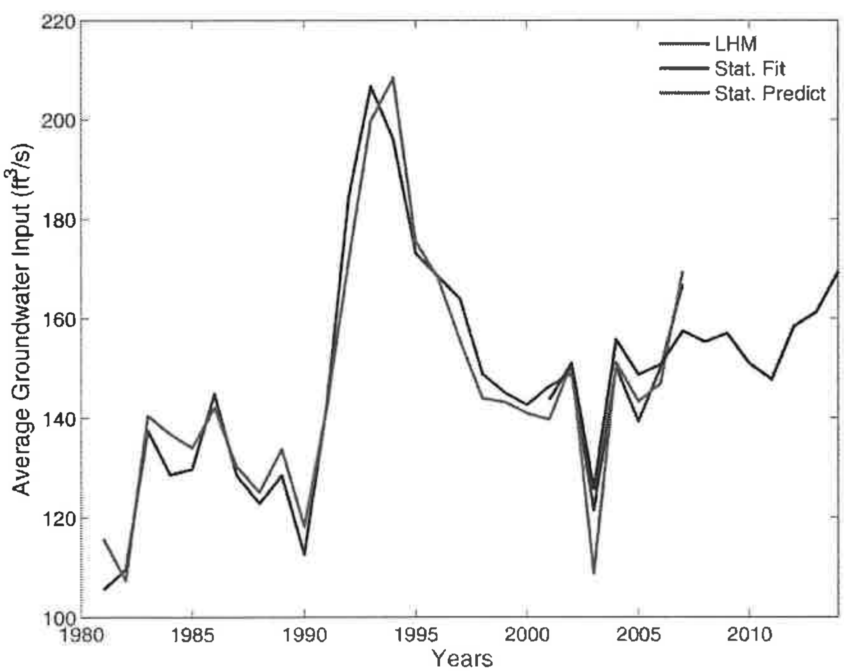


Figure 5.2.9. Plot of annual average groundwater input in cubic feet per second from the Landscape Hydrology Model (blue), a statistical model fit to the LHM prediction (red), and that same statistical model applied to the LPMI simulation results from 2000 - 2014.

Another key simulation component of the overall Higgins Lake water balance is evaporation from the lake. Estimates of lake evaporation are driven by simulated lake temperatures, along with weather inputs including air temperature, wind speed, relative humidity, and solar radiation. It is also affected by the simulated ice cover condition of the lake.

LHM simulates 1-dimensional heat transport within lakes, incorporating the influences of wind-driven convection (circulation of water vertically), density-driven mixing (that drives seasonal stratification and mixing), and lake ice buildup. Temperature is impacted by radiation exchange with the atmosphere (long and short wave, diffuse and direct), sensible heat exchange (direct warming/cooling via the presence and natural convection of warm/cold air above the lake), and latent heat exchange (warming/cooling caused by condensation onto the lake, or evaporation of water from the lake).

Figure 5.2.11 below illustrates air temperature from the NLDAS dataset, averaged over the June - September period of each year. Based on this evaluation, Higgins Lake air temperatures have been experiencing a steady and significant increase in average summer temperature from 1980 - 2015 at a rate of 0.84 degrees F/decade (with a *p* value of <1%).

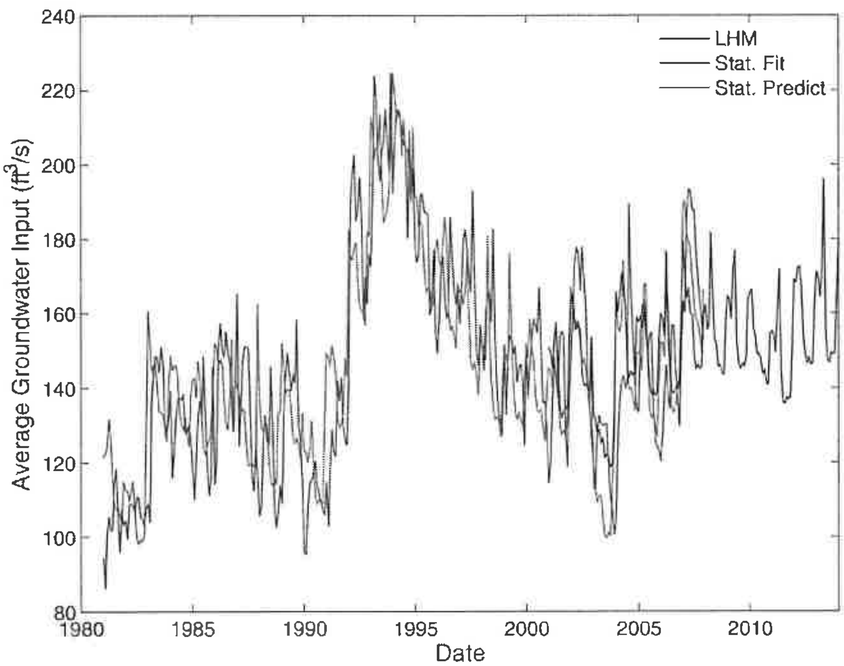


Figure 5.2.10. Plot of monthly average groundwater input in cubic feet per second from the Landscape Hydrology Model (blue), a statistical model fit to the LHM prediction (red), and that same statistical model applied to the LPMI simulation results from 2000 - 2014.

The increase in summer temperature has been a driving force for increased evaporation, as simulated by LHM. Figure 5.2.12 shows annual lake evaporation simulated by the LPMI model for 2000 - 2014. Although the time series is somewhat short for robust trend estimation, there appears to be an increasing trend of evaporation at a rate of 3.79 cubic feet per second/decade ($p = 0.15$). In general, lake evaporation averages between 17 and 34 cubic feet per second over the course of each year, and can fluctuate greatly between years. This evaporation rate would correspond to an equivalent loss of water from the lake between 14.5 and 28.9 inches each year.

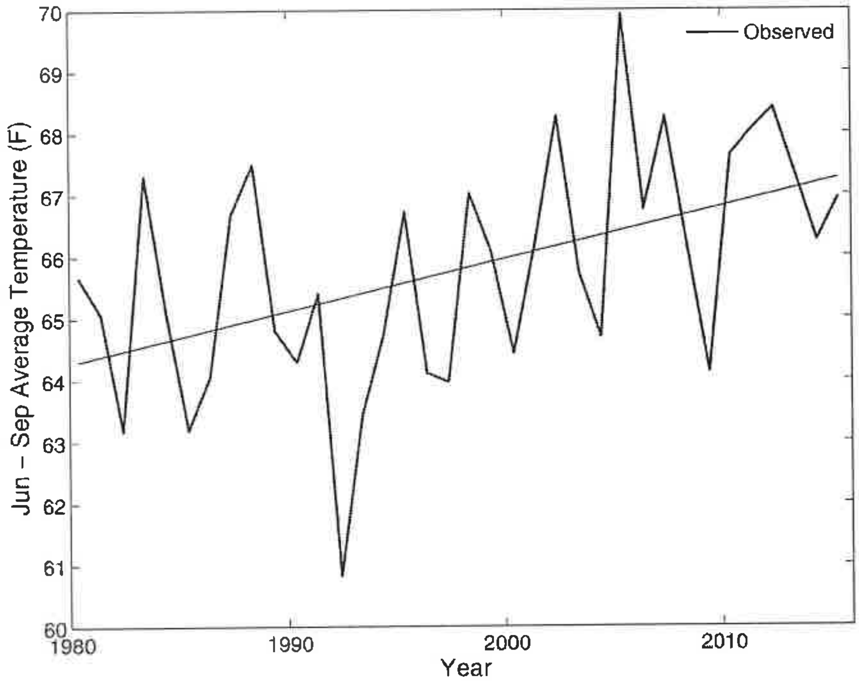


Figure 5.2.11. Plot of June - September average air temperatures over Higgins Lake from 1980 - 2015.

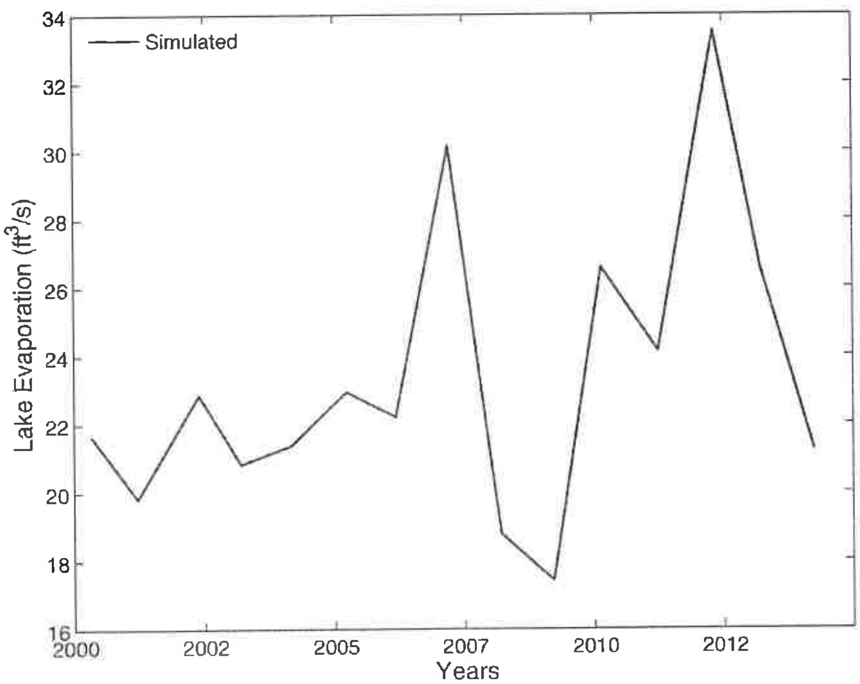


Figure 5.2.12. Plot of simulated annual lake evaporation from 2000 - 2014, in cubic feet per second.

Evaporation is clearly not constant throughout the year, and varies considerably from month-to-month (Figure 5.2.13). During some years (2012, for instance), evaporation rates exceeded 100 cubic feet per second, while simulated evaporation drops to 0 during most winters. In other years, peak evaporation was much lower, such as approximately 50 cubic feet per second in 2009.

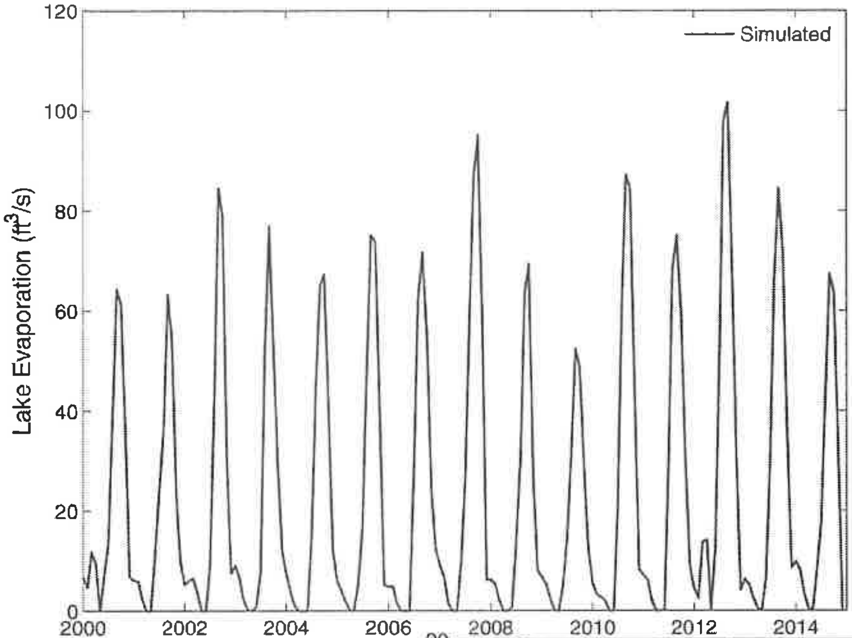


Figure 5.2.13. Plot of simulated monthly lake evaporation from 2000 - 2014, in cubic feet per second.

Averaging across the 15-year LPMI simulation reveals greater detail about the seasonal cycle of evaporation on Higgins Lake.

Contrary to our perception of evaporation rates, large lakes such as Higgins do not peak in the hottest summer months, but rather in September or October, as shown in Figure 5.2.14. Evaporation during peak summer months (June, July, and August) averages between 5 and 50 cubic feet per second. These rates are equivalent to 0.01 - 0.1 inches per day, averaging roughly ½ of the estimate provided by the Spicer group (Task 1.1).

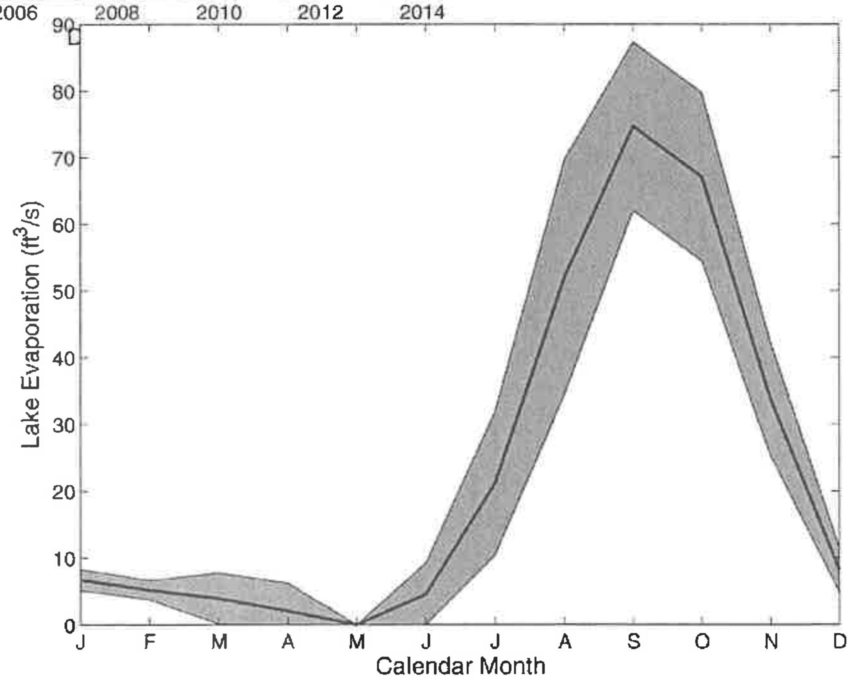


Figure 5.2.14. Plot of simulated monthly lake evaporation cycle, averaged from 2000 - 2014, in cubic feet per second. The shaded region indicates +/-1 standard deviation in monthly input.

5.3: Simulating Lake Levels with a Lake Mass-Balance Model

LHM provides detailed monthly (in fact, hourly, though the data were resampled to monthly periods for this analysis) estimates of critical input and output fluxes for Higgins Lake. To more fully understand what drives lake level dynamics, we first need to construct a conceptual mass balance, which is shown in Figure 5.3.1. For this analysis:

- Precipitation comes from hourly climate data from the National Land Data Assimilation System (NLDAS-2), aggregated daily.
- LHM provides: Surface water inputs, condensation, and evaporation
- The process-inferred statistical modeling described in Task 5.2 provides groundwater inputs
- Outlet flow will be described in this section, using the stage/discharge rating curves developed in 4.3 for the outlet control dam
- Lake storage is known using the gage height data from the USGS
- Groundwater loss will be estimated using what is known as a "residual mass balance approach" described below.

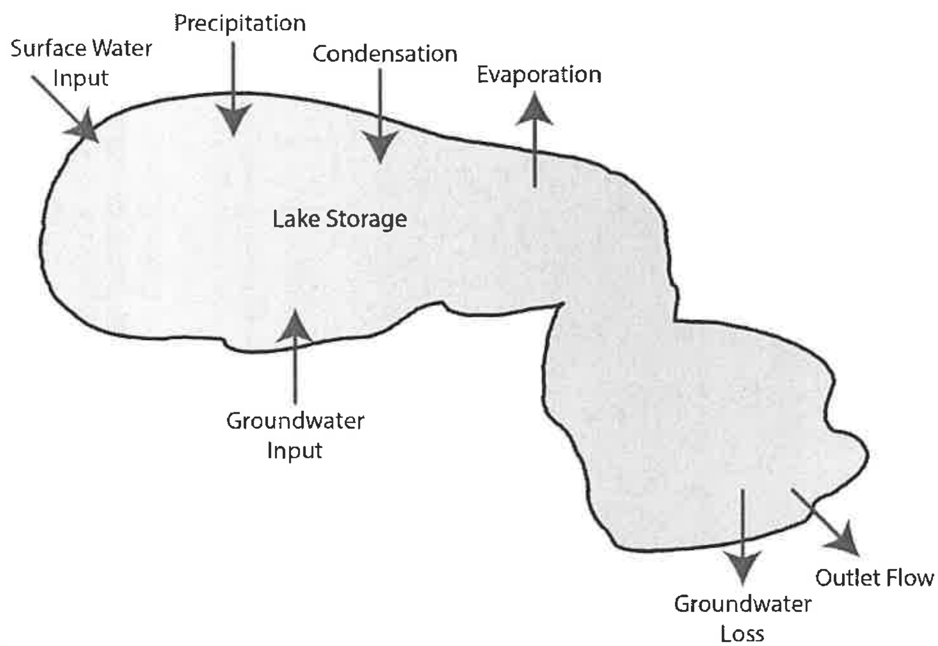


Figure 5.3.1. Conceptual diagram of the mass balance of Higgins Lake.

Represented in equation form, the Higgins Lake Mass Balance is:

$$\Delta S = P + E_{in} - E_{out} + G_{in} - G_{out} \quad + Q_{in} - Q_{out} \qquad \textbf{Equation 1}$$

where: ΔS is Higgins Lake storage, $P$is precipitation, E_{in} is condensation, E_{out} is evaporation, G_{in} is groundwater discharge input to the lake, G_{out} is groundwater loss from the lake, Q_{in} is input streamflow, and Q_{out} is outlet streamflow.

This subtask will first describe the derivation of the outlet stream flow term, then the groundwater loss term. Finally, it will apply these models to simulate change in lake level (storage), and compare this to observed data.

Detailed daily records of Higgins Lake outlet control structure gate configurations have been published in monthly hand-written reports since 2008 and are maintained up to present day. These records describe the open/closed status of the dam's six adjustable gates (flop gates). For this model, three years of those records from 2012 to 2014 were digitized. Those digital records were then used with observed lake elevations during that same period to develop a multinomial logistic regression model that predicts the probability of a particular outcome (all gates closed, 1 open, 2 open, or 3 or more open) versus lake level. Furthermore, separate models were created for the summer (April 15 through October 31st) and winter (November 1st through April 14th) periods. This is because there are separate legally-defined lake level targets for each of these periods, and the dam is managed accordingly.

Figure 5.3.2 plots the winter and summer models. These are somewhat complicated, but are best understood by picking a particular level, and then observing the probabilities of any particular gate configuration being used at that time. For instance, at the two different winter lake levels in use during the 2000-2014 modeling period, the most likely gate configuration is 3 or more open, with probabilities between 72 and 81 percent. As levels drop further, it becomes more likely that only 1 gate would be open. Conversely, during the summer it is far more likely that all gates remain closed, until lake levels are above the legal level, at which point the most likely configuration becomes a single gate open. Very rarely are all three gates open during this period.

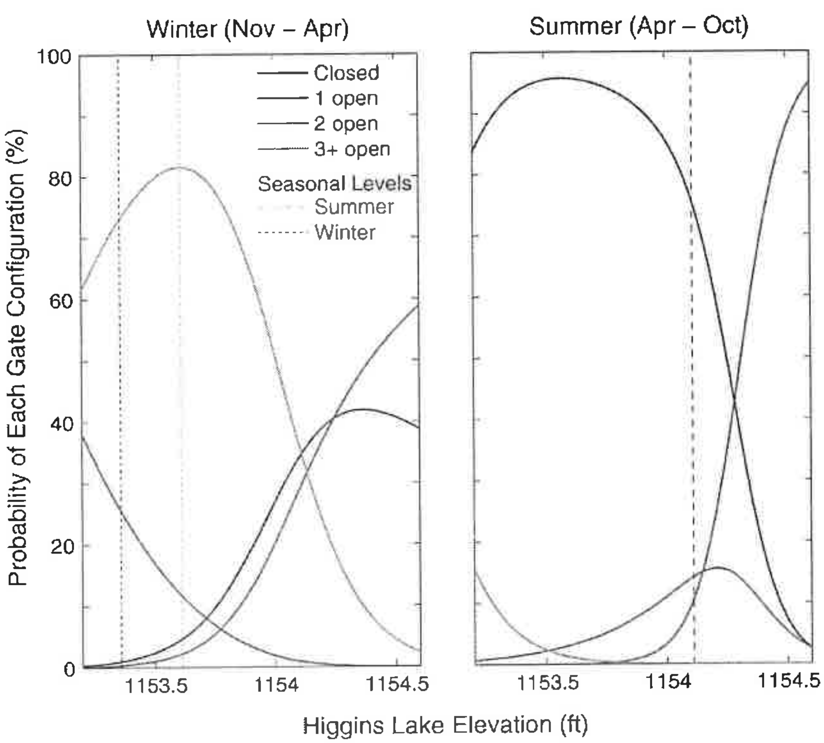


Figure 5.3.2. Plots of the probability of the dam outlet flop gates being in each condition (Closed, 1 gate open, 2 gates open, or 3 or more gates open) versus the lake level on Higgins Lake. Legal lake levels for each season are shown in the corresponding plot, note there are two winter lake levels depending on the year. The Winter and Summer management differs significantly, thus separate models were developed for each season.

Because this model predicts gate configuration with a certain probability, if the model is run 100 times, then 100 different outcomes would occur, though on average the bulk probabilities would match those in Figure 5.3.2. Thus for estimating lake levels and stream outflows, the model was run 100 times in order to better capture the variability in flows/levels that would result from dam management.

The first step in validating this gate configuration model is to compare Cut River outlet streamflow to observed values. This is a two step process: First, observed lake levels for the 2012 - 2014 period and observed gate configurations were used to predict Cut River outflow using the dam configuration rating curves in Figure 4.3.2. These are shown as the red time series in Figure 5.3.3, observed flows at the HL-CR-1 gauge are shown in blue. Second, the observed lake levels from 2000 - 2014 were used with the multinomial logistic regression model to predict gate configurations, which along with the dam rating curves predict outlet discharge. This procedure was repeated 100 times, resulting in the black line (mean) and shaded region (+/- 1 standard deviation) of simulated flow for the entire simulation period.

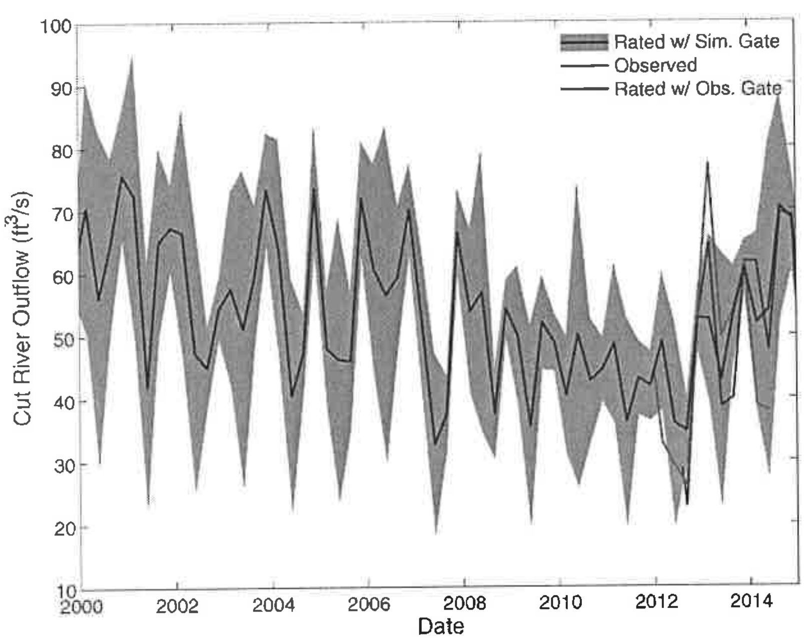


Figure 5.3.3. Plot of seasonal average outflows from Higgins Lake into the Cut River, including observed flows at HL-CR-1 (blue), flows calculated from the dam configuration rating curves above (Figure 4.3.2) and approximately 3 years of digitized dam management records (red), flows calculated using the dam configuration rating curves and a probabilistic simulation of dam gate management (black, with shaded +/-1 standard deviation).

The only remaining unknown quantity in the Higgins Lake Water Balance is then groundwater loss term. This was estimated using a residual mass balance approach. For this, Equation 1 is rearranged:

$$G_{out} = P + E_{in} - E_{out} + G_{in} + Q_{in} - Q_{out} - \Delta S \qquad \textbf{Equation 2}$$

Which allows for groundwater loss to be solved for directly. This approach inherently assumes that the errors across the observed and modeled water balance terms are small. This is, in general, a reasonable assumption. However, groundwater input to Higgins Lake is not directly measurable, and therefore difficult to directly validate. Rather than assuming that this approach yields a direct estimation of groundwater loss, we assume that it also incorporates some error in modeled groundwater input, thus a more accurate representation is:

$$G_{in} - G_{out} = G_{net} = \Delta S - P - E_{in} + E_{out} - Q_{in} + Q_{out} \qquad \textbf{Equation 3}$$

Where G_{net} is net groundwater input to the lake.

Solving for net groundwater input using daily values of the other mass balance terms, and then averaging monthly results in output shown in Figure 5.3.4. This shows that, in general Higgins Lake is a strongly gaining lake from groundwater, but some months it is a net contributor to the groundwater system. Thus the lake is best seen as a groundwater flow through lake.

Physically, this is a reasonable conclusion, given the surface and ground watersheds shown in Figure 1.6.5. The groundwater and surface water sheds of the southeast portion of Higgins Lake extend essentially no further than the lake itself, thus this is very likely a groundwater outflow location.

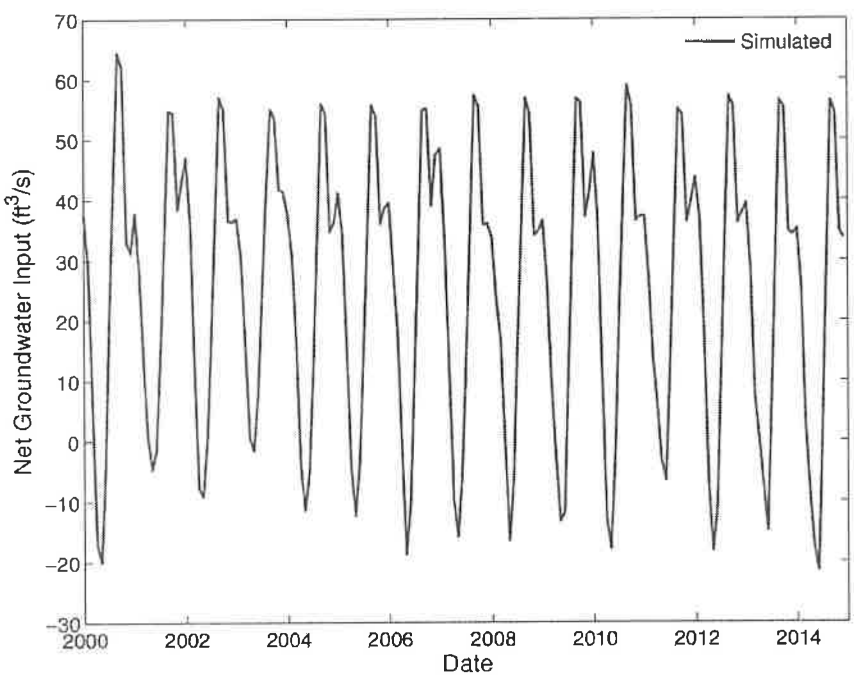


Figure 5.3.4. Simulated net (input - output) groundwater input for the model period 2000 - 2014.

Looking at the simulated net groundwater input on a monthly average basis shows an interesting seasonal cycle (Figure 5.3.5), where from March through May the lake likely contributes water to the regional groundwater system. For the rest of the year, particularly during high evaporation periods in September - October, the lake is strongly gaining on the whole. The lake also gains significantly during the winter.

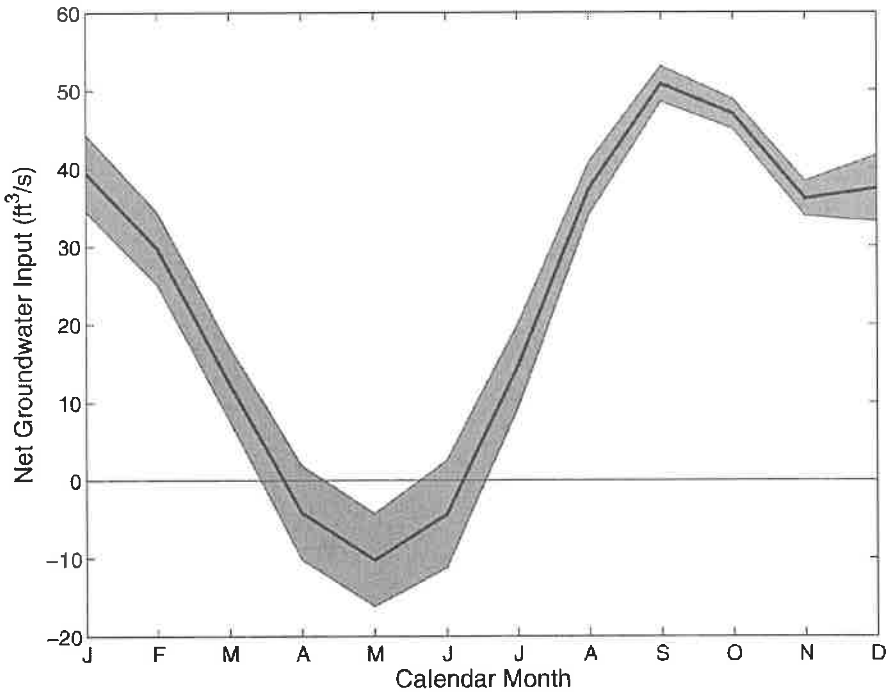


Figure 5.3.5. Simulated monthly net (input - output) groundwater input averaged over the model period 2000 - 2014. The shaded region indicates +/-1 standard deviation in monthly input.

With all terms of the lake mass balance known, we can return to Equation 1, and use the model to predict change in storage (lake level) in Higgins Lake, and compare the model's behavior to observed lake levels. The model simulates daily changes in lake level, based on the inputs from LHM and climate, then simulates statistical dam configuration using the models developed in this section, which provides a dynamic outlet flow response. The model was run 100 times to better capture the probabilistic behavior of dam management. The output of this is shown in Figure 5.3.6.

In general, the model does a good job of capturing lake level dynamics, some years matching behavior very well, while in others the peak and trough levels are not accurately matched. For the 2000 - 2014 period, the model had a mean absolute error of 1.61 inches in level, and an R^2 of 50%, with a Nash Sutcliffe Efficiency of 0.36. Overall, this is a good model with significant predictive power.

Since the model was calibrated to dam management during a period of lower winter lake level targets (as this was the only digital management data available), it is likely to underpredict winter levels. However, the model still provided good results in general.

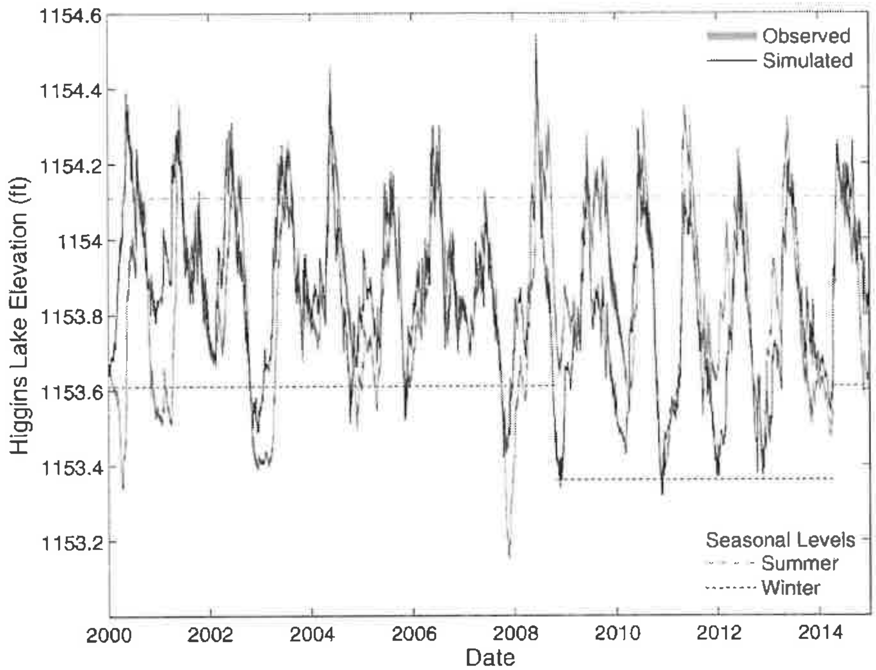


Figure 5.3.6. Plot of simulated and observed Higgins Lake elevations in feet for the period 2000 - 2014. Barely visible are the +/- 1 standard deviation of simulated levels for the 100 simulation runs.

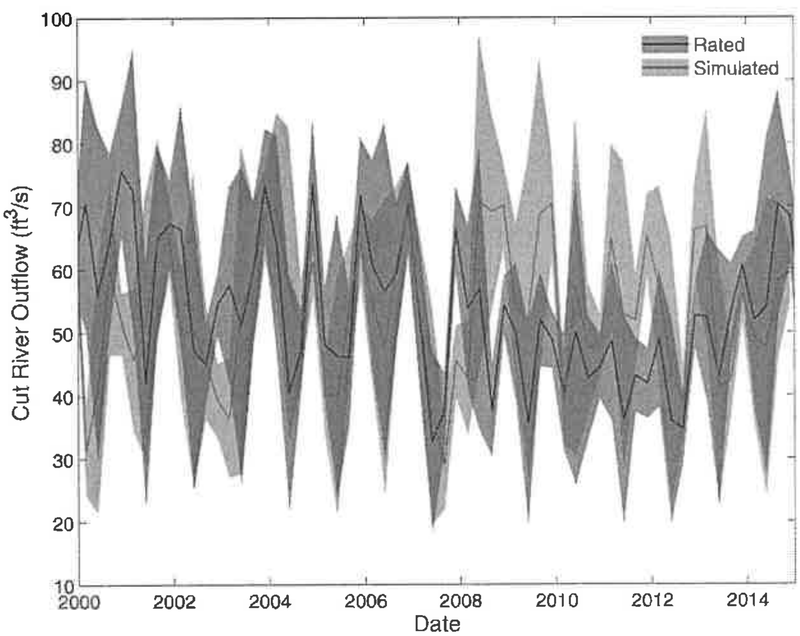


Figure 5.3.7. Plot of seasonal Cut River outflows from Higgins Lake using the dam configuration rating curves and the dam management model (Rated) along with outflow predicted using simulated lake levels and the dam management model (Simulated).

Finally, given the simulated lake levels, dynamically predicted outflows were plotted against outflows predicted using observed lake levels (Figure 5.3.7). In general, the models agree within a single standard deviation in monthly outflows. However, some years, 2008-2009 in particular, the dynamic lake level model overpredicts Cut River outflows.

5.4: Evaluation of Lake Level Scenarios with Mass Balance Model

The full suite of models can then be applied to simulate Higgins Lake levels in response to altered dam management, or hypothetically speaking dam removal. This section investigates two such change scenarios, in which: 1) the dam is left fully open at all times, but remains in place, and 2) where the dam is removed. The first scenario is evaluated by foregoing the dam management model and setting the gate configuration as all open. The second scenario removes both the dam management model and the dam configuration rating curves, and represents Higgins Lake outflows using the HEC-RAS outputs shown in Figure 5.1.4.

These scenarios are overlain with the current management simulation in Figure 5.4.1. As expected, simulated levels are lower for both scenarios, with peaks not reaching the same elevations, and troughs lower than under current management. However, it is also clear that the change in levels is not as large as was expected during the initial development of the lake level scenarios. Because the sill of the the outlet control structure is approximately 18 inches below legal lake level, we originally assumed that this would be the level to which summer lake levels could reach, however this never occurred. Nor did the 20 inch lowering which we considered possible with dam removal occur in our simulated scenarios.

Figure 5.4.2 plots the monthly differences between the two alternate scenarios and current lake level management. In general, the always open scenario oscillates between 6.5 and 0.5 inches below current levels on an annual basis, while the no dam scenario exhibits roughly the same pattern, but between 10 and 4 inches below current levels. The no dam scenario shows a greater degree of variability in differences from current.

Figure 5.4.3 plots the daily lake levels as a probability of occurrence, with winter and summer levels split out separately. Somewhat surprisingly, winter levels are not strongly impacted by the dam open scenario, but are more affected in the no dam scenario. Summer levels show that the dam always open scenario results in about the same lowering relative to current management as does the dam removal relative to the dam open scenario. The lowest lake level in all scenarios was approximately 18 inches below the current legal summer level, and had a very low probability of occurrence < 1%. Thus, the 18 inch drop scenarios considered in Task 2.3 should be considered highly improbable for the summer, and the 20 inch drop essentially not possible.

In fact, this model likely overstates the lower levels because it does not dynamically adjust for the increases in groundwater inputs that would occur with lower groundwater levels. As lake levels decline so would groundwater loss, and groundwater gain would increase, thus the estimates shown here should be considered pessimistic in terms of lake level declines for these scenarios.

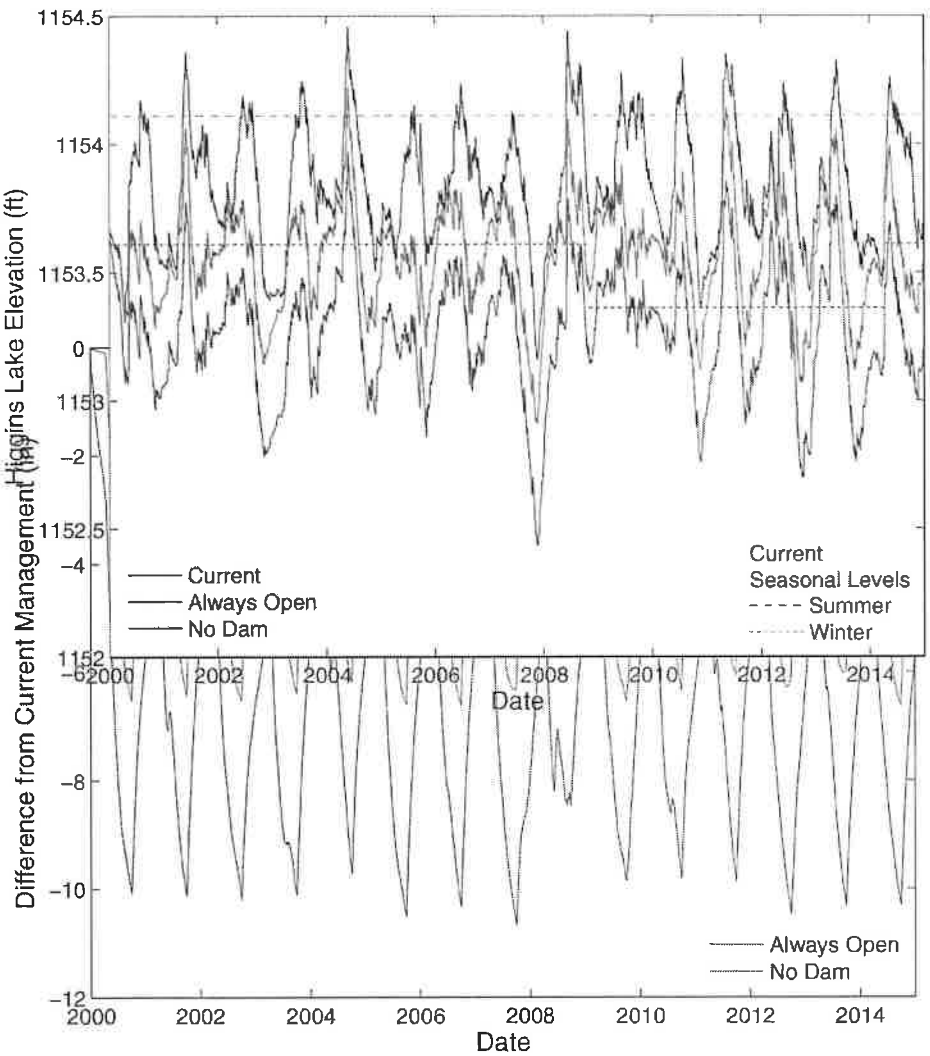


Figure 5.4.1. Plot of daily lake levels simulated by the Higgins Lake Water Balance model for the simulation period 2000-2014. Three scenarios are shown: 1) Current management of the dam, 2) Leaving the dam fully open at all times, and 3) Removing the dam.

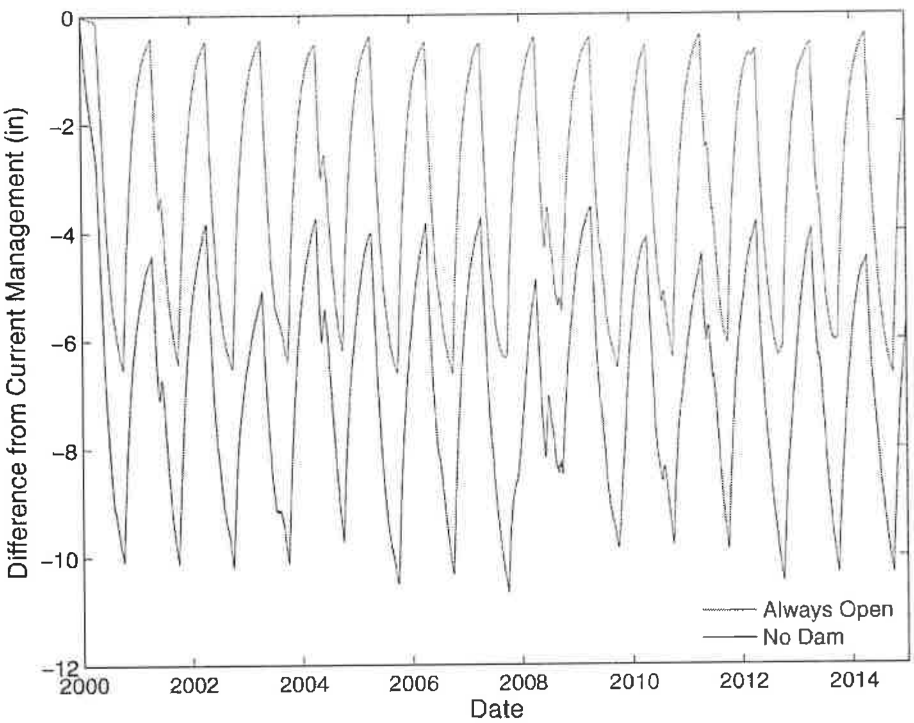


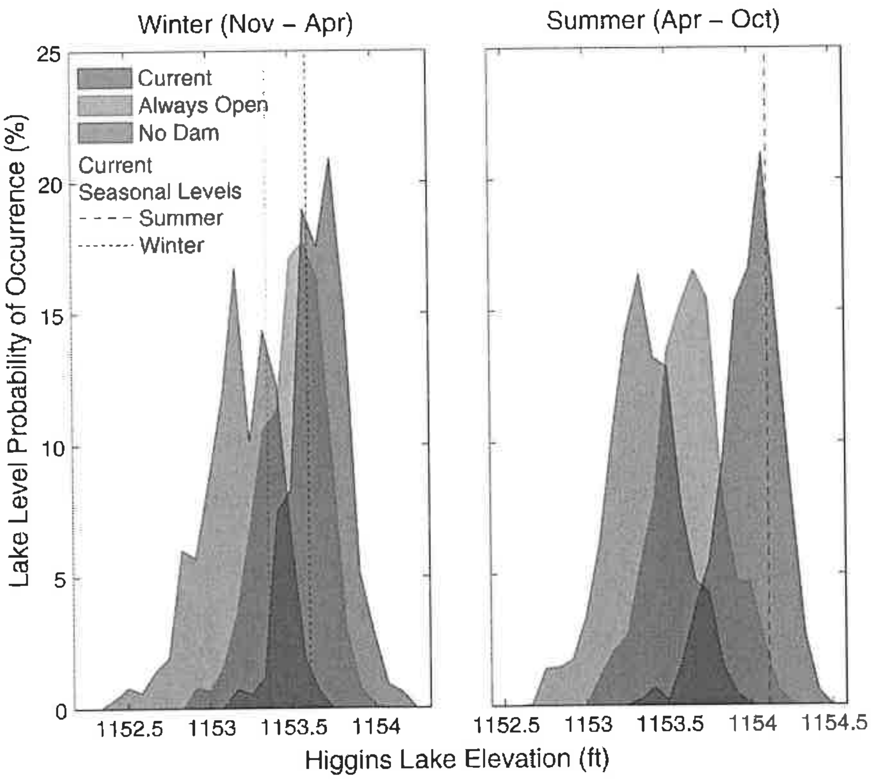
Figure 5.4.2. Plot of the monthly differences between current dam management and the two alternate dam scenarios, in inches.

Perhaps most importantly for recreational and ecological lake uses, the mean summer and winter lake level changes for the two scenarios are shown relative to current management in Table 5.4.1. During winter, levels were an average of 2.4 inches lower in the always open scenario, and 6 inches lower in the no dam scenario. During summer, levels were on average 4.8 inches lower in the always open scenario, and 8.4 inches lower in the no dam scenario. As was mentioned above in Task 2.3, this is why these two scenarios were chosen to present the spatial impacts of lake level changes on intermediate dock length, and final shoreline position.

Table 5.4.1. Average (mean) lake levels during the summer and winter periods for each of the three simulated lake level scenarios. Units are in feet of elevation.

Dam Scenario	Winter (elev. ft)	Summer (elev. ft)
Current	1153.7	1154.0
Always Open	1153.5 (2.4 inches lower)	1153.6 (4.8 inches lower)
No Dam	1153.2 (6 inches lower)	1153.3 (8.4 inches lower)

Figure 5.4.3. Histograms of summer and winter lake levels averaged across the 2000 - 2014 daily water balance model for each of the three dam management scenarios. Both winter legal levels are plotted in dotted vertical lines, and the summer in dashed vertical. Histogram bins are 1 inch, thus the vertical axis can be used to infer the probability of each 1-inch bin occurring under each scenario.



Altering dam management will also impact flows on the Cut River, which are plotted as histograms of daily values in the summer and winter separately in Figure 5.4.4. Note that the two dam management change scenarios have essentially the same probabilities, which is expected because the level of the outlet within such a small margin has little impact on flows--only active management will create seasonal storage. Indeed, the summer flows under the unmanaged scenarios are significantly higher, approximately 25 cubic feet per second, whereas winter flows are lower by a somewhat smaller margin.

Critically from an ecological perspective, the unmanaged dam scenarios keep flows within a 50 cfs target range for most of the year, which is highlighted in the ecological impacts report on Task 6.

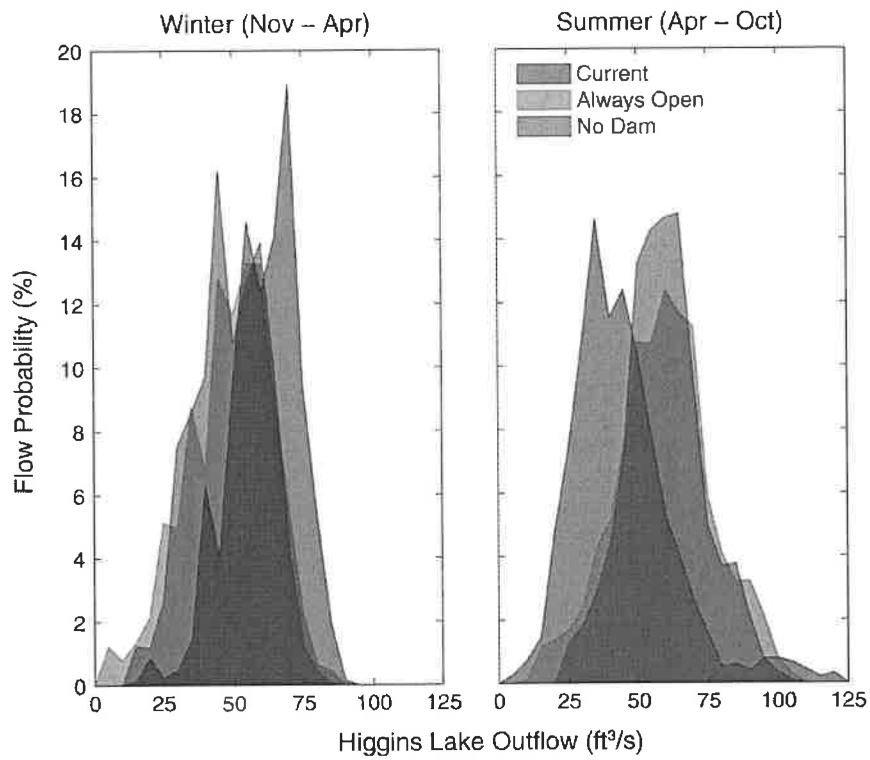


Figure 5.4.4. Histograms of summer and winter Higgins Lake Outflow through the Cut River for the three scenarios. Histogram bins are 5 cubic feet per second, thus the vertical axis can be used to infer the probability of each 5-cfs bin occurring under each scenario.

Task 5 Findings Summarized

- A suite of hydraulic (HEC-RAS), hydrologic (LHM), and statistical models (groundwater input and dam management) were used to calculate the terms of a dynamic lake level model.
- This lake level model produced reasonable daily estimates of Higgins Lake levels, within 1.6 inches of the actual observed level on average.
- Two scenarios, in which the dam is left open at all times, and where the dam is theoretically removed, were investigated with the dynamic lake level model.
- Mean changes in summer lake levels were 4.8 inches lower for the always open scenario, and 8.4 inches lower for the no dam scenario.
- These level changes are much smaller than would be expected assuming that the lake would drop to the lowest elevation of the current dam (18 inches below current summer level), or the lake outlet bottom (20 inches below current summer level).
- This dynamic lake level model likely over predicts level declines, due to the lack of a feedback with the groundwater system that would occur in reality.
- The level drop scenarios with changes greater than 9 inches thus represent increasingly unlikely scenarios, with essentially no chance of the 18 or 20 inch drop scenarios occurring.
- Cut River outflows from Higgins Lake are enhanced during the summer in the unmanaged scenarios, reaching 50 cfs for most of the summer (and winter as well).

Task 7: Survey of Higgins Lake Landowner Concerns

In this task we briefly summarize the results from a local residents survey conducted by Huron Pines, a project partner. The survey lists the top 5 concerns of respondents coded into 12 categories. Notably, boating, beach use, and water quality were the top three concerns of respondents.

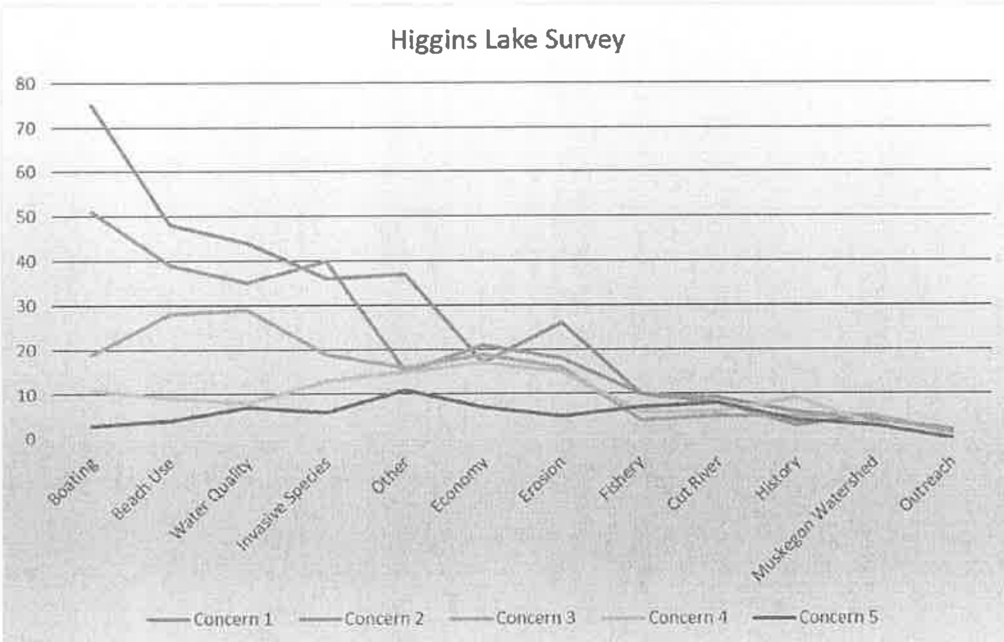


Figure 7.1. Plot of survey responses grouped into broadly-defined categories. Numbers of responders indicating each category is plotted, line colors denote the order of concern listed, from most important (Concern 1) to least important (Concern 5).

Conclusions

The key findings from each of the Tasks 1-5 are detailed in subsections above. Most significant among them are that:

- A state-of-the-art hydrologic study has been completed that provides Higgins Lake area residents, dam managers, and state regulators with an unprecedented view of the lake.
- No credible evidence of significantly lower lake levels or outlet position/configurations in recent (post-settlement) history was found
- Strong evidence for active shoreline erosion was observed at many locations around the lake.
- This study produced a series of outputs that will benefit managers, conservation groups, residents, and researchers.
- The new bathymetric map produced by this study provides the detail needed to assess potential changes in shoreline, dredging, and dock lengths due to lake level changes
- The first continuous multi-year and longitudinal flow datasets have been collected for the Cut River, which highlight:
    - The role of Higgins Lake in maintaining flows on the Cut River, and
    - The relatively minor role that management of the control structure at the outlet of Higgins Lake plays in determining Houghton Lake inputs downstream, except in short periods when gates are opened.
- Dynamic lake level modeling has shown that even with drastically altered dam management, or even fully removing the dam, lake levels are unlikely to drop more than 9 inches on average during summer months.
- Scenarios in which the dam is either left open or removed lead to higher summer outflows and somewhat lower winter outflows, which may be of ecological importance (see Task 6 report).

References

Kraus, N. C. 1988 "The effects of seawalls on the beach: an extended literature review." *Journal of Coastal Research* Special Issue No. 4, p 1-28.

Kriesel, W., and Friedman, R., 2003, "Coping with coastal erosion—Evidence for community-wide impacts", *Shore and Beach*, v. 71, no. 3, p. 19–23.

Phillips, B., and Rasid, H., 1996, "Impact of Lake Level Regulation on Shoreline Erosion and Shore Property Hazards: The Binational Case Experience of Lake of The Woods", *The Great Lakes Geographer*, v. 3, no.2, p. 11-28.

Appendix A

Cumulative Probability of Outflow During Summer, Table

Flow(cfs)	Prob_Curr(%)	Prob_Open(%)	Prob_NoDam(%)
5	0.235294	0	0
10	1.01961	0.117647	0
15	2.54902	1.2549	0
20	7.17647	2.62745	0
25	14.2745	4.31373	1.29412
30	25.9608	6.70588	3.13725
35	40.1176	10.9804	6
40	51.7255	16.0784	10.4314
45	62.902	23.6863	17.7255
50	74.3137	34.4314	30.9412
55	82.2353	45.1373	45.2157
60	87.2157	57.5294	59.8824
65	91.2941	69.1765	74.6667
70	93.8431	80.4314	84.3137
75	95.098	86.3137	89.2941
80	95.9608	90.3922	92.9804
85	96.5098	93.6078	96.7451
90	96.9412	96.8235	98.8235
95	97.6863	98.9412	99.5686
100	98.1569	99.7255	99.9216
105	99.0196	100	100
110	99.5294	100	100
115	99.7255	100	100

120	100	100	100

Appendix B

Cumulative Probability of Outflow During Winter, Table

Flow(cfs)	Prob_Curr(%)	Prob_Open(%)	Prob_NoDam(%)
5	0	1.22909	0
10	0	2.01434	0
15	0.273131	3.34585	1.22909
20	0.990099	5.49676	2.42404
25	1.26323	10.618	5.08706
30	1.67293	15.5685	12.5982
35	3.10686	24.3428	21.1676
40	9.49129	31.1369	30.8638
45	13.3834	43.9399	47.0809
50	23.0113	55.6163	57.8354
55	37.2482	68.9314	70.6043
60	50.2561	82.1782	84.534
65	64.6637	91.2598	94.1618
70	82.7586	96.6541	98.3271
75	92.1475	98.8733	99.522
80	97.6784	99.522	99.9659
85	99.8976	99.9659	100
90	100	100	100
95	100	100	100
100	100	100	100

105	100	100	100
110	100	100	100
115	100	100	100
120	100	100	100

Appendix C

Cumulative Probability of Lake Levels During Summer, Table

Level(ft)	Prob_Curr(%)	Prob_Open(%)	Prob_NoDam(%)
1152.5	0	0	0
1152.58	0	0	0
1152.67	0	0	0.588235
1152.75	0	0	2.11765
1152.83	0	0	3.52941
1152.92	0	0	6.19608
1153	0	0.392157	10.4706
1153.08	0	2.27451	18.0392
1153.17	0	4.23529	31.6078
1153.25	0	7.92157	46.0784
1153.33	0.27451	14	60.6275
1153.42	1.01961	24.6667	75.4118
1153.5	1.41176	39.4118	85.6078
1153.58	4.86275	55.5686	91.4902
1153.67	9.21569	71.4118	96.1176
1153.75	15.4118	84.4706	99.0196
1153.83	27.1373	90.2353	99.7255

1153.92	45.5686	94.9804	100
1154	62.5882	98.1961	100
1154.08	82.3137	99.8039	100
1154.17	93.451	100	100
1154.25	98.549	100	100
1154.33	99.6863	100	100
1154.42	100	100	100
1154.5	100	100	100

Appendix D

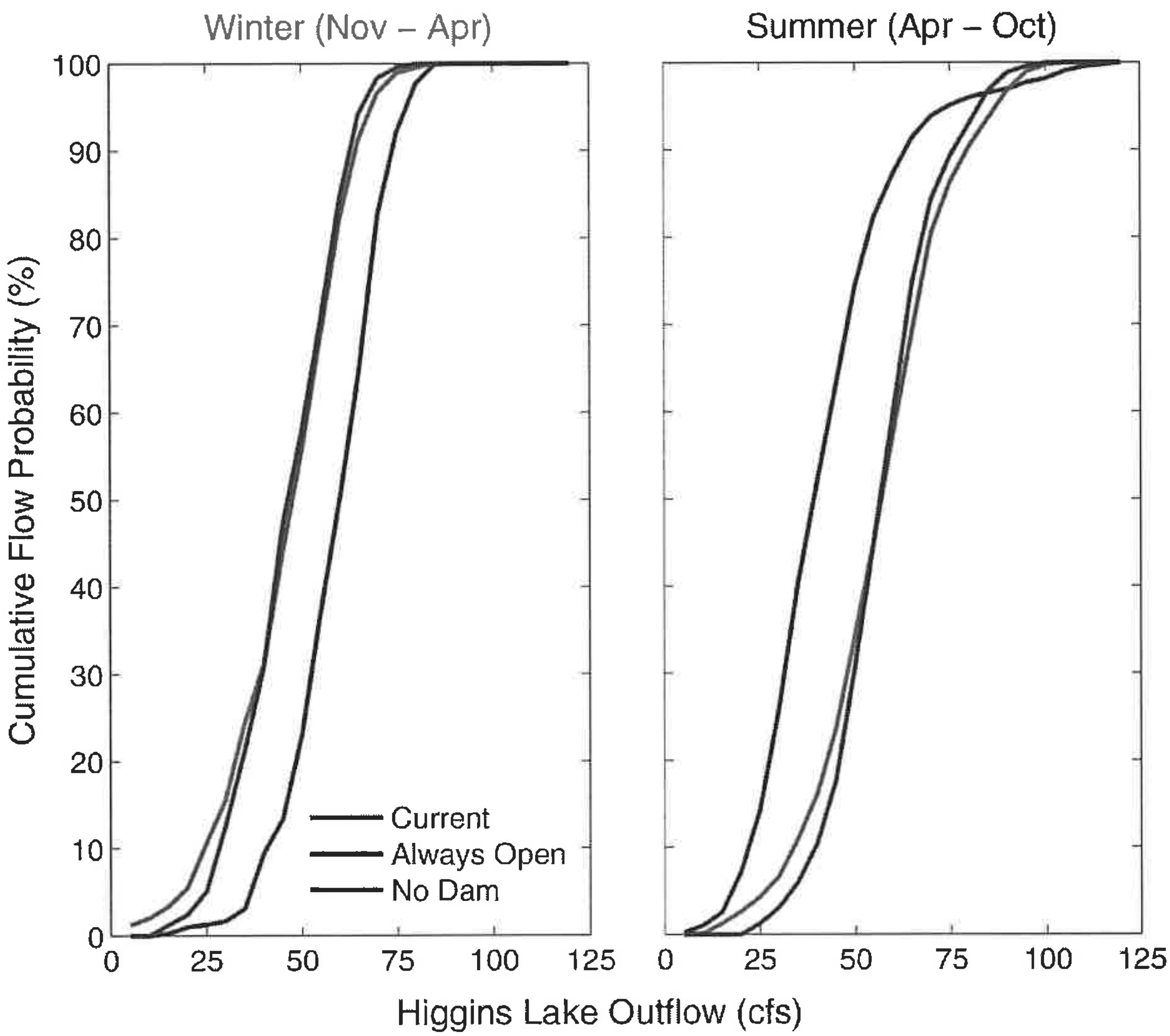
Cumulative Probability of Lake Levels During Winter, Table

Level(ft)	Prob_Curr(%)	Prob_Open(%)	Prob_NoDam(%)
1152.25	0	0	0
1152.33	0	0	0
1152.42	0	0	0.955958
1152.5	0	0	1.33151
1152.58	0	0	2.18505
1152.67	0	0	3.51656
1152.75	0	0	8.02322
1152.83	0	0.238989	12.9737
1152.92	0	1.12666	20.5531
1153	0	2.25333	30.4882
1153.08	0.170707	4.30181	46.8078
1153.17	1.02424	10.2424	57.5964
1153.25	1.70707	16.7293	71.1506

1153.33	5.90645	28.4397	85.0461
1153.42	12.564	44.3837	94.6398
1153.5	26.3913	62.0348	98.4978
1153.58	46.5005	79.72	99.8293
1153.67	63.4005	92.8645	100
1153.75	84.9778	98.0881	100
1153.83	93.24	99.522	100
1153.92	97.3028	100	100
1154	98.8392	100	100
1154.08	99.5903	100	100
1154.17	100	100	100
1154.25	100	100	100

Appendix E

Cumulative Probability of Outflow Figure



Appendix F

Cumulative Probability of Lake Level Figure

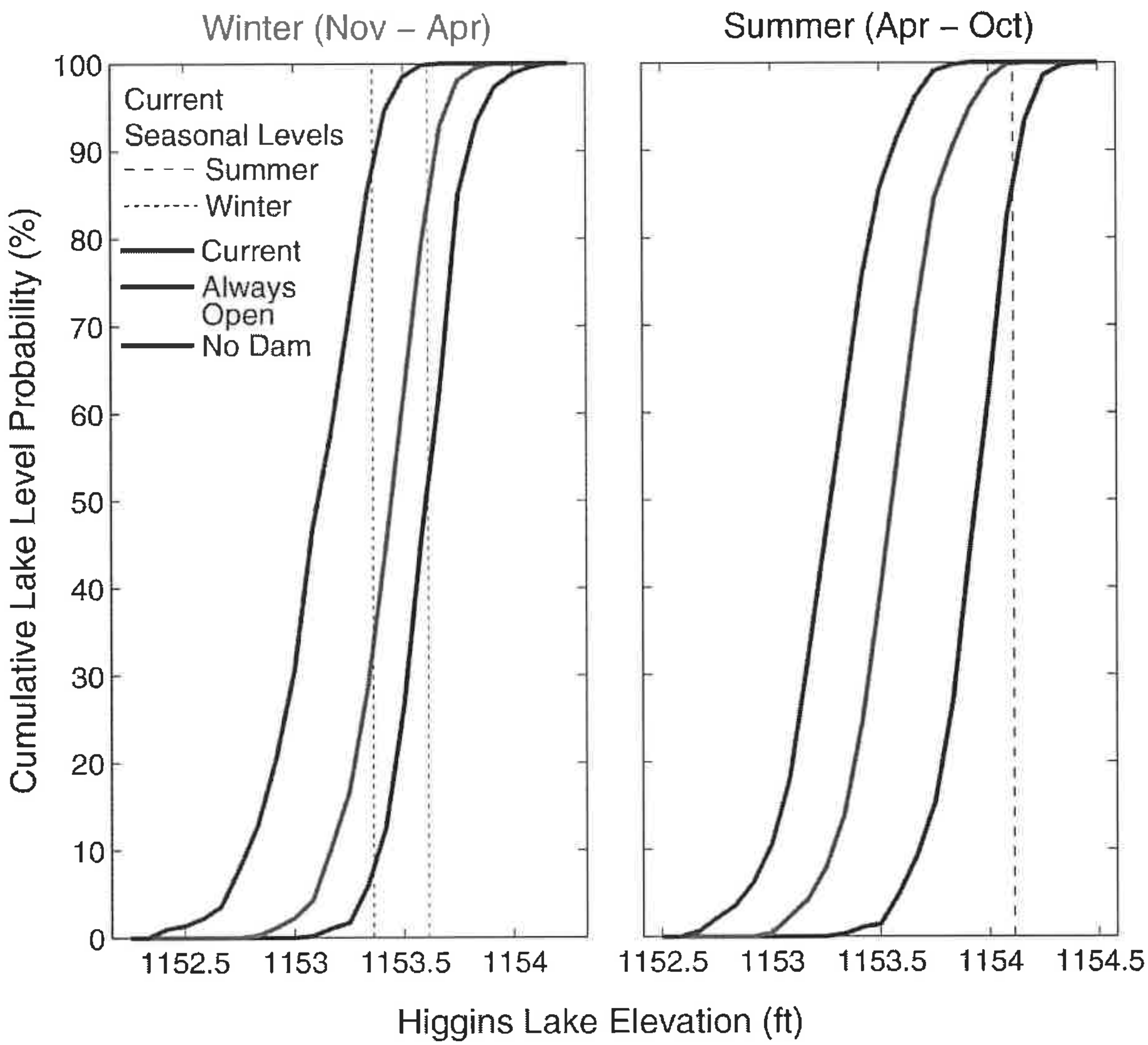


EXHIBIT 13

DNR

Department of Natural Resources, Fisheries Division

Higgins Lake Dam Study File Notes
Richard O'Neal, March 8, 2017

Purpose: Higgins Lake Fisheries Division summary notes of the study: Ecohydrological evaluation of removing the Higgins Lake-Level control structure.

This study was a joint effort between the Higgins Lake Property Owners Association, the Higgins Lake Foundation and DNR Fisheries Division. Funding was provided through the Consumers Energy Habitat Improvement Account (managed by Fisheries Division) and the Higgins Lake Foundation. The study was designed by a collaboration of Michigan State University, the University of Michigan, the Muskegon River Watershed Assembly, Huron Pines, the Higgins Lake Foundation, the Higgins Lake Property Owners Association and Fisheries Division. The University of Michigan provided the final fishery habitat analyses (Wiley and Layman 2015) and Michigan State University provided analyses for the other parts of the study (Kendall et al. 2016).

The primary interests by Fisheries Division were the potential effects the dam was having on fisheries habitat in Higgins Lake and the Cut River. These concerns included the historical manipulation of flows in the Cut River that included complete stoppage of flows to excessive high flows, and the effects of vegetative habitat in Higgins Lake. Property owners on the lake were concerned with excessive shore erosion that was documented through photographs collected over a number of years. Shoreline erosion rates had continued to increase as lake levels continued to increase above the legal established lake levels.

The purpose of the proposed study was to evaluate the likely effects of removing the control structure (returning the lake levels to their "natural" condition) on Higgins Lake and the Cut River system; including surface water levels, shore-line characteristics and erosion, and fishery-related habitat. Various other lake levels were also evaluated. The intent was to provide information to stakeholders regarding the influence of the hydrologic connection between Higgins Lake and the Cut River on: lake and stream water levels, seasonal level fluctuations, beach areas and bank erosion, boating and boat dockage, aquatic plant distributions, areas of gravel bottom, and other fishery-relevant habitat and characteristics. As a part of this study, the Huron Pines group conducted a survey of stakeholders to determine if they had other concerns that need to be evaluated. The information from this study will be used as a basis for stakeholder discussions regarding lake-level management and restoration of natural hydrologic conditions to Higgins Lake and the Cut River. The University of Michigan focused primarily on fishery habitat evaluations and worked jointly with Michigan State University on data collection.

The court established lake level for Higgins Lake is 1154.11 above mean sea level on April 15, and is to be lowered to 1153.612 feet above mean sea level on or about November 1. During 2009 – 2013/2014, the winter level was set at 1153.36 feet above mean sea level.

Study Results

The results of the study indicated that lake level management does not have significant effects on fishery habitat in Higgins Lake but does have significant effects on shoreline erosion. Lake-level manipulations have significant effects on fisheries habitat in the Cut River.

Figures 1-4 provide probability information from the study for Cut River flows and lake levels in Higgins Lake that will be referenced in this summary (Data from Appendices A-D in Kendall et.al 2016). Table 1 provides lake level information used in the study. The "No Dam" scenario best indicates flow and lake level probability under natural conditions.

The study results indicate that flows of 100-150 cfs are necessary to provide optimal habitat for fish in the Cut River (Figure 5). Flows of 50 cfs are a target flow rate to protect Cut River fisheries and cannot be achieved when all dam gates are closed (Figure 6). Flows of 50 cfs during summer have a much greater likelihood of occurring in the unmanaged dam scenarios (No dam and Gates 4-6 open, Table 2). A summer flow of 33cfs is likely to be exceeded 95% of the time under natural conditions, 90% of the time with Gates 4-6 open, and 63% of the time under current operation. Note that with the 4.75 ft low flow opening in the dam, Cut River flows are lower than recommended under current operation. Presently, the low flow opening is not large enough to consistently provide even 33cfs (the 95% natural flow).

Flows of 50 cfs during winter have a greater likelihood of occurring under current operation than in the managed dam scenario (Table 2). A winter flow of 25 cfs is likely to be exceeded 95% of the time under natural conditions, 90% of the time with Gates 4-6 open, and 99% of the time under current operation.

The probability of achieving the established summer lake level (1154.11 feet) is 15% under current operation and 0% for the unmanaged dam scenarios (Table 2). The probability of achieving an established summer lake level 100% of the time under current operation would occur at 1153.28 feet (SLL-10), and at lower levels (1152.92, SLL-14.3) for the unmanaged dam scenarios. Additional study information regarding lake levels are provided in Tables 3 & 4.

Other issues to address include:

- Drying of the stream bed and excessive high flows with dam gate manipulations, especially in the one mile section of the Cut River upstream of Marl Lake.
- The reason for maintaining a winter lake level.
- Climate warming and evaporation rates (currently 110-210 cfs/day, 0.01 – 0.1 inches/day) and groundwater inputs (110-219cfs/day).

Literature Cited

Kendall, D. K., B. M. Budd and D. W. Hyndman. 2016. Ecohydrologic evaluation of removing the Higgins Lake-Level control structure. Michigan State University, Lansing, Michigan.

Wiley, M. J., and A. J. Layman. 2015. Ecohydrologic evaluation of removing the Higgins Lake-Level control structure, Study Job Part D6: Habitat modeling to examine fishery related impacts. University of Michgan, Ann Arbor, Michigan

Figure 1. Cut River cumulative flow probabilities for summer. Curves represent estimated flows (data from Appendix A in Kendall et al. 2016) under current dam operation, with all gates open (includes radial gates 4, 5, and 6), and with the dam structure removed. Summer flows have the probability of meeting or exceeding 50 cfs this percentage of the time: current operation = 26%, radial always gates open = 66%, and with no dam = 69%. Summer flows have the probability of exceeding these levels 90% of the time: Current operation = 22 cfs, radial always gates open = 34 cfs, and with no dam = 40 cfs. Summer flows have the probability of exceeding these levels 95% of the time: Current operation = 18 cfs, radial always gates open = 26 cfs, and with no dam = 33 cfs.

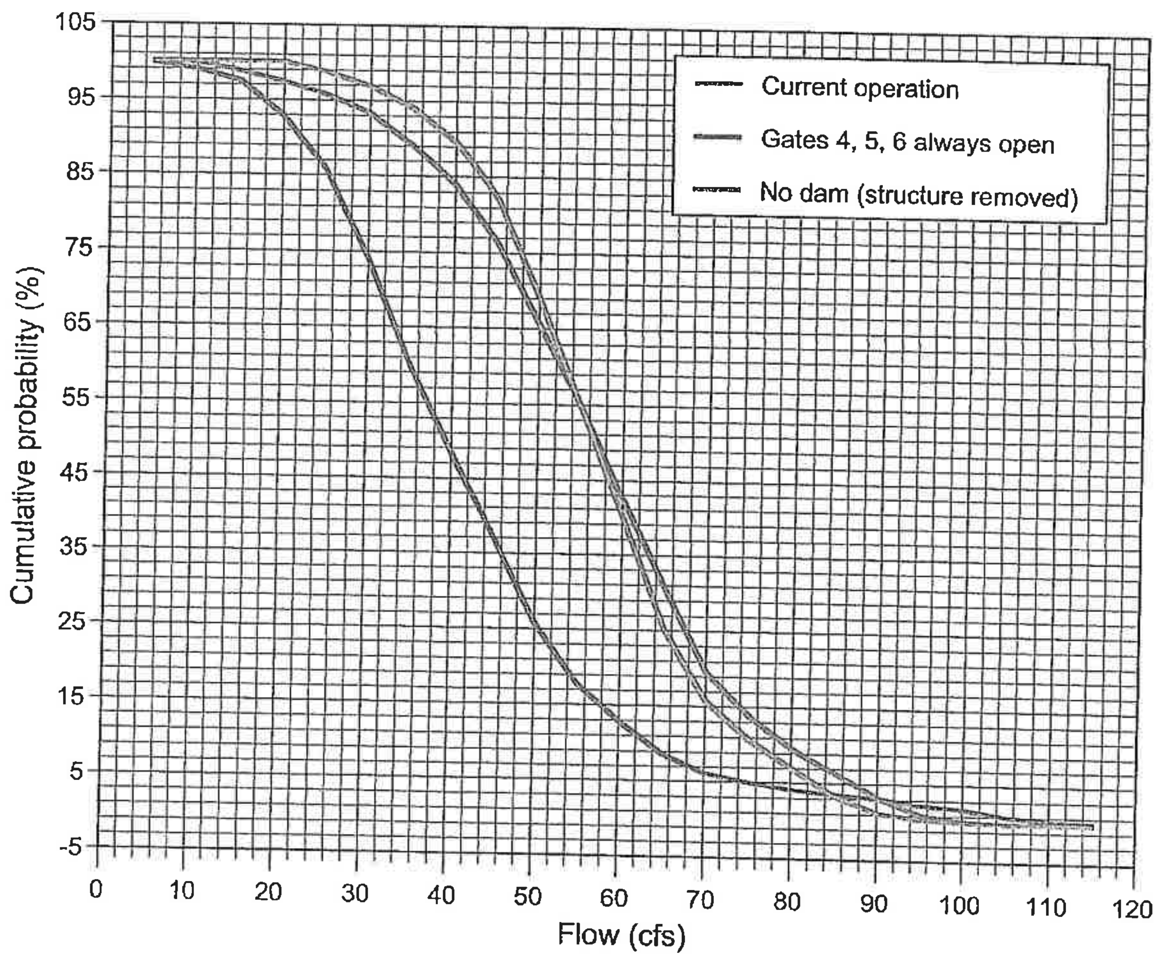


Figure 2. Cut River cumulative flow probabilities for winter. Curves represent estimated flows (data from Appendix B in Kendall et al. 2016) under current dam operation, with all gates open (includes radial gates 4, 5, and 6), and with the dam structure removed. Winter flows have the probability of meeting or exceeding 50 cfs this percentage of the time: current operation = 77%, radial always gates open = 44%, and with no dam = 42%. Winter flows have the probability of exceeding these levels 90% of the time: current operation = 41 cfs, radial always gates open = 24 cfs, and with no dam = 28 cfs. Winter flows have the probability of exceeding these levels 95% of the time: current operation = 37 cfs, radial always gates open = 20 cfs, and with no dam = 25 cfs.

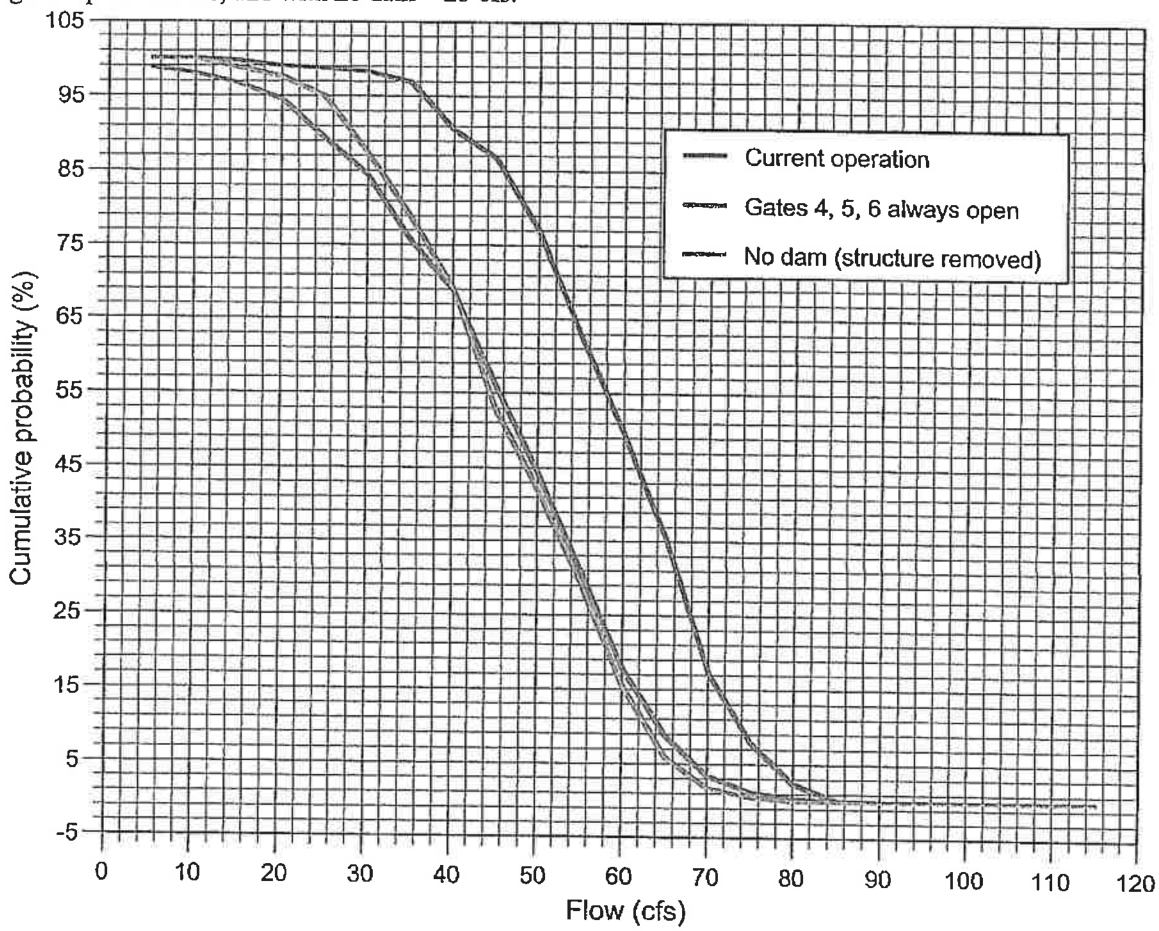


Figure 3. Higgins Lake cumulative lake level probabilities for summer. Curves represent estimated lake levels (data from Appendix C in Kendall et al. 2016) under current dam operation, with all gates open (includes radial gates 4, 5, and 6), and with the dam structure removed.

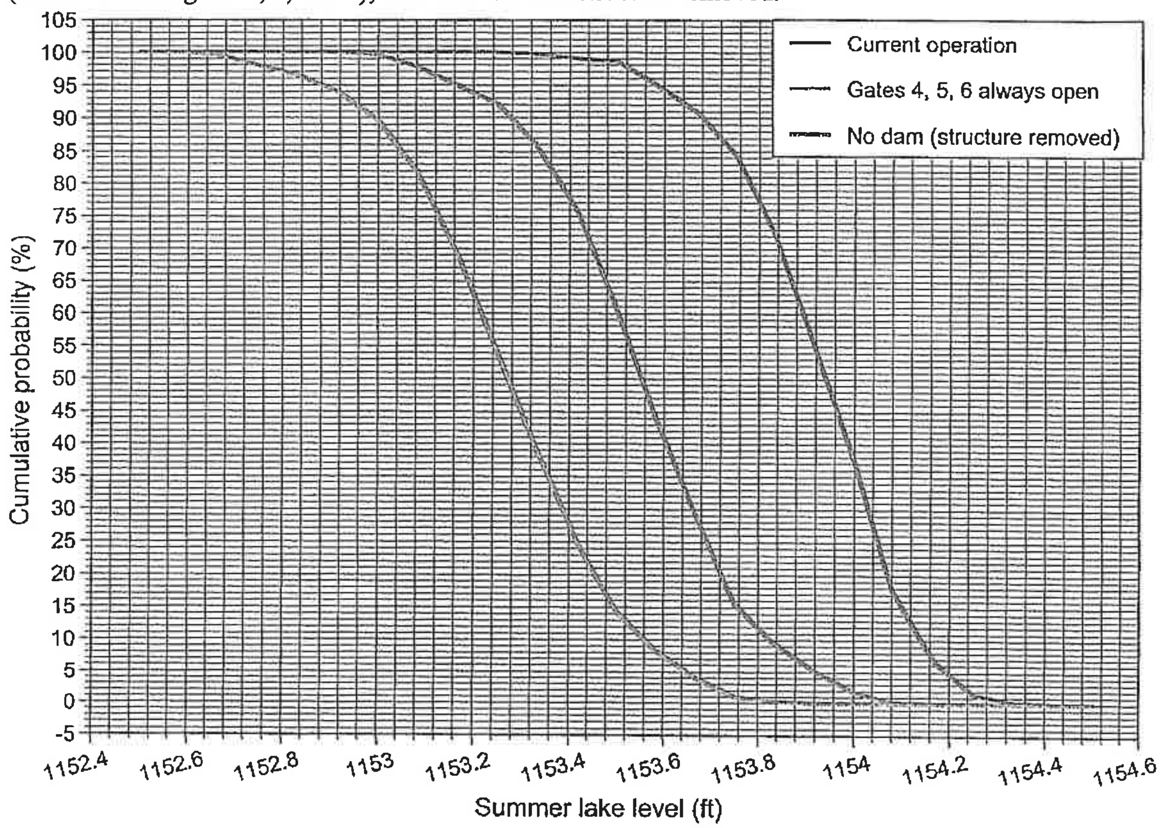


Figure 4. Higgins Lake cumulative lake level probabilities for winter. Curves represent estimated lake levels (data from Appendix D in Kendall et al. 2016) under current dam operation, with all gates open (includes radial gates 4, 5, and 6), and with the dam structure removed.

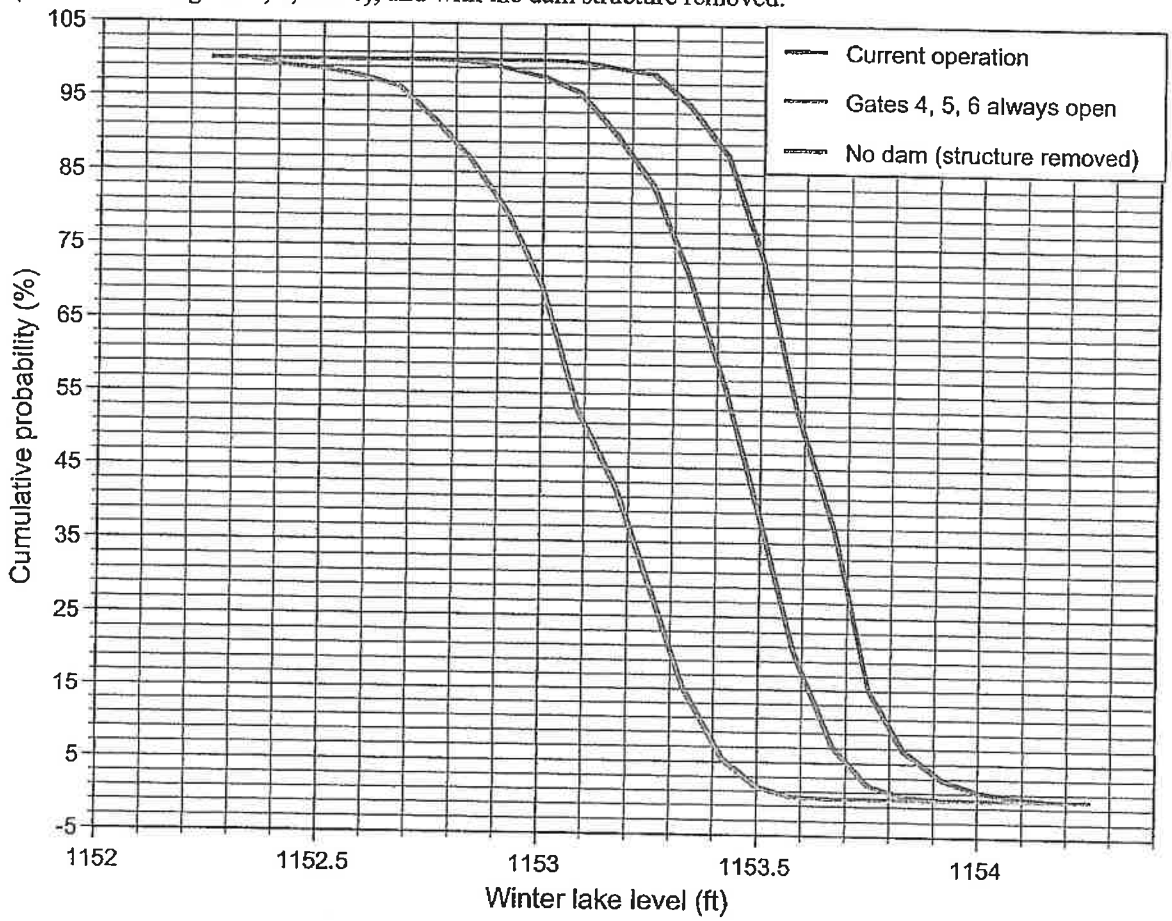


Figure 5. Average Cut River fish habitat response curves (from Wiley and Layman 2015).

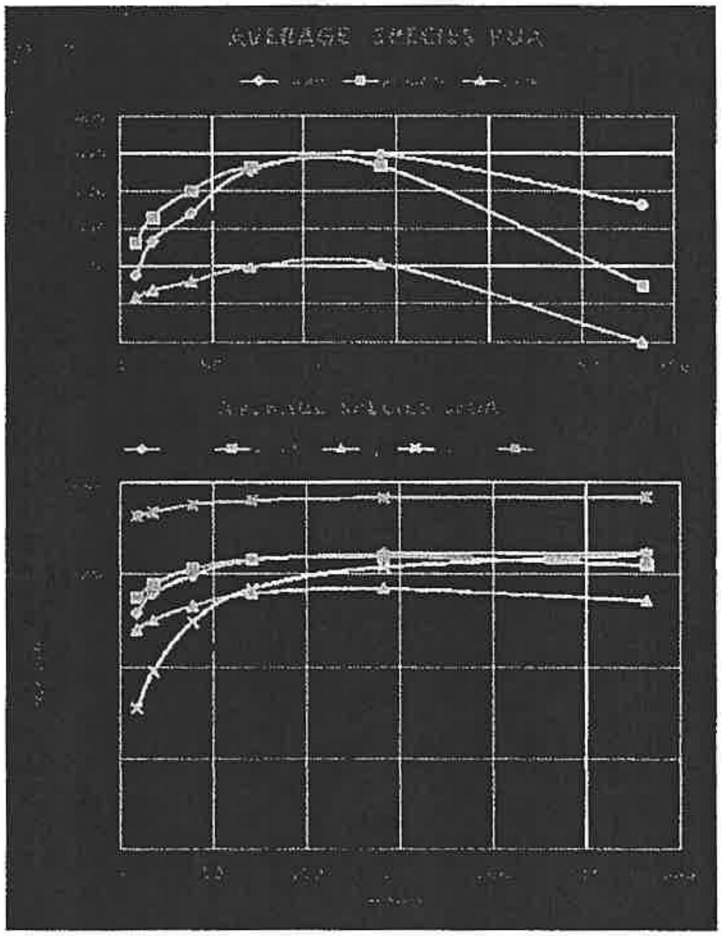


Figure 6. Relationships between Higgins Lake water surface elevations, dam configuration, dam discharge rate and instream fish habitat at the Lansing Road bridge reach of the Cut River (from Wiley and Layman 2015). Note that 1.5 cms equals 53 cfs and 1 cms equals 35 cfs.

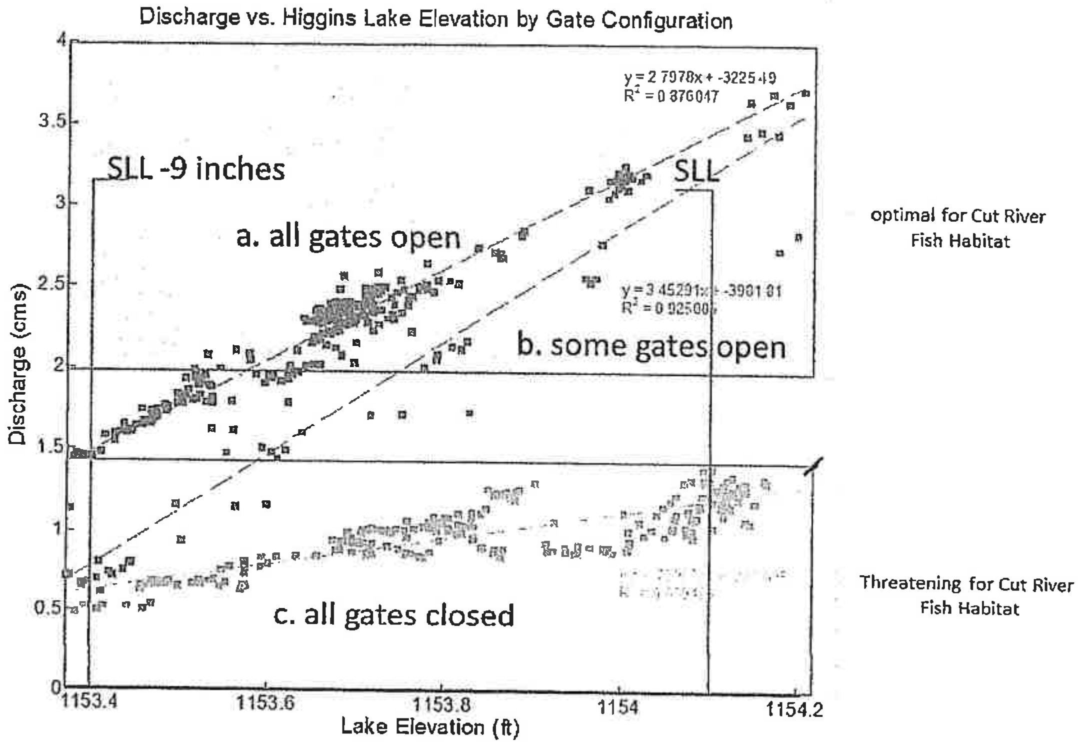


Table 1. Higgins Lake water elevations used in the study. Note that SLL indicates the court established summer lake level for Higgins Lake (from Wiley and Layman 2015 and Kendall et al. 2016). All gates open refers to radial gates 4, 5, and 6 only.

Description	SLL ± inch	Elevation (feet)	SLL ± feet	MSU model	UM model
	SLL+60	1159.03	4.92		High sensitivity
All gates closed	SLL+1	1154.21	0.1		X
Summer legal level (1926, 1941, 1956)	SLL	1154.11	0	X	X
	SLL-4	1153.78	-0.3	X	
Winter legal level (1926 & 1956)	SLL-6	1153.61	-0.5	X	
Winter legal level (2009-2014)	SLL-9	1153.36	-0.75	X	X
	SLL-13	1153.03	-1.08	X	
All gates open (4, 5, 6)	SLL-18	1152.61	-1.51	X	X
Dam removed MSU model	SLL-20	1152.44	-1.67	X	
Natural Bottom MSU 2013	SLL-24	1152.07	-2.04		
Dam removed UM model	SLL-26	1151.95	-2.17		X
Natural bottom DNR 1956	SLL-37	1151	-3.11		
	SLL-60	1149.19	-4.92		Low sensitivity

1981

Table 2. Information on Cut River flows and Higgins Lake water levels from figures 1-4.

	Current operation	Gates 4-6 open	No dam
Summer (April-October)			
Flow			
50 cfs	26%	66%	69%
90%	22 cfs	34 cfs	40 cfs
95%	18 cfs	26 cfs	33 cfs
34 cfs	63%	90%	95%
Lake level			
SLL=1154.11 (Current)	15%	0%	0%
1153.71 (SLL-4.8 inches)	88%	22%	2%
1153.41 (SLL-8.4 inches)	98%	77%	26%
1153.28 (SLL-10 inches)	100%	86%	48%
1152.92 (SLL-14.3 inches)	100%	100%	94%
1152.60 (SLL-18.1 inches)	100%	100%	100%
Winter (November-April)			
Flow			
50 cfs	77%	44%	42%
90%	40 cfs	24 cfs	28 cfs
95%	36 cfs	19 cfs	25 cfs
25 cfs	99%	90%	95%
Lake level			
Current WLL=1153.61 (SLL-6 inches)	47%	15%	0%
1153.41 (WLL-2.4 inch)	87%	57%	5%
1153.36 (alternate, WLL-3.0 inches)	91%	67%	11%
1153.11 (WLL-6.0 inch)	99%	93%	49%
1153.0 (WLL-7.3 inches)	100%	98%	69%
1152.80 (WLL-9.7 inches)	100%	100%	88%
1152.30 (WLL-15.7 inches)	100%	100%	100%

Table 3. Summer lake level information for Higgins Lake. Note that "SLL" denotes the legal summer lake level, "WLL" denotes the legal winter lake level, "ALT" denotes the alternate winter legal lake level. Percentages indicate the amount of time the lake elevation meets or exceeds the summer legal lake level (from Figure 3). Shoreline gain indicates the average change in shoreline position (in feet) as water levels decline from the SLL (from Tables 2.3.1 and 2.3.2 in the main report). The amount of dredging required to maintain adequate boating depths for five of the marinas and boat ramps is also provided (from Table 2.3.3 in Kendall et al. 2016).

Lake level elevation (ft)	Summer level	Winter level	Current	Gates 4-6 open	No dam	Shoreline gain (feet, acres)	Dredging (yards^3)
1154.11	Current SLL		15%	0%	0%		
	SLL-4.0 inches					12.3, 35	1,955
1153.71	SLL-4.8 inches		88%	22%	2%		
1153.61	SLL-6.0 inches	WLL				17.0, 48	2,539
1153.41	SLL-8.4 inches		98%	77%	26%		
1153.36	SLL-9.0 inches	WLL-3.0 inches, ALT				25.3, 69	3,889
1153.28	SLL-10.0 inches		100%	86%	48%		
1153.11	SLL-11.9 inches	WLL-6.0 inches					
	SLL-13.0 inches					45.1, 118	5,812
1153.00	SLL-13.2 inches	WLL-7.3 inches					
1152.92	SLL-14.3 inches		100%	100%	94%		
1152.80	SLL-15.6 inches	WLL-9.7 inches					
All gates open	SLL-18.0 inches					64.1, 170	8,720
1152.60	SLL-18.1 inches		100%	100%	100%		
No dam	SLL-20.0 inches					83.6, 215	9,461
1152.30	SLL-21.6 inches	WLL-15.7 inches					

Table 4. Winter lake level information for Higgins Lake. Note that "SLL" denotes the legal summer lake level, "WLL" denotes the legal winter lake level, "ALT" denotes the alternate winter legal lake level. Percentages indicate the amount of time the lake elevation meets or exceeds the winter legal lake level (from Figure 4). Shoreline gain indicates the average change in shoreline position (in feet) as water levels decline from the SLL (from Tables 2.3.1 and 2.3.2 in the main report). The amount of dredging required to maintain adequate boating depths for five of the marinas and boat ramps is also provided (from Table 2.3.3 in Kendall et al. 2016).

Lake level elevation (ft)	Summer level	Winter level	Current	Gates 4-6 open	No dam	Shoreline gain (feet, acres)	Dredging (yards³)
1154.1	Current SLL						
	SLL-4.0 inches					12.3, 35	1955
1153.71	SLL-4.8 inches						
1153.61	SLL-6.0 inches	WLL	47%	15%	0%	17.0, 48	2539
1153.41	SLL-8.4 inches		87%	57%	5%		
1153.36	SLL-9.0 inches	WLL-3.0 inches, ALT	91%	67%	11%	25.3, 69	3889
1153.28	SLL-10.0 inches						
1153.11	SLL-11.9 inches	WLL-6.0 inches	99%	93%	49%		
	SLL-13.0 inches					45.1, 118	5812
1153	SLL-13.2 inches	WLL-7.3 inches	100%	98%	69%		
1152.92	SLL-14.3 inches						
1152.8	SLL-15.6 inches	WLL-9.7 inches	100%	100%	88%		
All gates open	SLL-18.0 inches					64.1, 170	8720
1152.6	SLL-18.1 inches						
No dam	SLL-20.0 inches					83.6, 215	9461
1152.3	SLL-21.6 inches	WLL-15.7 inches	100%	100%	100%		

EXHIBIT 14

Prepared Statement to Roscommon County Commissioners – Eric Ostergren, March 27, 2019

I've read the proposed Motion you plan on voting on and I hope that vote takes place today, however I object to the Motion. I have several reasons for my objections as follows:

As everyone here knows, the Roscommon County Commissioners have been ordered by the Circuit Court to maintain the legal levels of Higgins Lake but have failed to do so for several years. Of course, this Commission is limited by the constraints of Mother Nature but the main problem with failing to maintain the legal levels is the Lake Level Control Structure or Dam that was modified back in 2007. The 4.75 foot uncontrolled spillway which if modified, would help the Commission control the levels much better. Modifying the Dam is something within your control. Back in 2010 this Commission hired, at great expense, the Spicer Group to make recommendations to help the Commission maintain the legal level. These recommendations have been ignored by this Commission for 9 years. Repeated pleas have been made by various organizations over the years to implement the Spicer Group's recommendations and they have still been ignored by the Commission. Last year I made a presentation to the Commission which highlighted 636 Petitions that were signed at one time, 227 Petitions that were signed at another time and at another time a Survey that 496 participated in. Everyone asked the Commissioners to enforce the legal level and modify the 4.75 foot permanent opening in the Dam. I'm providing you a copy of that presentation in case you have forgotten for the record.

The problem is that the lower levels on Higgins during the mid to late summer season are causing diminished usage which is devaluating property values and decreasing the enjoyment of the lake. It is a serious problem and most on the lake are extremely upset about it.

The fact is that this Commission is under Court Order to maintain the Legal level on Higgins. You have failed. The Court Order doesn't say it is an option for the Commission to maintain the legal levels or you can do it if you feel like it or that you need the permission of 2/3rds of the lake front owners to maintain the legal levels. It says you are ordered to maintain the legal levels. You do not need anyone's permission to maintain the legal levels, including the DEQ, the DNR, or anyone else. Anyone who prevents you from maintaining the legal levels would need to get permission from the Court to change that. Just because the DEQ and DNR are powerful agencies doesn't change the fact that the Court is a higher authority and Court Orders are to be followed and obeyed. If you don't believe me, ask the Court. I have a feeling we are going to find out soon.

Your proposed Motion is fatality flawed, illegal and dishonest. You have conflated the statutes with how lake communities are supposed to establish or change legal levels with how you are supposed to maintain the established Court Ordered legal levels. No one is asking you to change the legal level. You should have obtained competent legal counsel who would have told you that your Motion will not hold up under legal challenge. The Commission can't forgo its legal responsibility by requiring 2/3rds of the lakefront property owners to approve before they could fulfill their legal responsibility.

Think about this: Why weren't 2/3rds of the lakefront property owners required back in 2007 when the LLCS was modified and why weren't 2/3rds of the lakefront property owners required when the Court modified the winter drawdown back in 2009 when it was lowered 3 inches? The reason is because the 2/3rds requirement is only required when you are trying to modify the legal level on a permanent basis. This motion you are trying to jam through is extremely dishonest, ill-conceived and is going to leave a stain on this Commission for years to come.

Finally, with that being said, I hope this Commission will vote today on the proposed Motion so this can move on to the next phase.

EXHIBIT 15

March 27, 2019

The Roscommon County Board of Commissioner's met on Wednesday, March 27, 2019 for a Regular Meeting. The meeting was held at the Roscommon County Building, 500 Lake Street, Roscommon, MI 48653. Chairman Robert E. Schneider called the meeting to order at 10:00 a.m.

The Pledge of Allegiance of the United States of America was recited.

Present: Schneider, Milburn, Muckenthaler, Russo, Melvin

Absent: None

Motion by Milburn, Seconded by Russo, to approve the Board Agenda. On Roll Call: Ayes: Muckenthaler, Milburn, Schneider, Russo, Melvin. Nays: None. Motion Carried.

Public Comment: County residents shared opinions on the resolution to petition change to lake level control structures and legal levels. Herbert Weatherly, representative with the Higgins Lake Property Owners Association, views comparison of Roscommon County to other counties as impractical since we have such large lakes and many home owners who do not permanently reside here. Mr. Weatherly feels it will be difficult to obtain the necessary 2/3 owner signatures. Tom Hankinson questioned why a subject of this importance to so many lake owners would be on the Board's current agenda instead of waiting until August when many more area residents and lake front property owners would be here. Eric Ostergren stated how he is not in support of the resolution, however, he encouraged the Board to vote today so the record will clearly show where they each stand on the matter. Mr. Ostergren feels the Board has ignored the 2010 Spicer Group recommendations. Mr. Ostergren said the 34th Circuit Court order is what the Commissioners need to follow. Bob Frye, Chairman of the Higgins Lake Land Conservancy, stated his disapproval of the resolution and explained how 2/3 consensus is unrealistic. He feels a better way to move forward with this matter is to get more public input and participation.

Administrator/Controller's Report: Administrator/Controller Jodi Valentino was busy following up on many calls and emails regarding today's lake level resolution. The wage analysis information has been passed onto the consultant. The wage analysis consultant will be meeting with department heads and elected official to complete the analysis. Findings are to be presented in June. Treasurer Ragan and Valentino updated the Board on the Tax Foreclosure lawsuit. An approximate $3,903,000 has been paid out to the townships. A full 2018 financial report will be presented to the Board at the next meeting. Jim Anderson is looking to complete our 2018 audit in May. A meeting with the Chief Judge, Prosecutor, and Court Administration concluded with MIDC adjustments needing to take place, especially in the area of arraignment representation. A meeting took place with DHHS Director Kara Mularz to review and discuss discontinued financial contributions to the DHHS Advisory Board.

Correspondence: Cheboygan County Board of Commissioners

Monthly Department Reports: Gypsy Moth, Economic Development Committee Corp.

Visitors: Chairman Schneider introduced RCTA Director Steve Dubois to the Board.

Unfinished Business/New Business: None

Motions and Resolutions:

1. Motion by Russo, Seconded by Muckenthaler, to appoint Richard Shutter to the Roscommon County Jury Board for a six (6) year term to expire April 30, 2025.

   On Roll Call: Ayes: Russo, Schneider, Melvin, Muckenthaler, Milburn. Nays: None. Motion Carried.

2. Motion by Russo, Seconded by Milburn, to appoint Ken Elmore to the Roscommon County Jury Board for a six (6) year term to expire April 30, 2025.

   On Roll Call: Ayes: Russo, Schneider, Melvin, Muckenthaler, Milburn. Nays: None. Motion Carried.

3. Motion by Melvin, Seconded by Milburn, to appoint Carolyn Pietchak to the Roscommon County Jury Board for a six (6) year term to expire April 30, 2025.

   On Roll Call: Ayes: Russo, Schneider, Melvin, Muckenthaler, Milburn. Nays: None. Motion Carried.

4. Motion by Melvin, Seconded by Muckenthaler, to adopt the 'Paid Medical Leave' policy effective March 27, 2019. (see attached)

   On Roll Call: Ayes: Russo, Schneider, Melvin, Muckenthaler, Milburn. Nays: None. Motion Carried.

5. Motion by Milburn, to table vote to adopt the "Requirements to Petition Change to Lake Level Control Structures and Legal Levels Resolution" - motion failed due to lack of support.

6. Motion by Melvin, Seconded by Russo, to adopt the "Requirements to Petition Change to Lake Level Control Structures and Legal Levels Resolution" as amended:

REQUIREMENTS TO PETITION CHANGE TO LAKE LEVEL CONTROL STRUCTURES AND LEGAL LEVELS RESOLUTION

WHEREAS, as outlined under Part 307, Inland Lake Levels, of the Natural Resources and Environmental Protection Act, 1994 PA 451 as amended (the Act), lake levels were established for Higgins Lake, Houghton Lake and Lake St. Helen to protect public health, welfare, and safety and for the conservation of natural resources; and

WHEREAS, the Roscommon County Board of Commissioners, as required by the Act, is the delegated authority of the county in regard to lake level and lake level control structure change(s); and

WHEREAS, MCL 324.30702 et seq. provides that the County Board of Commissioners in which an inland lake is located may, upon the board's own motion, or shall within 45 days following receipt of a petition to the board of 2/3 of the owners of lands abutting the inland lake, initiate action to take the necessary steps to cause to be determined the normal level of the inland lake; and

WHEREAS, the Roscommon County Board of Commissioners believes that lake usage and home values will be best represented by obtaining a majority opinion of those land owners outlined in the Act as being needed to petition for legal lake levels; and

WHEREAS, MCL 324.30703 further provides that the County Board of Commissioners may require a cash payment from the petitioners sufficient to cover the actual preliminary study costs or $10,000.00, whichever is less.

NOW, THEREFORE BE IT RESOLVED, that the Roscommon County Board of Commissioners shall require a petition of two-thirds of the owners of land abutting the lake prior to considering any public requests to initiate any change(s) to the existing lake level control structures and/or legal lake levels of Higgins Lake, Houghton Lake, and Lake St. Helen.

BE IT FURTHER RESOLVED, that before a preliminary study is conducted, the Roscommon County Board of Commissioners will require a cash payment from the petitioners sufficient to cover the actual preliminary study costs or $10,000.00, whichever is less.

On Roll Call: Ayes: Russo, Schneider, Muckenthaler, Melvin. Nays: Milburn. Resolution Adopted.

Committee Reports:

Russo: Agenda, took several calls from concerned citizens regarding the lake level resolution.
Muckenthaler: Collaborative Board
Milburn: VA, U.S. Representative John Moolenaar visited local veterans and handed out well-deserved awards.
Melvin: Agenda, VA phone meetings, aided some veterans with their needs.
Schneider: MAC meeting was this week, matters here took precedence and he missed the 3 day conference.

Public Comment: None

Motion by Milburn, Second by Russo to adjourn meeting. All Ayes. Motion Carried.

Meeting adjourned at 10:52 a.m.

Robert E. Schneider Chairman	Michelle M. Stevenson County Clerk/Reg. Of Deeds

EXHIBIT 16

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF ROSCOMMON

IN THE MATTER OF:
THE WATER LEVELS OF
HOUGHTON LAKE, HIGGINS LAKE, AND
LAKE ST. HELEN

Case No. 81-3003-CF
Hon. Robert W. Bennett

____/

OUTSIDE LEGAL COUNSEL PLC
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Attorney for Petitioners
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(989) 642-0055

STATE OF MICHIGAN DEPARTMENT
OF ATTORNEY GENERAL
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(517) 335-7664
bockd@michigan.gov

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(231) 946-0044
chris@envlaw.com

ROSATI SCHULTZ JOPPICH
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CAREY & JASKOWSKI, PLLC
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Attorneys for Non-Profit Intervenors
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HOUGHTON LAKE IMPROVEMENT BOARD
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Attorney for Governmental Entity
Intervenors
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Houghton Lake, MI 48629
(989) 387-1458
deamud@hlmich.net

____/

AFFIDAVIT OF ALISHA PASTELL

STATE OF MICHIGAN)
)
COUNTY OF ROSCOMMON)

Alisha Pastell, being first sworn, deposes and says as follows:

1. This affidavit is made from personal knowledge, and if sworn as a witness, I am able to testify competently to the facts stated or referred to.

2. I serve as the Board Secretary for the Roscommon County Board of Commissioners and as the Accounts Payable Clerk for Roscommon County. I have been employed by Roscommon County full time since January 22, 2014.

3. In connection with my duties since January 22, 2014, I compile and keep the records of a daily log of the Higgins Lake Level Control Structure (Higgins Lake Dam).

4. Attached to this Affidavit are the following pages of the Higgins Lake Dam Log:

Exhibit A:	April 2016-November 2016
Exhibit B:	April 2017-November 2017
Exhibit C:	April 2018-November 2018
Exhibit D:	April 2019-September 2019

5. I have reviewed the attached documents identified in Paragraph 4 and confirmed that they are true and accurate copies of the identified pages of the Higgins Lake Dam log that are maintained in the Office of the County Controller.

6. The columns labeled Boards 1, 2, and 3, and Gates 1, 2, and 3 correspond to each movable feature on the Higgins Lake Control Structure. These labels correspond to the illustration of the Lake Level Control Structure depicted at the top of the Higgins Lake Dam log. However, illustration labels as "Gate 4," "Gate 5," and "Gate 6" the gates that are labeled in the log column headings as "Gate 1, "Gate 2," and "Gate 3," respectively.

7. The daily entry for each of the boards and gates is logged as either "C" or "O."

8. An entry of "C" in any given cell indicates that the board or gate associated with that cell was closed, while an entry of "O" indicates that it was open on that day.

9. The actual day on which a board or gate was opened or closed can be determined by following the column for each board or gate through the month. The first occurrence of an

"O" after an occurrence of a "C" means that the gate was opened on that date, and vice versa. If, after the first occurrence of a "C," successive days also are logged as "C," it means that the Board or Gate remained closed for successive days. For example, in Exhibit A, the "O" entered in the cell for Gate 2 on April 21, 2016 means that Gate 2 was opened that day. It then remained open through April 27, 2016. It was closed on April 28, 2016, and remained closed through April 30 and was still closed into May as indicated by the log for May 1-3, 2016.

10. The readings for "Rain," "Snow," "Temp," and the "Staff Gage" (which measures the lake level) are drawn from instruments located at South Higgins Lake State Park as reported by the Higgins Lake Property Owners Association.

11. I personally populate the cells of the Higgins Lake Dam log. The general process for populating the cells starts with Commissioner Ken Melvin contacting me to state whether a gate needs to be opened or closed that day, and, if so, asking me to contact the Roscommon County Director of Maintenance or full-time maintenance staff with instructions to open or close the gate(s). I receive an e-mail after the gate(s) has been opened or closed, after which I update the log to reflect changes in the status of each gate. If no gates are opened or closed on a given day, I carry over the notations from the previous day.

12. E-mails supporting the cell entries are maintained by the Office of the Controller, and I could produce them if called upon to do so.

FURTHER, AFFIANT SAYETH NOT.

Alisha Pastell
ALISHA PASTELL

Subscribed and sworn to before me this 18th day of October, 2019.

Michelle M Stevenson
Notary Public
Roscommon County, Michigan
My Commission Expires: 11/27/2022

MICHELLE M. STEVENSON
NOTARY PUBLIC – STATE OF MICHIGAN
COUNTY OF ROSCOMMON
My Commission Expires Nov. 27, 2016 22
Acting in the county of Roscommon

MICHELLE M. STEVENSON
NOTARY PUBLIC - STATE OF MICHIGAN
COUNTY OF ROSCOMMON
My Commission Expires Nov. 27, 2022
Acting in the County of Roscommon

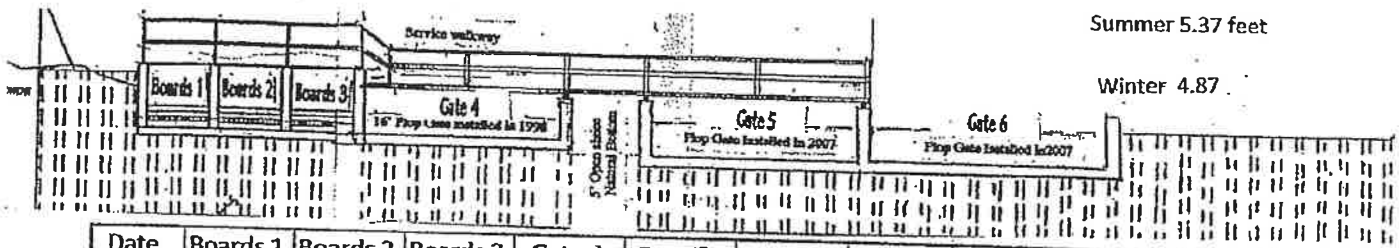
EXHIBIT A

Higgins Lake Dam April 2016

Staff Gauge

Summer 5.37 feet

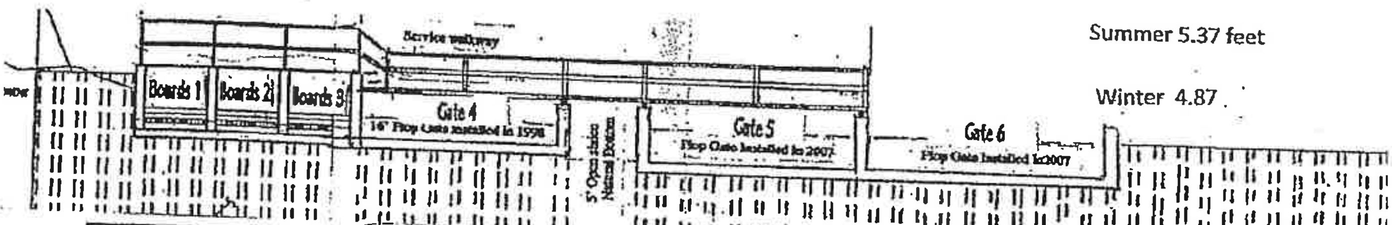
Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C	.30		47°	5.25
2	C	C	C	C	C	C	.02		31°	5.30
3	C	C	C	C	C	C			25°	5.30
4	C	C	C	C	C	C			29°	5.34
5	C	C	C	C	C	C			36°	5.31
6	C	C	C	C	C	C			36°	5.36
7	C	C	C	C	C	C			33°	5.37
8	C	C	C	C	C	C			38°	5.38
9	C	C	C	C	C	C			29°	5.36
10	C	C	C	C	C	C			33°	5.35
11	C	C	C	C	C	C	.07		38°	5.38
12	C	C	C	C	C	C			40°	5.37
13	C	C	C	C	C	C			47°	5.37
14	C	C	C	C	C	C			56°	5.37
15	C	C	C	C	C	C			65°	5.37
16	C	C	C	C	C	C			74°	5.38
17	C	C	C	C	C	C			78°	5.38
18	C	C	C	C	C	C			80°	5.37
19	C	C	C	C	C	C			65°	5.39
20	C	C	C	C	C	C			64°	5.39
21	C	C	C	C	O	C	.17		63°	5.42
22	C	C	C	C	O	C	.09		55°	5.39
23	C	C	C	C	O	C			58°	5.39
24	C	C	C	C	O	C			55°	5.39
25	C	C	C	C	O	C	.46		55°	5.37
26	C	C	C	C	O	C	.29		47°	5.43
27	C	C	C	C	O	C	.02		59°	5.41
28	C	C	C	C	C	C			47°	5.41
29	C	C	C	C	C	C	.03		57°	5.42
30	C	C	C	C	C	C			58°	5.41
31										

C = closed o = open

Higgins Lake Dam May 2016



Staff Gauge

Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C	.04		55°	5.41
2	C	C	C	C	C	C			61°	5.41
3	C	C	C	C	C	C			65°	5.41
4	C	C	C	C	O	O	.63		58°	5.47
5	C	C	C	C	O	O	.54		66°	5.49
6	C	C	C	C	O	O			76°	5.47
7	C	C	C	C	O	O			64°	5.45
8	C	C	C	C	O	O			60°	5.43
9	C	C	C	C	O	O			63°	5.43
10	C	C	C	C	C	C			62°	5.43
11	C	C	C	C	C	C			72°	5.41
12	C	C	C	C	C	C			72°	5.42
13	C	C	C	C	C	C	.03		61°	5.40
14	C	C	C	C	C	C	.18		46°	5.41
15	C	C	C	C	C	C	.02	T	48°	5.41
16	C	C	C	C	C	C	.04		59°	5.40
17	C	C	C	C	C	C			64°	5.39
18	C	C	C	C	C	C			66°	5.40
19	C	C	C	C	C	C			71°	5.39
20	C	C	C	C	C	C			75°	5.39
21	C	C	C	C	C	C			77°	5.40
22	C	C	C	C	C	C			74°	5.40
23	C	C	C	C	C	C			81°	5.37
24	C	C	C	C	C	C			83°	5.39
25	C	C	C	C	C	C	.35		82°	5.39
26	C	C	C	C	C	C	.10		81°	5.40
27	C	C	C	C	C	C	.22		85°	5.43
28	C	C	C	C	C	C			82°	5.44
29	C	C	C	C	C	C			80°	5.44
30	C	C	C	C	C	C			79°	5.44
31	C	C	C	C	C	C			78°	5.44

C = closed o = open

Higgins Lake Dam June 2016

Staff Gauge

Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C			66°	5.40
2	C	C	C	C	C	C	.14		74°	5.42
3	C	C	C	C	C	C			76°	5.44
4	C	C	C	C	C	C			79°	5.42
5	C	C	C	C	C	C	.27		68°	5.46
6	C	C	C	C	C	C	.02		71°	5.43
7	C	C	C	C	C	C	.03		57°	5.42
8	C	C	C	C	C	C			62°	5.42
9	C	C	C	C	C	C			73°	5.38
10	C	C	C	C	C	C			80°	5.35
11	C	C	C	C	C	C	.58		86°	5.47
12	C	C	C	C	C	C			72°	5.41
13	C	C	C	C	C	C			67°	5.44
14	C	C	C	C	C	C			73°	5.39
15	C	C	C	C	C	C			66°	5.39
16	C	C	C	C	C	C	.86		75°	5.47
17	C	C	C	C	C	C	.12		87°	5.44
18	C	C	C	C	C	C			87°	5.46
19	C	C	C	C	C	C			86°	5.46
20	C	C	C	C	C	C			83°	5.42
21	C	C	C	C	C	C			76°	5.44
22	C	C	C	C	C	C	.05		77°	5.44
23	C	C	C	C	C	C			79°	5.39
24	C	C	C	C	C	C			82°	5.39
25	C	C	C	C	C	C			86°	5.38
26	C	C	C	C	C	C			82°	5.44
27	C	C	C	C	C	C	.37		78°	5.44
28	C	C	C	C	C	C			71°	5.41
29	C	C	C	C	C	C			77°	5.40
30										
31										

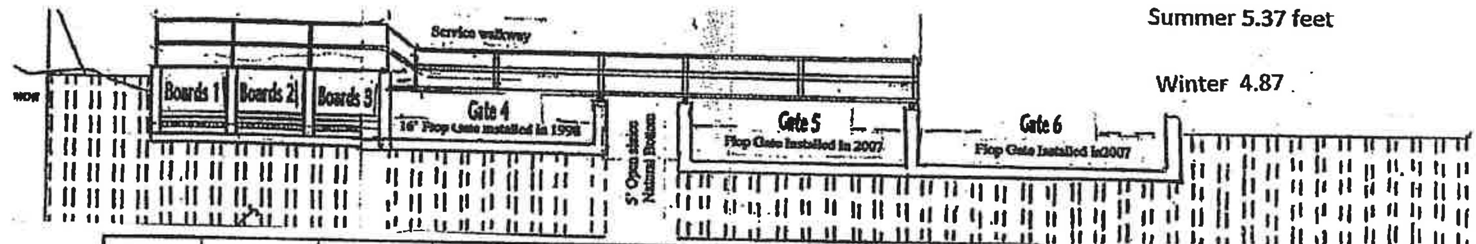
C = closed o = open

Higgins Lake Dam July 2016

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C	.62		69°	5.41
2	C	C	C	C	C	C			77°	5.37
3	C	C	C	C	C	C			80°	5.33
4	C	C	C	C	C	C			83°	5.32
5	C	C	C	C	C	C			86°	5.35
6	C	C	C	C	C	C			87°	5.37
7	C	C	C	C	C	C	.25		87°	5.36
8	C	C	C	C	C	C	.26		80°	5.43
9	C	C	C	C	C	C	.59		78°	5.37
10	C	C	C	C	C	C			81°	5.37
11	C	C	C	C	C	C	.03		83°	5.37
12	C	C	C	C	C	C			88°	5.35
13	C	C	C	C	C	C			90°	5.35
14	C	C	C	C	C	C	.26		79°	5.36
15	C	C	C	C	C	C	.04		68°	5.37
16	C	C	C	C	C	C			76°	5.32
17	C	C	C	C	C	C			77°	5.33
18	C	C	C	C	C	C	.25		79°	5.31
19	C	C	C	C	C	C			79°	5.30
20	C	C	C	C	C	C			89°	5.31
21	C	C	C	C	C	C			93°	5.28
22	C	C	C	C	C	C	.06		91°	5.31
23	C	C	C	C	C	C			90°	5.29
24	C	C	C	C	C	C	.06		82°	5.32
25	C	C	C	C	C	C	.35		83°	5.36
26	C	C	C	C	C	C			88°	5.31
27	C	C	C	C	C	C			87°	5.28
28	C	C	C	C	C	C	.03		81°	5.29
29	C	C	C	C	C	C	.12		80°	5.30
30	C	C	C	C	C	C			78°	5.35
31	C	C	C	C	C	C	.19		80°	5.28

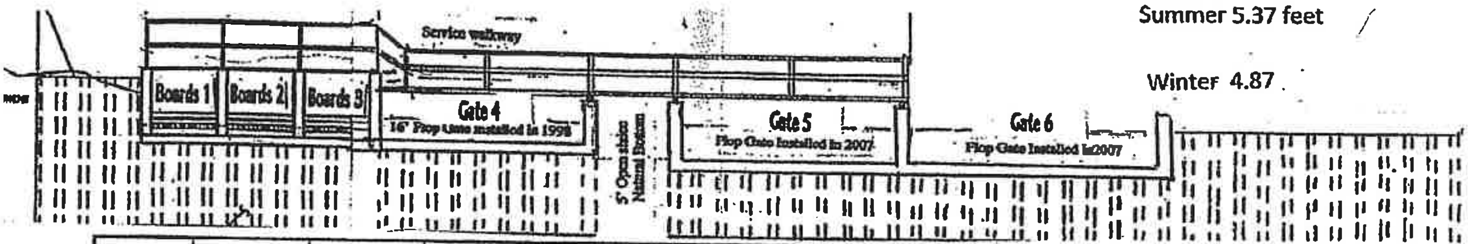
C = closed o = open

Higgins Lake Dam Aug 2016

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C			83°	5.21
2	C	C	C	C	C	C			87°	5.26
3	C	C	C	C	C	C			89°	5.24
4	C	C	C	C	C	C			93°	5.27
5	C	C	C	C	C	C			85°	5.21
6	C	C	C	C	C	C			84°	5.19
7	C	C	C	C	C	C			80°	5.19
8	C	C	C	C	C	C			84°	5.15
9	C	C	C	C	C	C			90°	5.15
10	C	C	C	C	C	C			91°	5.14
11	C	C	C	C	C	C			90°	5.15
12	C	C	C	C	C	C	.17		78°	5.15
13	C	C	C	C	C	C	.104		79°	5.21
14	C	C	C	C	C	C	.33		82°	5.21
15	C	C	C	C	C	C			83°	5.20
16	C	C	C	C	C	C	.03		83°	5.19
17	C	C	C	C	C	C			79°	5.23
18	C	C	C	C	C	C	.91		85°	5.20
19	C	C	C	C	C	C			82°	5.20
20	C	C	C	C	C	C			78°	5.21
21	C	C	C	C	C	C	.15		70	5.20
22	C	C	C	C	C	C	.04		77	5.20
23	C	C	C	C	C	C			83°	5.18
24	C	C	C	C	C	C			76°	5.16
25	C	C	C	C	C	C	.17		82°	5.16
26	C	C	C	C	C	C			80°	5.16
27	C	C	C	C	C	C			71°	5.17
28	C	C	C	C	C	C	.24		80°	5.16
29	C	C	C	C	C	C			83°	5.19
30	C	C	C	C	C	C			84°	5.14
31	C	C	C	C	C	C	.51		75°	5.15

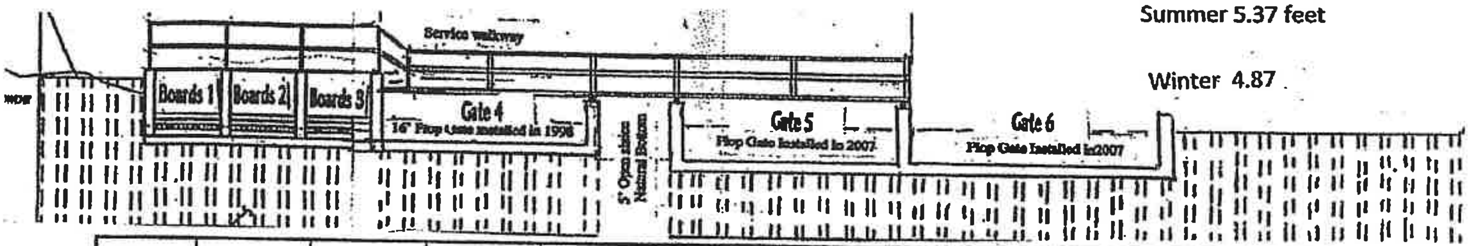
C = closed o = open

Higgins Lake Dam Sept 2016

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C			73°	5.09
2	C	C	C	C	C	C			75°	5.07
3	C	C	C	C	C	C			76°	5.08
4	C	C	C	C	C	C			78°	5.06
5	C	C	C	C	C	C			83°	5.04
6	C	C	C	C	C	C			88°	5.06
7	C	C	C	C	C	C	.45		82°	5.09
8	C	C	C	C	C	C	.68		79°	5.12
9	C	C	C	C	C	C			77°	5.09
10	C	C	C	C	C	C			72°	5.12
11	C	C	C	C	C	C	.31		71°	5.12
12	C	C	C	C	C	C			76°	5.11
13	C	C	C	C	C	C			72°	5.10
14	C	C	C	C	C	C	.08		69°	5.09
15	C	C	C	C	C	C			71°	5.08
16	C	C	C	C	C	C			74°	5.07
17	C	C	C	C	C	C	.21		77°	5.07
18	C	C	C	C	C	C	.04		74°	5.07
19	C	C	C	C	C	C			81°	5.08
20	C	C	C	C	C	C	.08		77°	5.09
21	C	C	C	C	C	C			74°	5.07
22	C	C	C	C	C	C	.10		74°	5.08
23	C	C	C	C	C	C	.03		65°	5.04
24	C	C	C	C	C	C			66°	5.04
25	C	C	C	C	C	C			70°	5.00
26	C	C	C	C	C	C	.25		60°	5.06
27	C	C	C	C	C	C			56°	5.03
28	C	C	C	C	C	C	.07		66°	5.03
29	C	C	C	C	C	C	.14		68°	5.01
30	C	C	C	C	C	C	.03		63°	4.98
31										

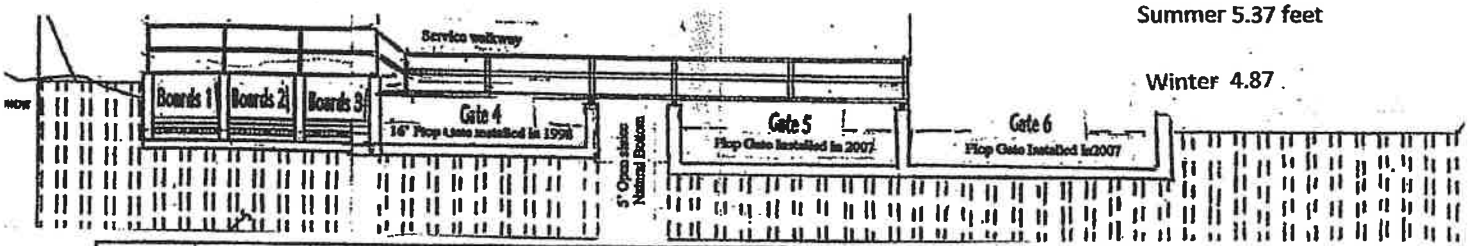
C = closed o = open

Higgins Lake Dam Oct 2016

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C	.15		63°	5.01
2	C	C	C	C	C	C	.24		68°	5.01
3	C	C	C	C	C	C	.05		64°	5.01
4	C	C	C	C	C	C			70°	5.02
5	C	C	C	C	C	C			77°	5.03
6	C	C	C	C	C	C	.42		66°	5.06
7	C	C	C	C	C	C	.30		75°	5.05
8	C	C	C	C	C	C			49°	5.04
9	C	C	C	C	C	C			54°	5.05
10	C	C	C	C	C	C			60°	5.04
11	C	C	C	C	C	C			66°	5.01
12	C	C	C	C	C	C	.02		69°	4.99
13	C	C	C	C	C	C	.21		51°	5.03
14	C	C	C	C	C	C			57°	5.01
15	C	C	C	C	C	C			63°	
16	C	C	C	C	C	C	.24		68°	
17	C	C	C	C	C	C			69°	5.03
18	C	C	C	C	C	C			71°	5.05
19	C	C	C	C	C	C	.15		67°	5.05
20	C	C	C	C	C	C			54°	5.06
21	C	C	C	C	C	C			50°	5.01
22	C	C	C	C	C	C			52°	5.01
23	C	C	C	C	C	C			60°	5.01
24	C	C	C	C	C	C			48°	4.98
25	C	C	C	C	C	C	.02		50°	4.97
26	C	C	C	C	C	C			39°	4.96
27	C	C	C	C	C	C	.20		46°	5.00
28	C	C	C	C	C	C			55°	4.97
29	C	C	C	C	C	C			61°	4.98
30	C	C	C	C	C	C	.21		50°	5.00
31	C	C	C	C	C	C			49°	4.96

not working

C = closed o = open

[illegible] 4.10.16

Higgins Lake Dam Nov 2016

Staff Gauge

Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	O	C	C	C	C			65°	4.98
2	C	O	C	C	C	C			56°	4.97
3	C	O	C	C	C	C			56°	4.93
4	C	O	C	C	C	C			54°	4.97
5	C	O	C	C	C	C			61°	4.96
6	C	O	C	C	C	C			62°	4.96
7	C	O	C	C	C	C			65°	4.94
8	C	O	C	C	C	C			53°	4.95
9	C	O	C	C	C	C			53°	4.93
10	C	O	C	C	C	C			60°	4.93
11	C	C	C	C	C	C			49°	4.92
12	C	C	C	C	C	C			50°	4.90
13	C	C	C	C	C	C			58°	4.87
14	C	C	C	C	C	C			58°	4.88
15	C	C	C	C	C	C			53°	4.90
16	C	C	C	C	C	C			54°	4.88
17	C	C	C	C	C	C			63°	4.87
18	C	C	C	C	C	C			66°	4.85
19	C	C	C	C	C	C	.11		47°	5.06
20	C	C	C	C	C	C	.02	1 3/4	28°	4.89
21	C	C	C	C	C	C			31°	4.85
22	C	C	C	C	C	C			34°	4.86
23	C	C	C	C	C	C			33°	4.88
24	C	C	C	C	C	C		1 3/4	36°	4.90
25	C	C	C	C	C	C			38°	4.90
26	C	C	C	C	C	C	.05		37°	4.89
27	C	C	C	C	C	C			42°	4.88
28	C	C	C	C	C	C	.03		43°	4.90
29	C	C	C	C	C	C	.32		53°	4.95
30	C	C	C	C	C	C			49°	4.96
31										

C = closed o = open

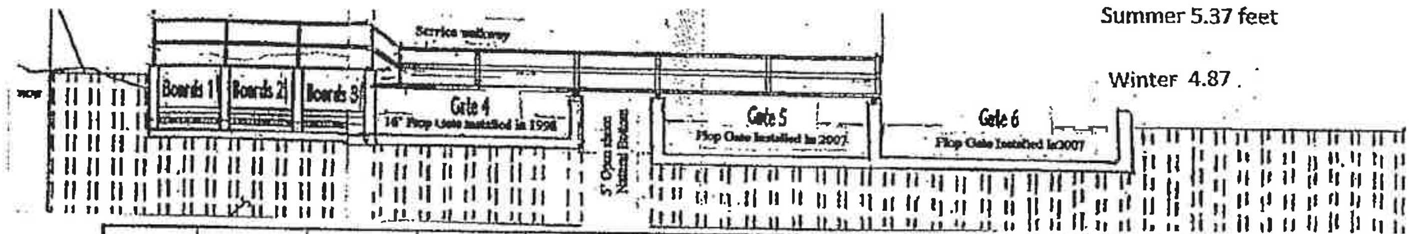
EXHIBIT B

Higgins Lake Dam April 2017

Staff Gauge

Summer 5.37 feet

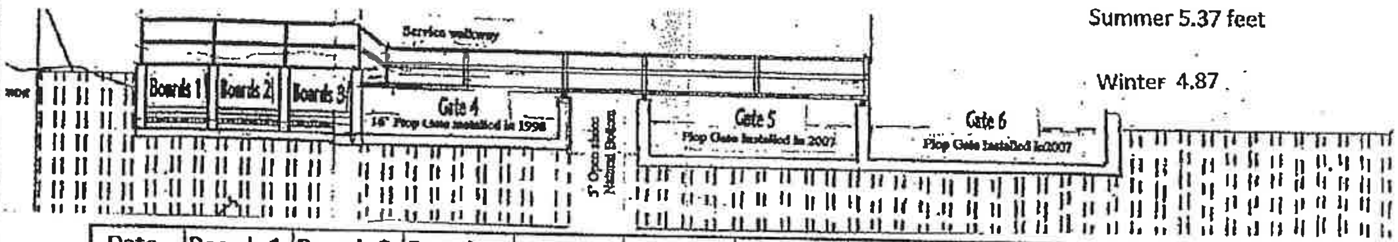
Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	O	O	O			47°	5.14
2	C	C	C	O	O	O			63°	5.15
3	C	C	C	O	O	O	.08		57°	5.23
4	C	C	C	O	O	O	.59		45°	5.25
5	C	C	C	O	O	O	.07		45°	5.28
6	C	C	C	O	O	O	.29	T	37°	5.31
7	C	C	C	O	O	O	.03		51°	5.28
8	C	C	C	O	O	O			62°	5.26
9	C	C	C	O	O	O	Ice	out	72°	5.28
10	C	C	C	C	C	C			70°	5.29
11	C	C	C	C	C	C	57		46°	5.30
12	C	C	C	C	C	C	.02		53°	5.34
13	C	C	C	C	C	C			50°	5.33
14	C	C	C	C	C	C			63°	5.32
15	C	C	C	C	C	C	.04		75°	5.52
16	C	C	C	O	O	O	1.77		67°	5.53
17	C	C	C	O	O	O			52°	5.52
18	C	C	C	O	O	O			61°	5.50
19	C	C	C	O	O	O			57°	5.52
20	C	C	C	O	O	O	.60		48°	5.56
21	C	C	C	O	O	O	.37		46°	5.52
22	C	C	C	O	O	O			62°	5.53
23	C	C	C	O	O	O			66°	5.53
24	C	C	C	O	O	O			69°	5.52
25	C	C	C	O	O	O			69°	5.49
26	C	C	C	O	O	O			76°	5.50
27	C	C	C	O	O	O	.05		69°	5.48
28	C	C	C	O	O	O	.03		61°	5.45
29	C	C	C	O	O	O			53°	5.44
30	C	C	C	O	O	O	.45		42°	5.49
31										

C = closed o = open

Higgins Lake Dam May 2017



Staff Gauge

Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	O	O	O	1.33		60°	5.56
2	C	C	C	O	O	O	.17		46°	5.57
3	C	C	C	O	O	O	.05		61°	5.55
4	C	C	C	O	O	O			59°	5.56
5	C	C	C	O	O	O			59°	5.53
6	C	C	C	O	O	O			59°	5.49
7	C	C	C	O	O	O			50°	5.47
8	C	C	C	O	O	O			52°	5.44
9	C	C	C	O	O	O	.03		36°	5.43
10	C	C	C	O	O	O			66°	5.44
11	C	C	C	O	O	O			69°	5.43
12	C	C	C	O	C	C			68°	5.42
13	C	C	C	O	C	C	.03		66°	5.40
14	C	C	C	O	C	C			63°	5.40
15	C	C	C	C	C	C			74°	5.40
16	C	C	C	C	C	C	.17		78°	5.44
17	C	C	C	C	C	C	.05		83°	5.40
18	C	C	C	C	C	C	.05		74°	5.41
19	C	C	C	C	C	C	.03		61°	5.40
20	C	C	C	C	C	C			58°	5.43
21	C	C	C	C	C	C	.10		59°	5.44
22	C	C	C	C	C	C	.14		62°	5.40
23	C	C	C	C	C	C	.02		65°	5.40
24	C	C	C	C	C	C	[illegible]		61°	5.43
25	C	C	C	C	C	C	.24		62°	5.46
26	C	C	C	C	O	C	.02		69°	5.48
27	C	C	C	C	O	C			74°	5.47
28	C	C	C	C	O	C			66°	5.48
29	C	C	C	C	O	C	.11		68°	5.45
30	C	C	C	C	O	C			68°	5.44
31	C	C	C	C	O	C	.09		66°	5.41

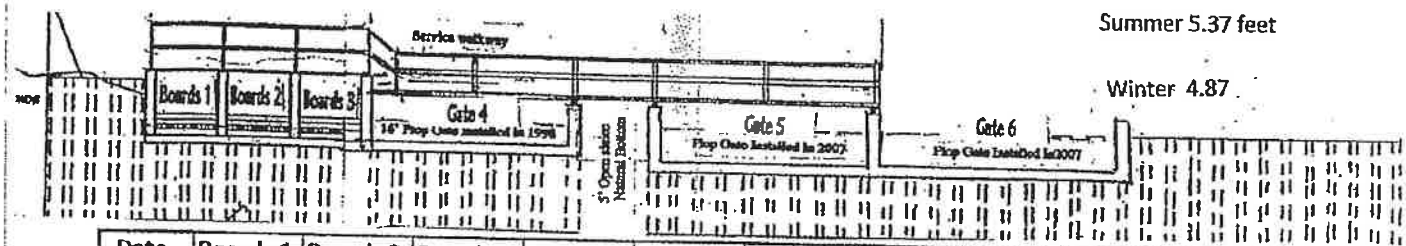
C = closed o = open

Higgins Lake Dam June 2017

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C			70°	5.43
2	C	C	C	C	C	C			77°	5.42
3	C	C	C	C	C	C			79°	5.42
4	C	C	C	C	C	C	.25		79°	5.45
5	C	C	C	C	C	C			71°	5.41
6	C	C	C	C	C	C	.07		73°	5.44
7	C	C	C	C	C	C			77°	5.43
8	C	C	C	C	C	C			75°	5.42
9	C	C	C	C	C	C	.02		68°	5.44
10	C	C	C	C	C	C			72°	5.40
11	C	C	C	C	C	C			76°	5.39
12	C	C	C	C	C	C			79°	5.48
13	C	C	C	C	O	O	.91		84°	5.47
14	C	C	C	C	O	O			81°	5.55
15	C	C	C	O	O	O	1.11		81°	5.56
16	C	C	C	O	O	O	.20		82°	5.55
17	C	C	C	O	O	O	.15		77°	5.54
18	C	C	C	O	O	O			74°	5.53
19	C	C	C	O	O	O	.03		71°	5.53
20	C	C	C	O	O	O	.46		67°	5.52
21	C	C	C	O	O	O			74°	5.49
22	C	C	C	O	O	O	.28		76°	5.52
23	C	C	C	O	O	O	.32		77°	5.50
24	C	C	C	O	O	O			70°	5.51
25	C	C	C	O	O	O	.07		64°	5.48
26	C	C	C	O	O	O	.07		61°	5.45
27	C	C	C	O	O	O	.11		70°	5.45
28	C	C	C	O	O	O	.07		73°	5.41
29	C	C	C	C	C	C	.38		78°	5.46
30	C	C	C	C	C				78°	5.46
31										

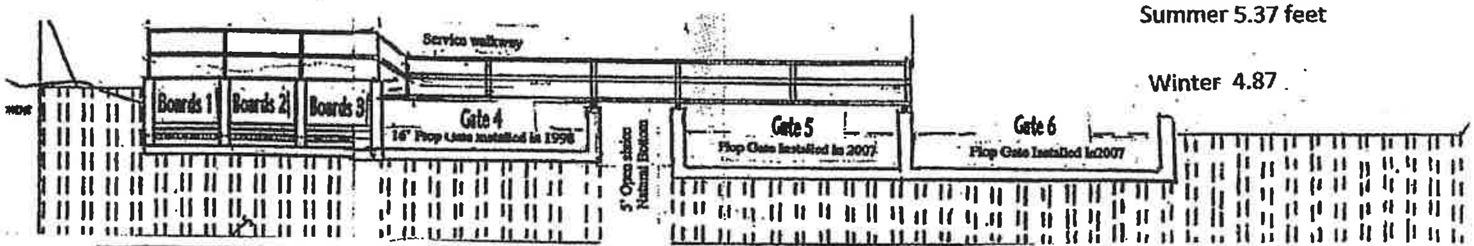
C = closed o = open

Higgins Lake Dam July 2017

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C			73°	5.45
2	C	C	C	C	C	C			77°	5.43
3	C	C	C	C	C	C			77°	5.44
4	C	C	C	C	C	C			80°	5.43
5	C	C	C	C	C	C			84°	5.42
6	C	C	C	C	C	C			87°	5.53
7	C	C	C	C	C	C	.80		79°	5.48
8	C	C	C	C	C	C			76°	5.46
9	C	C	C	C	C	C			81°	5.48
10	C	C	C	C	C	C	.20		79°	5.49
11	C	C	C	C	C	C	.17		83°	5.47
12	C	C	C	C	C	C			78°	5.53
13	C	C	C	C	C	C	.58		76°	5.52
14	C	C	C	C	C	C	.03		69°	5.49
15	C	C	C	C	C	C			80°	5.48
16	C	C	C	C	C	C			76°	5.47
17	C	C	C	C	C	C			78°	5.46
18	C	C	C	C	C	C			85°	5.47
19	C	C	C	C	C	C			81°	5.44
20	C	C	C	C	C	C			84°	5.43
21	C	C	C	C	C	C			81°	5.39
22	C	C	C	C	C	C	.03		81°	5.46
23	C	C	C	C	C	C	.07		77°	5.42
24	C	C	C	C	C	C	.09		76°	5.41
25	C	C	C	C	C	C			80°	5.35
26	C	C	C	C	C	C	.01		73°	5.40
27	C	C	C	C	C	C	.30		83°	5.42
28	C	C	C	C	C	C			76°	5.38
29	C	C	C	C	C	C			81°	5.36
30	C	C	C	C	C	C			83°	5.36
31	C	C	C	C	C	C			85°	5.36

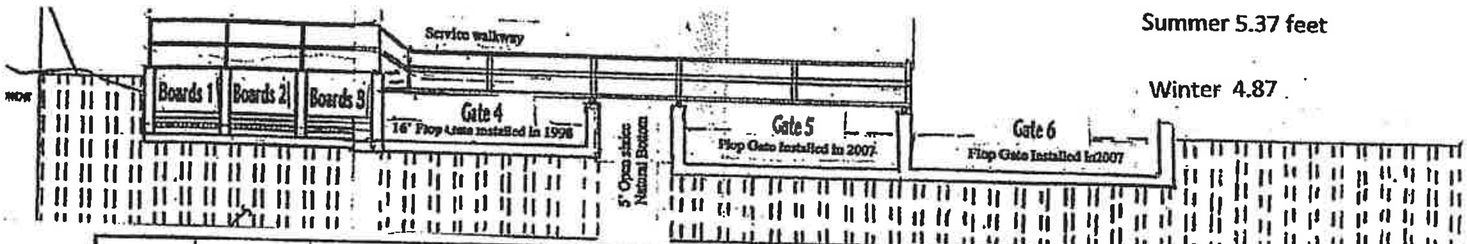
C = closed o = open

Higgins Lake Dam Aug 2017

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C	.04		83°	5.33
2	C	C	C	C	C	C			75°	5.38
3	C	C	C	C	C	C	.35		71°	5.37
4	C	C	C	C	C	C	.94		67°	5.43
5	C	C	C	C	C	C	.07		72°	5.38
6	C	C	C	C	C	C			74°	5.40
7	C	C	C	C	C	C			74°	5.38
8	C	C	C	C	C	C			81°	5.37
9	C	C	C	C	C	C			80°	5.35
10	C	C	C	C	C	C			80°	5.39
11	C	C	C	C	C	C	.06		75°	5.34
12	C	C	C	C	C	C	.26		74°	5.33
13	C	C	C	C	C	C	.05		77°	5.32
14	C	C	C	C	C	C			75°	5.32
15	C	C	C	C	C	C	1.10		78°	5.36
16	C	C	C	C	C	C			78°	5.3[illegible]
17	C	C	C	C	C	C	.76		73°	5.41
18	C	C	C	C	C	C	.27		72°	5.41
19	C	C	C	C	C	C	.02		79°	5.39
20	C	C	C	C	C	C			77°	5.38
21	C	C	C	C	C	C			84°	5.37
22	C	C	C	C	C	C	.06		71°	5.40
23	C	C	C	C	C	C	.02		68°	5.34
24	C	C	C	C	C	C			66°	5.32
25	C	C	C	C	C	C			69°	5.31
26	C	C	C	C	C	C			72°	5.29
27	C	C	C	C	C	C			70°	5.29
28	C	C	C	C	C	C	.04		68°	5.28
29	C	C	C	C	C	C	.06		75°	5.29
30	C	C	C	C	C	C			78°	5.26
31	C	C	C	C	C	C			68°	5.26

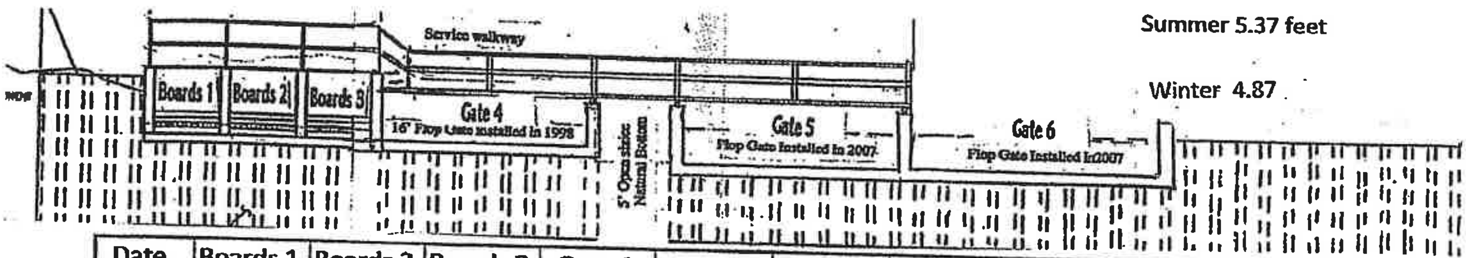
C = closed o = open

Higgins Lake Dam Sept 2017

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C			68	5.22
2	C	C	C	C	C	C			72°	5.28
3	C	C	C	C	C	C			76°	5.20
4	C	C	C	C	C	C			73°	5.19
5	C	C	C	C	C	C	.31		65°	5.25
6	C	C	C	C	C	C	.07		62°	5.21
7	C	C	C	C	C	C	.04		63°	5.20
8	C	C	C	C	C	C	.07		66°	5.20
9	C	C	C	C	C	C			65°	5.19
10	C	C	C	C	C	C			67°	5.19
11	C	C	C	C	C	C			72°	5.18
12	C	C	C	C	C	C			79°	5.16
13	C	C	C	C	C	C			78°	5.16
14	C	C	C	C	C	C			79°	5.16
15	C	C	C	C	C	C			81°	5.16
16	C	C	C	C	C	C			82°	5.15
17	C	C	C	C	C	C			84°	5.20
18	C	C	C	C	C	C	.43		74°	5.19
19	C	C	C	C	C	C			73°	5.17
20	C	C	C	C	C	C	.03		78°	5.15
21	C	C	C	C	C	C			88°	5.16
22	C	C	C	C	C	C			92°	5.17
23	C	C	C	C	C	C			91°	5.18
24	C	C	C	C	C	C			91°	5.17
25	C	C	C	C	C	C			89°	5.16
26	C	C	C	C	C	C			88°	5.15
27	C	C	C	C	C	C			71°	5.14
28	C	C	C	C	C	C			68°	5.11
29	C	C	C	C	C	C			60°	5.13
30	C	C	C	C	C	C	.07		61°	
31										

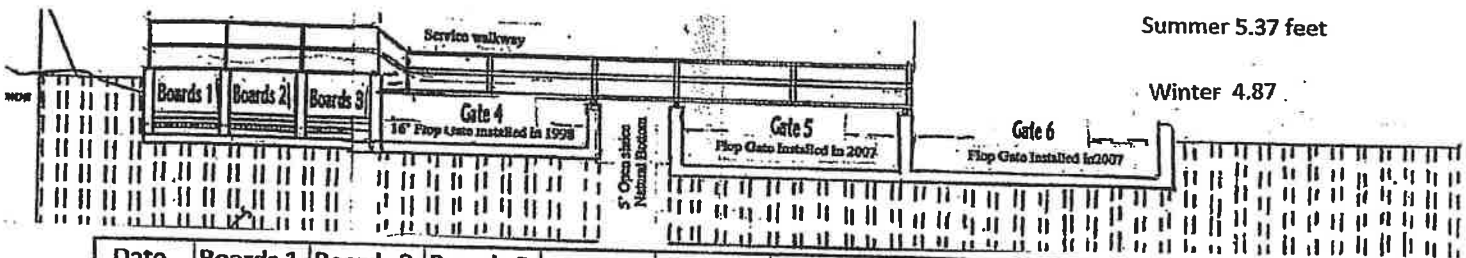
C = closed o = open

Higgins Lake Dam Oct 2017

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C			66°	5.06
2	C	C	C	C	C	C			76°	5.05
3	C	C	C	C	C	C			78°	5.04
4	C	C	C	C	C	C	.40		70°	5.09
5	C	C	C	C	C	C			65°	5.06
6	C	C	C	C	C	C			67°	5.04
7	C	C	C	C	C	C	.14		76°	5.06
8	C	C	C	C	C	C	30		74°	5.09
9	C	C	C	C	C	C			76°	5.06
10	C	C	C	C	C	C			63°	5.08
11	C	C	C	C	C	C	.10		61°	5.05
12	C	C	C	C	C	C	.04		63°	5.06
13	C	C	C	C	C	C			68°	5.04
14	C	C	C	C	C	C	.03		61°	5.10
15	C	C	C	C	C	C	.65		65°	5.08
16	C	C	C	C	C	C	.04		56°	5.08
17	C	C	C	C	C	C			66°	5.07
18	C	C	C	C	C	C			68°	5.04
19	C	C	C	C	C	C			63°	5.05
20	C	C	C	C	C	C			74°	5.02
21	C	C	C	C	C	C			73°	5.01
22	C	C	C	C	C	C			76°	5.10
23	C	C	C	C	C	C	1.37		52°	5.34
24	C	C	C	C	C	C	2.85		48°	5.37
25	C	C	C	C	C	C	.12		46°	5.36
26	C	C	C	C	C	C	.02		50°	5.36
27	C	C	C	C	C	C	.03		47°	5.36
28	C	C	C	C	C	C	.08		44°	5.35
29	C	C	C	C	C	C			46°	5.34
30	C	C	C	C	C	C			44°	5.32
31	C	C	C	C	C	C	.14		42°	5.33

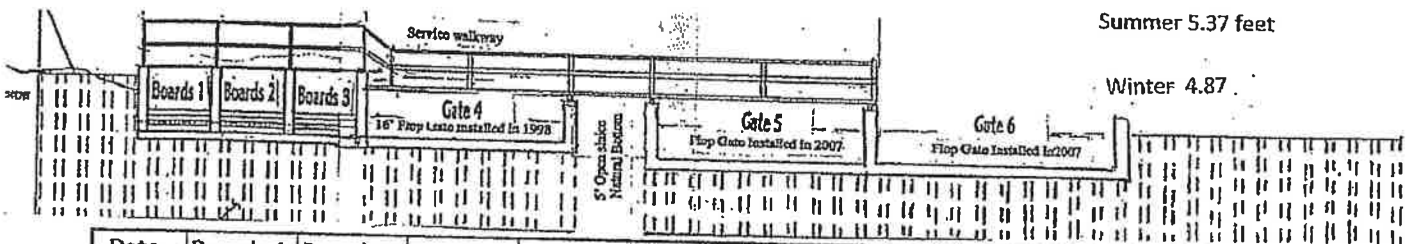
C = closed o = open

Higgins Lake Dam NOV. 2017

Staff Gauge

Summer 5.37 feet

Winter 4.87

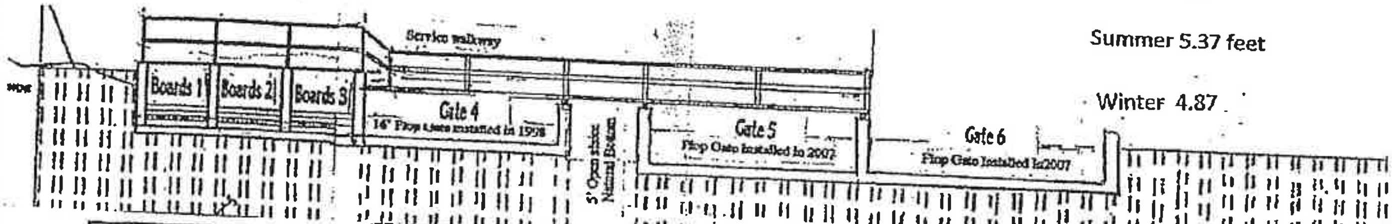


Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	O	O	O	.04		43°	5.32
2	C	C	C	O	O	O	.08		45°	5.29
3	C	C	C	O	O	O	.07		44°	5.27
4	C	C	C	O	O	O			42°	5.26
5	C	C	C	O	O	O	.16		49°	5.27
6	C	C	C	O	O	O	.04		42°	5.24
7	C	C	C	O	O	O			42°	5.23
8	C	C	C	O	O	O			43°	5.19
9	C	C	C	O	O	O			37°	5.22
10	C	C	C	O	O	O	.08	1½	21°	5.20
11	C	C	C	O	O	O			30°	5.16
12	C	C	C	O	O	O			36°	5.14
13	C	C	C	O	O	O			39°	5.13
14	C	C	C	O	O	O			44°	5.14
15	C	C	C	O	O	O	.31		42°	5.20
16	C	C	C	O	O	O	.75		37°	5.20
17	C	C	C	O	O	O			37°	5.22
18	C	C	C	O	O	O	.61		38°	5.28
19	C	C	C	O	O	O	.17	1	34°	5.23
20	C	C	C	O	O	O			43°	5.21
21	C	C	C	O	O	O			41°	5.19
22	C	C	C	O	O	O			29°	5.19
23	C	C	C	O	O	O			46°	5.17
24	C	C	C	O	O	O			55°	5.20
25	C	C	C	O	O	O	.07		49°	5.18
26	C	C	C	O	O	O	.02		41°	5.16
27	C	C	C	O	O	O			38°	5.14
28	C	C	C	O	O	O			33°	5.13
29	C	C	C	O	O	O			40°	5.13
30	C	C	C	O	O	O	.11	T	41°	5.11
31										

C = closed o = open

EXHIBIT C

Higgins Lake Dam April 2018



Staff Gauge

Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage	
1	C	C	C	C	O	C			32°	4.94	Snow melt
2	C	C	C	C	O	C			41°	4.92	
3	C	C	C	C	O	C		T	36°	4.97	
4	C	C	C	C	O	C		5 3/4	29°	4.98	
5	C	C	C	C	O	C		1/2	34°	4.96	
6	C	C	C	C	O	C		1/2	31°	4.96	
7	C	C	C	C	O	C		7/8	25°	4.98	
8	C	C	C	C	O	C			34°	4.95	
9	C	C	C	C	O	C			36°	4.96	
10	C	C	C	C	O	C			42°	4.96	
11	C	C	C	C	O	C			47°	4.95	
12	C	C	C	C	O	C			52°	4.96	
13	C	C	C	C	O	C			36°	5.06	
14	C	C	C	C	O	C		1	33°	5.11	snow melted
15	C	C	C	C	O	C			30°	5.18	
16	C	C	C	C	C	C			33°	5.21	
17	C	C	C	C	C	C			32°	5.21	
18	C	C	C	C	C	C			40°	5.20	
19	C	C	C	C	C	C			44°	5.21	
20	C	C	C	C	C	C			56°	5.20	
21	C	C	C	C	C	C			57°	5.22	
22	C	C	C	C	C	C			63°	5.20	
23	C	C	C	C	C	C			70°	5.21	
24	C	C	C	C	C	C			57°	5.22	
25	C	C	C	C	C	C	.26		48°	5.26	
26	C	C	C	C	C	C			61°	5.26	
27	C	C	C	C	C	C	.05		46°	5.27	
28	C	C	C	C	C	C			49°	5.27	
29	C	C	C	C	C	C			58°	5.27	
30	C	C	C	C	C	C			71°	5.28	
31											

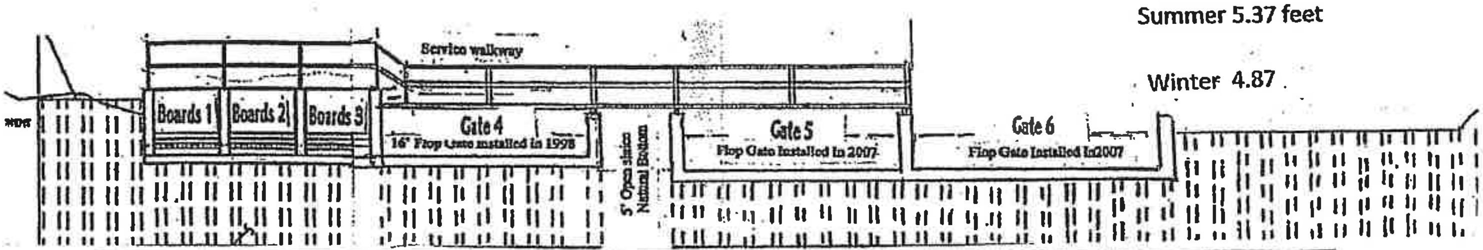
C = closed o = open

Higgins Lake Dam May 2018

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage	
									61	5.26 P	
1	C	C	C	C	C	C			61	5.27 P	
2	C	C	C	C	C	C	.08		62	5.29 P	
3	C	C	C	C	C	C	.05		62	5.37 P	
4	C	C	C	C	C	C	.62		63	5.38 P	Ice Out
5	C	C	C	C	C	C	.32		63	5.38 P	
6	C	C	C	C	C	C			64	5.39 P	
7	C	C	C	C	C	C			64	5.39 P	
8	C	C	C	C	C	C			65	5.39 P	
9	C	C	C	C	C	C			65	5.39 P	
10	C	C	C	C	O	O	.83		66	5.46 P	
11	C	C	C	C	O	O			66	5.44 P	
12	C	C	C	C	O	O			66	5.43 P	
13	C	C	C	C	O	O			66	5.41 P	
14	C	C	C	C	C	C			67	5.40 P	
15	C	C	C	C	C	C	.05		67	5.41 P	
16	C	C	C	C	C	C			68	5.40 P	
17	C	C	C	C	C	C			68	5.40 P	
18	C	C	C	C	C	C			69	5.39 P	
19	C	C	C	C	C	C	.35		69	5.42 P	
20	C	C	C	C	C	C	.27		69	5.43 P	
21	C	C	C	C	C	C	.36		69	5.43 P	
22	C	C	C	C	C	C			70	5.45 P	
23	C	C	C	C	C	C			70	5.44 P	
24	C	C	C	C	C	C			70	5.44 P	
25	C	C	C	C	C	C			71	5.43 P	
26	C	C	C	C	C	C			71	5.44 P	
27	C	C	C	C	C	C	.30		71	5.46 P	
28	C	C	C	C	C	C			71	5.47 P	
29	C	C	C	C	C	C			72	5.46 P	
30	C	C	C	C	C	C			72	5.45 P	
31	C	C	C	C	C	C	.59		72	5.50 P	

C = closed o = open

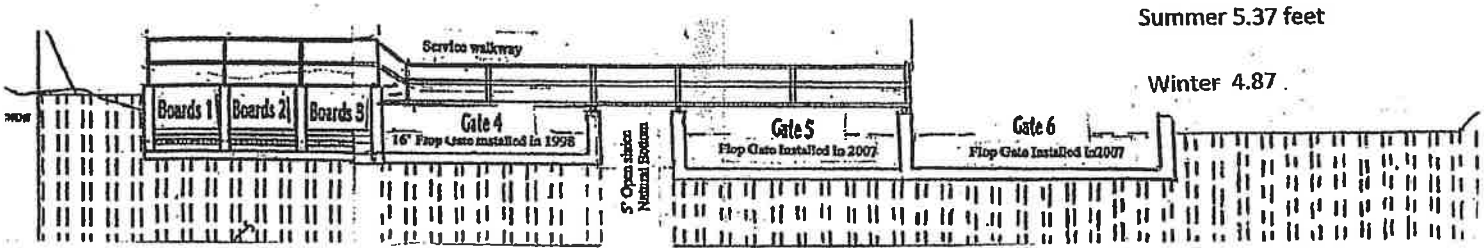
Revision 4-10-15

Higgins Lake Dam June 2018

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	c	c	c	c	O	O			72	5.50 P
2	c	c	c	c	o	O			73	5.46 P
3	c	c	c	c	o	O	.10		73	5.44 P
4	c	c	c	c	c	c	.04		73	5.43 P
5	c	c	c	c	c	c			73	5.40 P
6	c	c	c	c	c	c			74	5.39 P
7	c	c	c	c	c	c			74	5.38 P
8	c	c	c	c	c	c			74	5.37 P
9	c	c	c	c	c	c	.03		74	5.36 P
10	c	c	c	c	c	c			74	5.34 P
11	c	c	c	c	c	c			75	5.32 P
12	c	c	c	c	c	c			75	5.32 P
13	c	c	c	c	c	c			75	5.32 P
14	c	c	c	c	c	c			75	5.30 P
15	c	c	c	c	c	c			76	5.29 P
16	c	c	c	c	c	c			76	5.29 P
17	c	c	c	c	c	c			76	5.29 P
18	c	c	c	c	c	c			76	5.32 P
19	c	c	c	c	c	c	.12		76	5.32 P
20	c	c	c	c	c	c	.19		76	5.32 P
21	c	c	c	c	c	c			77	5.30 P
22	c	c	c	c	c	c			77	5.28 P
23	c	c	c	c	c	c	.09		77	5.28 P
24	c	c	c	c	c	c	.17		77	5.28 P
25	c	c	c	c	c	c	.08		78	5.27 P
26	c	c	c	c	c	c			78	5.26 P
27	c	c	c	c	c	c	.04		78	5.26 P
28	c	c	c	c	c	c			78	5.25 P
29	c	c	c	c	c	c			79	5.24 P
30	c	c	c	c	c	c			79	5.23 P
31										

C = closed o = open

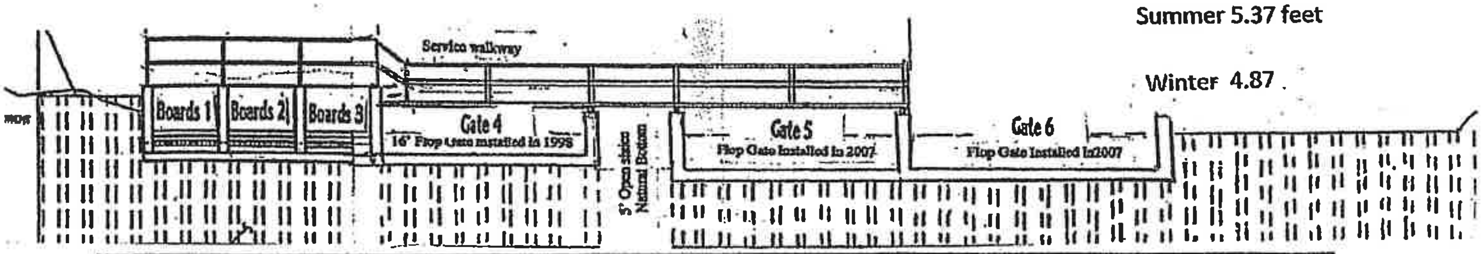
Revised 4.10.15

Higgins Lake Dam July 2018

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C				5.23
2	C	C	C	C	C	C	.11			5.25
3	C	C	C	C	C	C				5.24
4	C	C	C	C	C	C				5.24
5	C	C	C	C	C	C				5.24
6	C	C	C	C	C	C				5.16
7	C	C	C	C	C	C				5.17
8	C	C	C	C	C	C				5.14
9	C	C	C	C	C	C				5.13
10	C	C	C	C	C	C				5.11
11	C	C	C	C	C	C				5.10
12	C	C	C	C	C	C				5.08
13	C	C	C	C	C	C	.53			5.11
14	C	C	C	C	C	C	.20			5.13
15	C	C	C	C	C	C	.19			5.13
16	C	C	C	C	C	C				5.14
17	C	C	C	C	C	C				5.12
18	C	C	C	C	C	C				5.08
19	C	C	C	C	C	C				5.06
20	C	C	C	C	C	C				5.04
21	C	C	C	C	C	C				5.06
22	C	C	C	C	C	C	.61			5.08
23	C	C	C	C	C	C	.05			5.07
24	C	C	C	C	C	C				5.07
25	C	C	C	C	C	C				5.06
26	C	C	C	C	C	C				5.06
27	C	C	C	C	C	C				5.04
28	C	C	C	C	C	C				5.03
29	C	C	C	C	C	C				5.02
30	C	C	C	C	C	C				5.01
31	C	C	C	C	C	C	.03			5.00

C = closed o = open

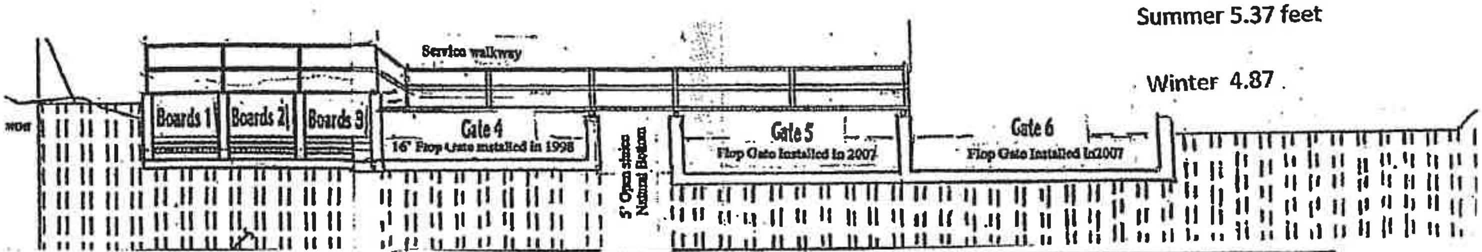
Revision 4-10-15

Higgins Lake Dam aug 2018

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C				5.00
2	C	C	C	C	C	C	.13			5.02
3	C	C	C	C	C	C	.54			5.04
4	C	C	C	C	C	C				5.03
5	C	C	C	C	C	C				5.02
6	C	C	C	C	C	C				5.02
7	C	C	C	C	C	C	.03			5.02
8	C	C	C	C	C	C	.09			5.01
9	C	C	C	C	C	C	.02			5.00
10	C	C	C	C	C	C				4.99
11	C	C	C	C	C	C				4.98
12	C	C	C	C	C	C				4.97
13	C	C	C	C	C	C				4.97
14	C	C	C	C	C	C				4.96
15	C	C	C	C	C	C				4.95
16	C	C	C	C	C	C				4.94
17	C	C	C	C	C	C	.20			4.94
18	C	C	C	C	C	C				4.94
19	C	C	C	C	C	C				4.92
20	C	C	C	C	C	C				4.91
21	C	C	C	C	C	C	.03			4.93
22	C	C	C	C	C	C	.53			4.93
23	C	C	C	C	C	C				4.89
24	C	C	C	C	C	C				4.87
25	C	C	C	C	C	C	.26			4.90
26	C	C	C	C	C	C				4.91
27	C	C	C	C	C	C	.37			4.93
28	C	C	C	C	C	C	.64			4.98
29	C	C	C	C	C	C				5.05
30	C	C	C	C	C	C	.52			5.03
31	C	C	C	C	C	C				5.02

C = closed o = open

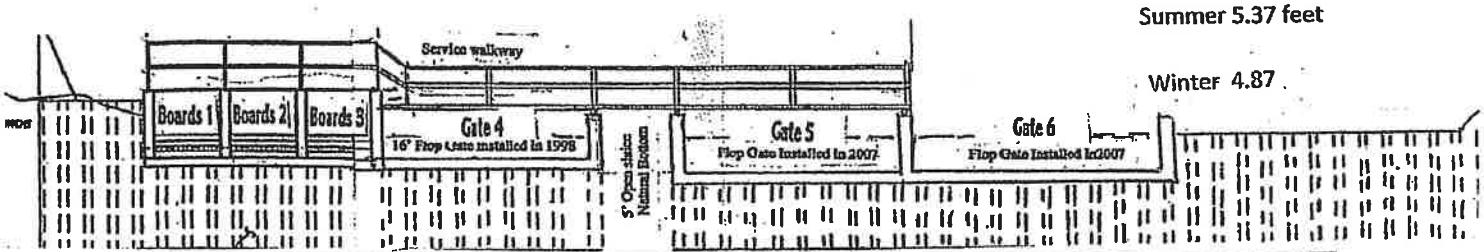
Revised 4-10-15

Higgins Lake Dam Sept 2018

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C				5.01
2	C	C	C	C	C	C	.24			5.03
3	C	C	C	C	C	C	.28			5.06
4	C	C	C	C	C	C	.62			5.10
5	C	C	C	C	C	C				5.11
6	C	C	C	C	C	C	.50			5.13
7	C	C	C	C	C	C				5.12
8	C	C	C	C	C	C				5.09
9	C	C	C	C	C	C				5.06
10	C	C	C	C	C	C				5.04
11	C	C	C	C	C	C				5.04
12	C	C	C	C	C	C				5.03
13	C	C	C	C	C	C				5.03
14	C	C	C	C	C	C				5.03
15	C	C	C	C	C	C				5.02
16	C	C	C	C	C	C				5.02
17	C	C	C	C	C	C				5.02
18	C	C	C	C	C	C				5.01
19	C	C	C	C	C	C				5.00
20	C	C	C	C	C	C	.04			5.01
21	C	C	C	C	C	C	.17			5.01
22	C	C	C	C	C	C				4.98
23	C	C	C	C	C	C				4.97
24	C	C	C	C	C	C				4.95
25	C	C	C	C	C	C	.04			4.95
26	C	C	C	C	C	C	.15			4.95
27	C	C	C	C	C	C	.03			4.93
28	C	C	C	C	C	C	.08			4.93
29	C	C	C	C	C	C	.07			4.91
30	C	C	C	C	C	C				4.89
31										

C = closed o = open

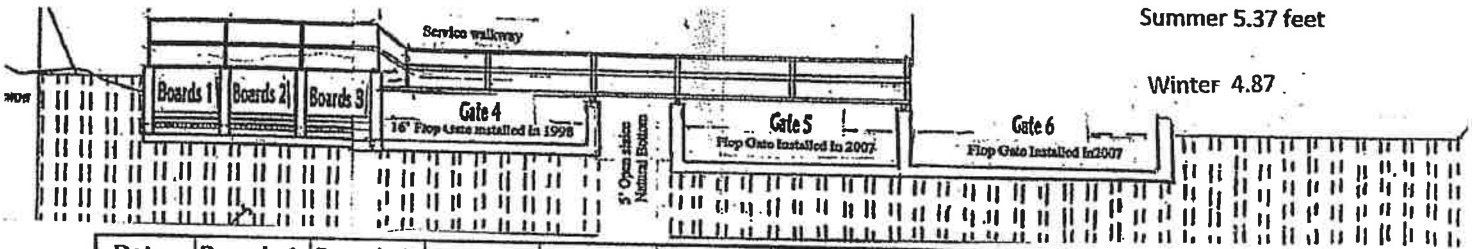
Revision 4-10-15

Higgins Lake Dam Oct 2018

Staff Gauge

Summer 5.37 feet

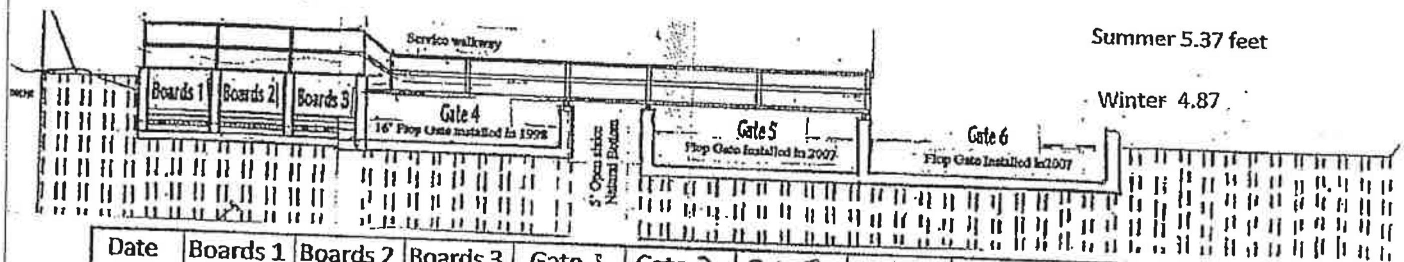
Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C				4.88
2	C	C	C	C	C	C	1.21			4.93
3	C	C	C	C	C	C	.32			4.94
4	C	C	C	C	C	C	.33			4.99
5	C	C	C	C	C	C	.33			4.97
6	C	C	C	C	C	C				4.98
7	C	C	C	C	C	C	.04			4.98
8	C	C	C	C	C	C	.02			5.02
9	C	C	C	C	C	C	.04			5.03
10	C	C	C	C	C	C				5.04
11	C	C	C	C	C	C	.43			5.06
12	C	C	C	C	C	C	.02			5.05
13	C	C	C	C	C	C				5.03
14	C	C	C	C	C	C				5.02
15	C	C	C	C	C	C	.04			5.01
16	C	C	C	C	C	C				4.98
17	C	C	C	C	C	C				4.98
18	C	C	C	C	C	C	.03			—
19	C	C	C	C	C	C				4.94
20	C	C	C	C	C	C	.14			4.98
21	C	C	C	C	C	C	.18			4.96
22	C	C	C	C	C	C				4.95
23	C	C	C	C	C	C	.03			4.95
24	C	C	C	C	C	C				4.93
25	C	C	C	C	C	C				4.94
26	C	C	C	C	C	C				4.93
27	C	C	C	C	C	C	.06			4.93
28	C	C	C	C	C	C	.09			4.94
29	C	C	C	C	C	C				4.9[illegible]
30	C	C	C	C	C	C				4.94
31	C	C	C	C	C	C	.16			4.9[illegible]

C = closed o = open

Higgins Lake Dam Nov 1 2018



Staff Gauge

Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	O	O	O				4.98
2	C	C	C	O	O	O				4.96
3	C	C	C	O	O	O				4.96
4	C	C	C	O	O	O				—
5	C	C	C	O	O	O	.12			4.95
6	C	C	C	O	O	O	.53			4.99
7	C	C	C	O	O	O	.10			5.00
8	C	C	C	O	O	O				5.00
9	C	C	C	O	O	O		T		4.99
10	C	C	C	O	O	O	.12	1/2		4.99
11	C	C	C	O	O	O		1		4.98
12	C	C	C	O	O	O		3/4		4.97
13	C	C	C	O	O	O		1/2		4.95
14	C	C	C	O	O	O				4.94
15	C	C	C	O	O	O				4.93
16	C	C	C	O	O	O		2		4.94
17	C	C	C	O	O	O		1/4		4.93
18	C	C	C	O	O	O				4.93
19	C	C	C	O	O	O				4.92
20	C	C	C	C	C	C				4.90
21	C	C	C	C	C	C				4.92
22	C	C	C	C	C	C				4.88
23	C	C	C	C	C	C				4.87
24	C	C	C	C	C	C	.05			4.88
25	C	C	C	C	C	C	.10			4.91
26	C	C	C	C	C	C				4.94
27	C	C	C	C	C	C				4.91
28	C	C	C	C	C	C				4.90
29	C	C	C	C	C	C				4.88
30	C	C	C	C	C	C				4.8[illegible]
31										

C = closed o = open

EXHIBIT D

Higgins Lake Dam April -09

Staff Gauge

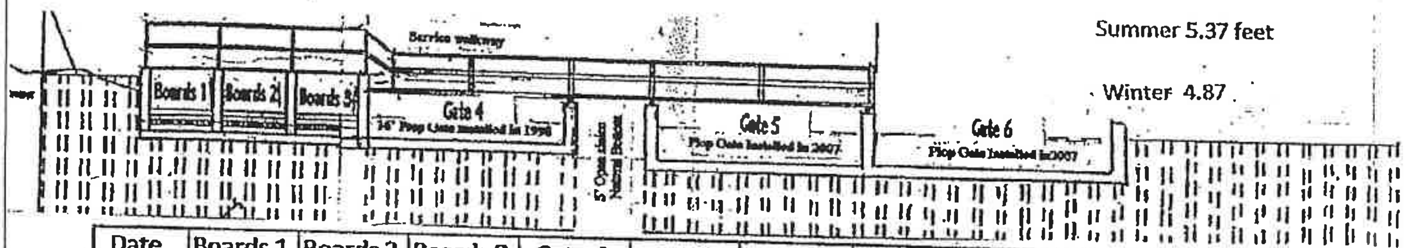
Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	O	O	O				4.97
2	C	C	C	O	O	O	.05	T		4.97
3	C	C	C	O	O	O	.09	T		4.98
4	C	C	C	O	O	O				4.97
5	C	C	C	O	O	O	.09	1/8		4.98
6	C	C	C	O	O	O	.04			4.98
7	C	C	C	O	O	O				4.99
8	C	C	C	O	O	O	.15			5.01
9	C	C	C	O	O	O				5.02
10	C	C	C	O	O	O	.03			5.01
11	C	C	C	O	O	O				5.02
12	C	C	C	O	O	O	.30			5.05
13	C	C	C	O	O	O				5.06
14	C	C	C	O	O	O				5.08
15	C	C	C	C	C	C				5.11
16	C	C	C	C	C	C				5.11
17	C	C	C	C	C	C				5.12
18	C	C	C	C	C	C	.55			5.20
19	C	C	C	C	C	C	.48			5.23
20	C	C	C	C	C	C				5.23
21	C	C	C	C	C	C				5.23
22	C	C	C	C	C	C				5.22
23	C	C	C	C	C	C	.08			5.23
24	C	C	C	C	C	C				5.24
25	C	C	C	C	C	C				5.24
26	C	C	C	C	C	C				5.26
27	C	C	C	C	C	C				5.25
28	C	C	C	C	C	C				5.23
29	C	C	C	C	C	C				5.23
30	C	C	C	C	C	C				5.23
31										

C = closed o = open

Higgins Lake Dam May 2019



Staff Gauge

Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C	.23			5.27
2	C	C	C	C	C	C	.26			5.31
3	C	C	C	C	C	C	.21			5.32
4	C	C	C	C	C	C				5.32
5	C	C	C	C	C	C				5.32
6	C	C	C	C	C	C				5.33
7	C	C	C	C	C	C				5.32
8	C	C	C	C	C	C				5.31
9	C	C	C	C	C	C	.53			5.37
10	C	C	C	C	C	C	.28			5.39
11	C	C	C	C	C	C				5.40
12	C	C	C	C	C	C				5.39
13	C	C	C	C	C	C				5.38
14	C	C	C	C	C	C				5.39
15	C	C	C	C	C	C				5.39
16	C	C	C	C	C	C				5.39
17	C	C	C	C	C	C	.04			5.38
18	C	C	C	C	C	C	.03			5.39
19	C	C	C	C	C	C				5.40
20	C	C	C	C	C	O	.42			5.41
21	C	C	C	C	C	O	.03			5.41
22	C	C	C	C	C	O	.05			5.40
23	C	C	C	C	C	O	.44			5.42
24	C	C	C	C	C	O				5.43
25	C	C	C	C	C	O	.17			5.45
26	C	C	C	C	C	O	.05			5.45
27	C	C	C	C	C	O				5.45
28	C	C	C	O	O	O	.[illegible]			5.50
29	C	C	C	O	O	O	.[illegible]			5.50
30	C	C	C	O	O	O				5.48
31	C	C	C	O	O	O				5.47

Open 3

open 2+3

C = closed o = open

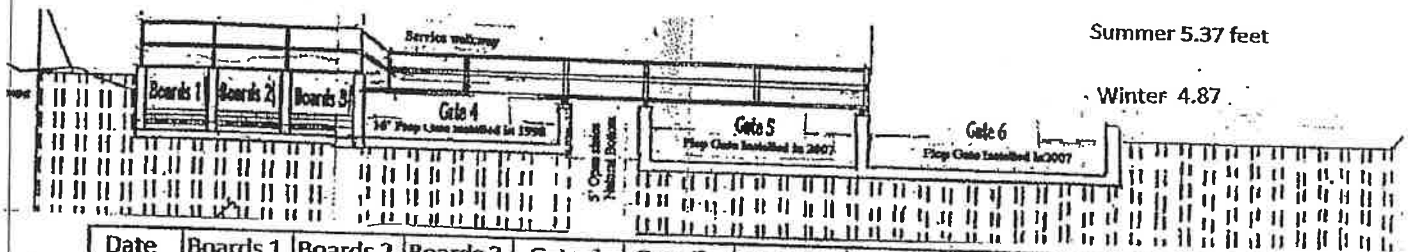
Reviewed 4.10.[illegible]

Higgins Lake Dam June 2019

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	O	O	O				5.46
2	C	C	C	O	O	O				5.44
3	C	C	C	C	C	C				5.41
4	C	C	C	C	C	C				5.40
5	C	C	C	C	C	C	.12			5.42
6	C	C	C	C	C	C				5.43
7	C	C	C	C	C	C				5.42
8	C	C	C	C	C	C				5.41
9	C	C	C	C	C	C				5.43
10	C	C	C	C	C	O	1.07			5.50
11	C	C	C	C	O	O				5.49
12	C	C	C	C	O	O				5.49
13	C	C	C	C	O	O	.96			5.56
14	C	C	C	C	O	O	.25			5.57
15	C	C	C	C	O	O	.51			5.59
16	C	C	C	C	O	O	.02			5.57
17	C	C	C	C	O	O				5.55
18	C	C	C	C	O	O				5.53
19	C	C	C	C	O	O				5.53
20	C	C	C	C	O	O	.10			5.51
21	C	C	C	C	O	O				5.49
22	C	C	C	C	O	O				5.47
23	C	C	C	C	O	O				5.45
24	C	C	C	C	O	O	.29			5.47
25	C	C	C	C	O	O	.29			5.47
26	C	C	C	C	O					5.45
27	C	C	C	C	O	O				5.44
28	C	C	C	C	C	C	.14			5.44
29	C	C	C	C	C	C	.04			5.42
30	C	C	C	C	C	C				5.41
31										

C = closed o = open

Higgins Lake Dam July 2019

Staff Gauge

Summer 5.37 feet

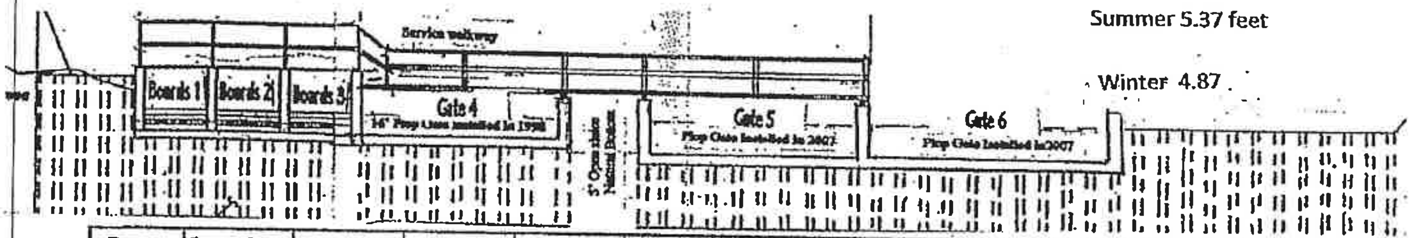
Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C				5.39
2	C	C	C	C	C	C				5.40
3	C	C	C	C	C	C				5.39
4	C	C	C	C	C	C				5.38
5	C	C	C	C	C	C				5.41
6	C	C	C	C	C	C				5.41
7	C	C	C	C	C	C				5.39
8	C	C	C	C	C	C				5.38
9	C	C	C	C	C	C				5.36
10	C	C	C	C	C	C				5.34
11	C	C	C	C	C	C				5.35
12	C	C	C	C	C	C				5.32
13	C	C	C	C	C	C				5.30
14	C	C	C	C	C	C				5.28
15	C	C	C	C	C	C				5.32
16	C	C	C	C	C	C				5.35
17	C	C	C	C	C	C				5.35
18	C	C	C	C	C	C				5.33
19	C	C	C	C	C	C				5.39
20	C	C	C	C	C	C				5.43
21	C	C	C	C	C	C				5.45
22	C	C	C	C	C	C				5.43
23	C	C	C	C	C	C				5.40
24	C	C	C	C	C	C				5.38
25	C	C	C	C	C	C				5.37
26	C	C	C	C	C	C				5.37
27	C	C	C	C	C	C				5.38
28	C	C	C	C	C	C				5.40
29	C	C	C	C	C	C				5.40
30	C	C	C	C	C	C				5.40
31	C	C	C	C	C	C				5.38

C = closed o = open

Revised 4.10.18

Higgins Lake Dam Aug 2019



Staff Gauge

Summer 5.37 feet

Winter 4.87

Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow	Temp.	Staff Gage
1	C	C	C	C	C	C				5.37
2	C	C	C	C	C	C				5.36
3	C	C	C	C	C	C				5.35
4	C	C	C	C	C	C	.22			5.34
5	C	C	C	C	C	C				5.34
6	C	C	C	C	C	C	.30			5.36
7	C	C	C	C	C	C				5.34
8	C	C	C	C	C	C	.04			5.33
9	C	C	C	C	C	C				5.30
10	C	C	C	C	C	C				5.28
11	C	C	C	C	C	C				5.27
12	C	C	C	C	C	C				5.26
13	C	C	C	C	C	C				5.25
14	C	C	C	C	C	C				5.24
15	C	C	C	C	C	C	.02			5.23
16	C	C	C	C	C	C				5.21
17	C	C	C	C	C	C	.19			5.23
18	C	C	C	C	C	C				5.22
19	C	C	C	C	C	C	.13			5.23
20	C	C	C	C	C	C				5.21
21	C	C	C	C	C	C				5.21
22	C	C	C	C	C	C				5.20
23	C	C	C	C	C	C				5.17
24	C	C	C	C	C	C				5.14
25	C	C	C	C	C	C				5.17
26	C	C	C	C	C	C				5.12
27	C	C	C	C	C	C	.22			5.14
28	C	C	C	C	C	C	.38			5.15
29	C	C	C	C	C	C				5.13
30	C	C	C	C	C	C				5.12
31	C	C	C	C	C	C				5.11

C = closed o = open

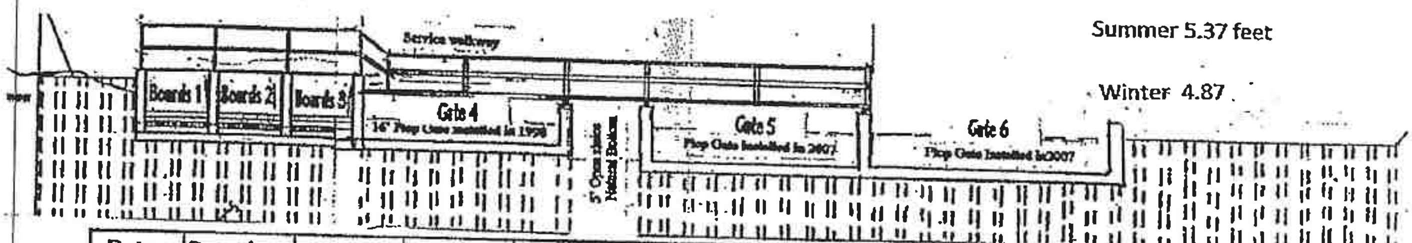
Revised 4.10.16

Higgins Lake Dam Sept 2019

Staff Gauge

Summer 5.37 feet

Winter 4.87



Date	Boards 1	Boards 2	Boards 3	Gate 1	Gate 2	Gate 3	Rain	Snow.	Temp.	Staff Gage
1	C	C	C	C	C	C				5.11
2	C	C	C	C	C	C				5.09
3	C	C	C	C	C	C	.65			5.11
4	C	C	C	C	C	C	.08			5.12
5	C	C	C	C	C	C				5.10
6	C	C	C	C	C	C				5.10
7	C	C	C	C	C	C	.19			5.11
8	C	C	C	C	C	C				5.10
9	C	C	C	C	C	C				5.09
10	C	C	C	C	C	C	.20			5.09
11	C	C	C	C	C	C	.06			5.14
12	C	C	C	C	C	C				5.19
13	C	C	C	C	C	C				5.20
14	C	C	C	C	C	C				5.21
15	C	C	C	C	C	C				5.24
16	C	C	C	C	C	C				5.25
17	C	C	C	C	C	C				5.24
18	C	C	C	C	C	C				5.24
19	C	C	C	C	C	C				5.22
20	C	C	C	C	C	C				5.22
21	C	C	C	C	C	C				5.22
22	C	C	C	C	C	C				5.25
23	C	C	C	C	C	C				5.32
24	C	C	C	C	C	C				5.32
25	C	C	C	C	C	C				5.31
26	C	C	C	C	C	C				5.31
27	C	C	C	C	C	C				5.29
28	C	C	C	C	C	C				5.29
29	C	C	C	C	C	C				5.25
30										
31										

C = closed o = open

[illegible] 4.10.16

EXHIBIT 17

2016 "Michigan Summer" Historical Lake Levels
(Together With Legal Lake Level Line)

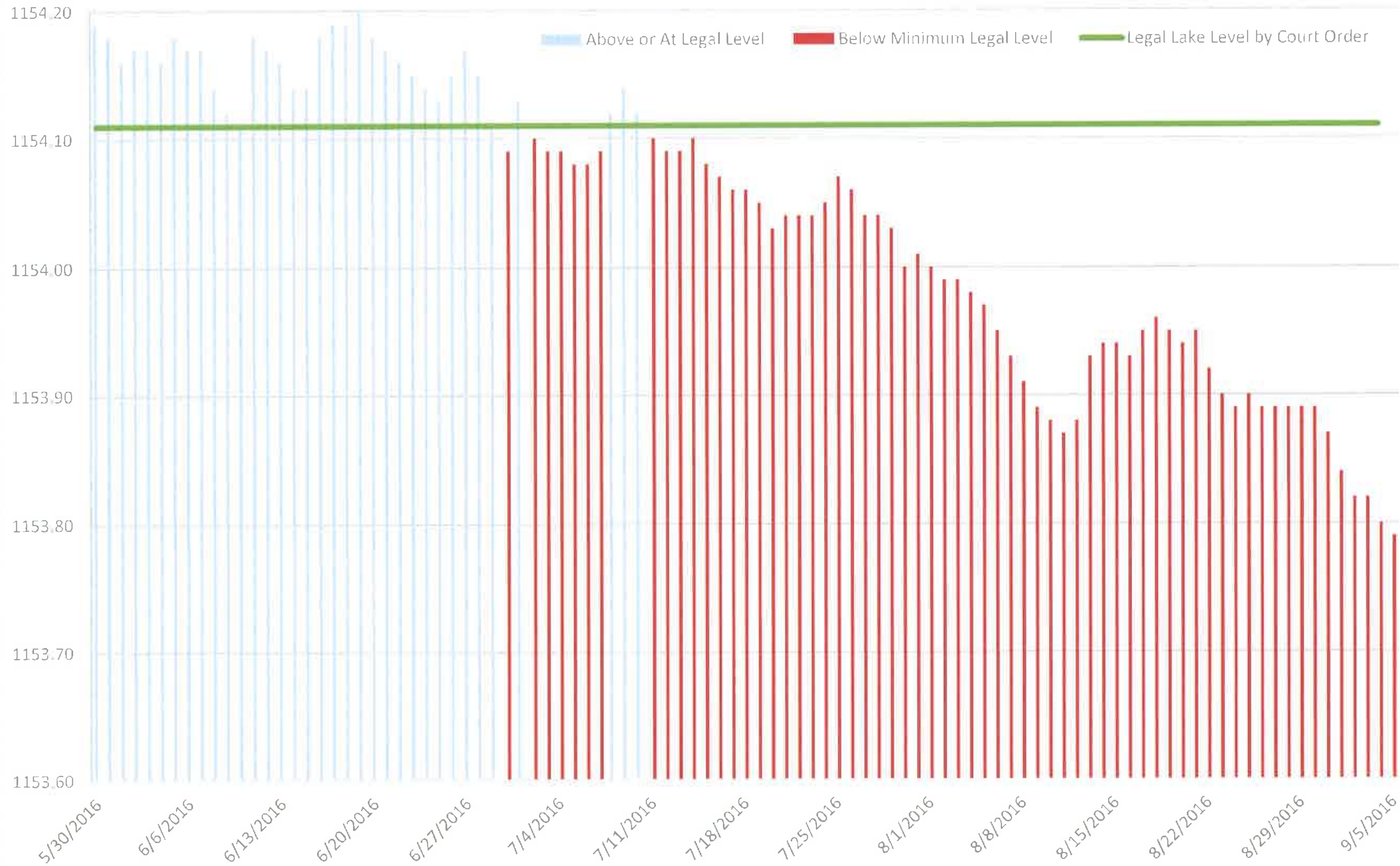


EXHIBIT
E
OUTSIDE LEGAL COUNSEL PLC
www.olcplc.com

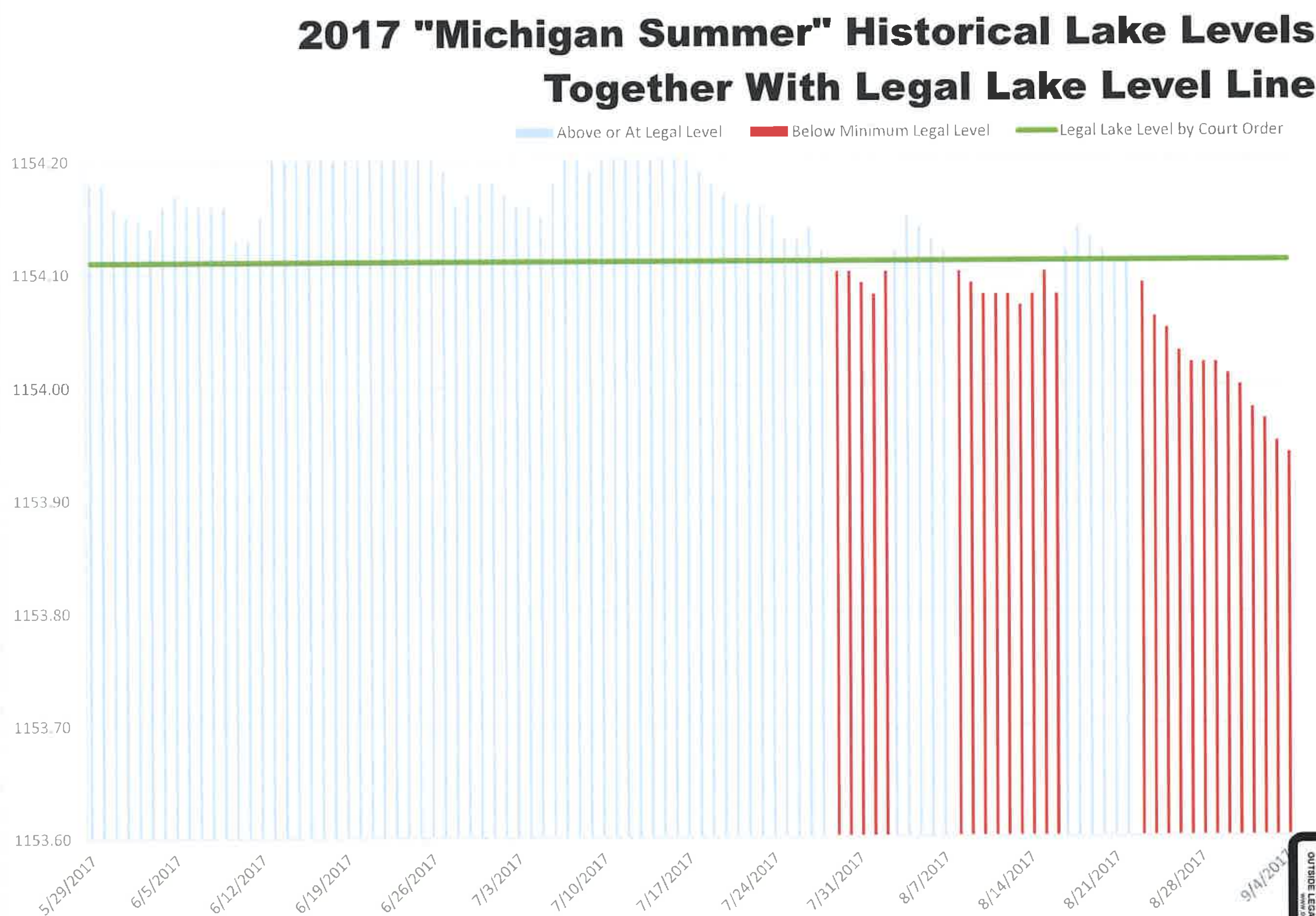


EXHIBIT
F
OUTSIDE LEGAL COUNSEL PLC
www.olcplc.com

EXHIBIT
G
OUTSIDE LEGAL COUNSEL PLC
www.olcplc.com

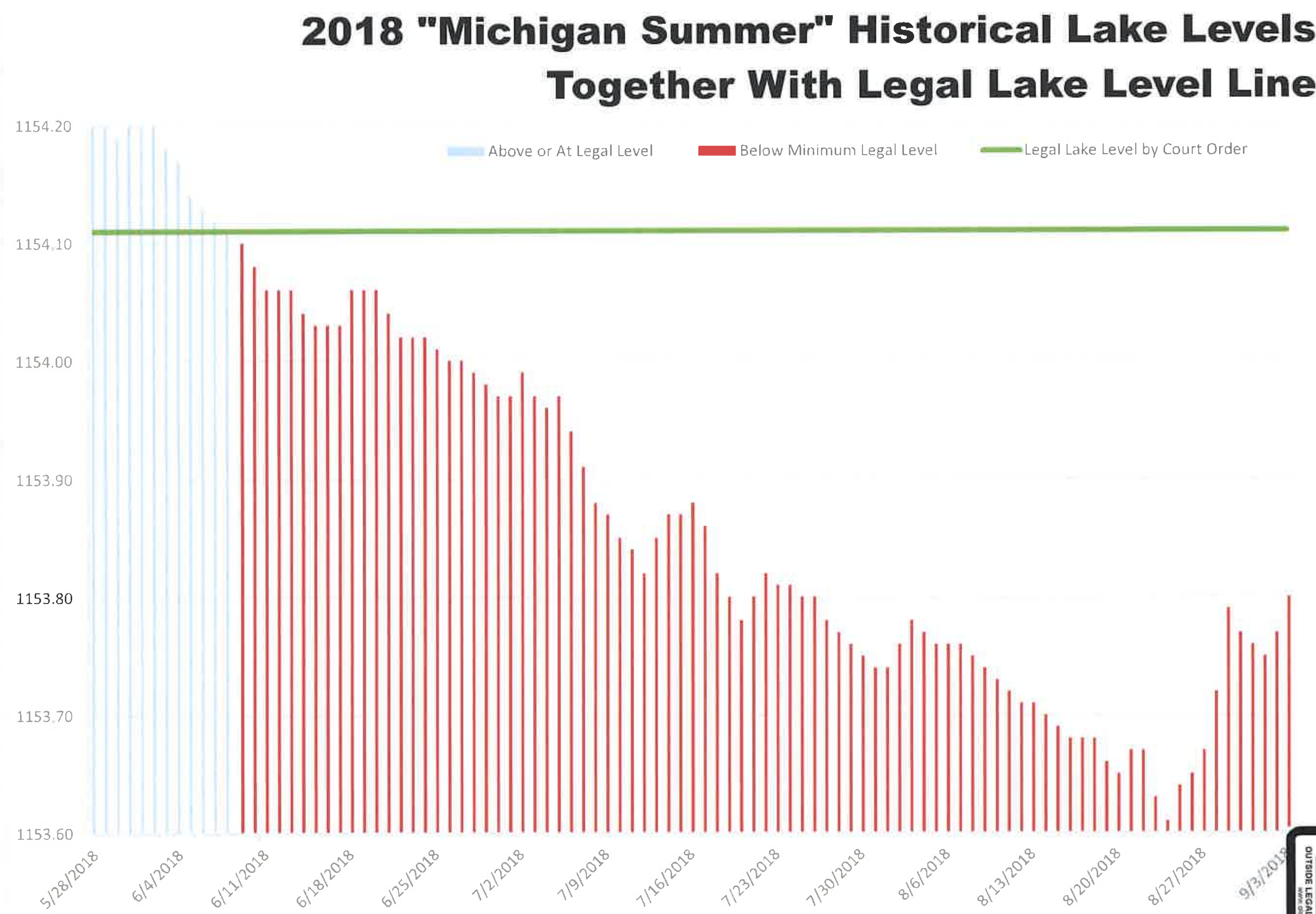


EXHIBIT 18

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF ROSCOMMON

IN THE MATTER OF:
THE WATER LEVELS OF
HOUGHTON LAKE, HIGGINS LAKE, AND
LAKE ST. HELEN

Case No. 81-3003-CF
Hon. Robert W. Bennett

OUTSIDE LEGAL COUNSEL PLC
By: PHILIP LEE ELLISON (P74117)
Attorney for Petitioners
P.O. Box 107
Hemlock, MI 48616-0170
(989) 642-0055

STATE OF MICHIGAN DEPARTMENT
OF ATTORNEY GENERAL
By: DANIEL P. BOCK (71246)
Attorneys for Intervenor MI-EGLE
P.O. Box 30755
Lansing, MI 48909
(517) 335-7664
bockd@michigan.gov

OLSON, BZDOK & HOWARD, P.C.
By: CHRISTOPHER M. BZDOK (P53094)
Attorneys for Intervenor Property Owners
420 East Front Street
Traverse City, MI 49696
(231) 946-0044
chris@envlaw.com

ROSATI SCHULTZ JOPPICH
& AMTSBUECHLER, PC
By: MATTHEW J. ZALEWSKI (P72207)
Attorneys for Respondent Roscommon
County
27555 Executive Drive, Suite 250
Farmington Hills, MI 48331-3550
(248) 489-4100
mzalewski@rsjalaw.com

CAREY & JASKOWSKI, PLLC
By: WILLIAM L. CAREY (P31602)
Attorneys for Non-Profit Intervenors
2373 S. I-75 Business Loop
P.O. Drawer 665
Grayling, MI 49738
(989) 348-5232
wcarey@carey-jaskowski.com

HOUGHTON LAKE IMPROVEMENT BOARD
By: James R. Deamud (P23267)
Attorney for Governmental Entity
Intervenors
4419 W. Nestel Road
Houghton Lake, MI 48629
(989) 387-1458
deamud@hlmich.net

ORDER VACATING ORDER TO SHOW CAUSE

At a session of the Court held in the
Roscommon County Courthouse, Roscommon, Michigan

on ______________________________

PRESENT: HON ROBERT W. BENNETT
CIRCUIT COURT JUDGE

This matter having come before the Court on Respondent Roscommon County's Motion to Strike Affidavit of Eric Ostergren and/or to Set Aside *Ex Parte* Order to Show Cause, the Court having considered the briefs of the parties, the Court having heard oral argument on October 21, 2019, and the Court being otherwise fully advised in the premises;

IT IS ORDERED that Respondent's Motion is GRANTED, for the reasons stated on the record;

IT IS FURTHER ORDERED that this Court's *Ex Parte* Order to County of Roscommon and/or its Delegated Authority to Show Cause dated May 28, 2019 is VACATED, for the reasons stated on the record.

This is a final order that resolves the last remaining claim and closes the case.

HON. ROBERT W. BENNETT P44262
Circuit Court Judge

APPROVED AS TO FORM FOR ENTRY:

Philip L Ellison (w/consent)
PHILIP LEE ELLISON (P74117)
Attorney for Movants

Christopher M Bzdok (w/consent)
CHRISTOPHER M. BZDOK (P53094)
Attorney for Intervenor Property Owners

Daniel P. Bock (w/consent)
DANIEL P. BOCK (P71246)
Attorney for Intervenor MI-EGLE

MATTHEW J. ZALEWSKI (P72207)
Attorney for Respondent Roscommon County

William L. Carey (w/ consent)
WILLIAM L. CAREY (P31602)
Attorney for Non-Profit Intervenors

James R. Deamud (w/consent)
JAMES R. DEAMUD (P23267)
Attorney for Intervenor Houghton Lake Improvement Board

EXHIBIT 19

STATE OF MICHIGAN

34TH JUDICIAL CIRCUIT COURT (ROSCOMMON COUNTY)

IN THE MATTER OF THE WATER LEVEL
OF HOUGHTON LAKE, HIGGINS LAKE,
AND LAKE ST. HELEN

File No. 81-003003-CF

RESPONDENT ROSCOMMON COUNTY'S MOTION TO STRIKE AFFIDAVIT OF ERIC OSTEGREN AND/OR TO SET ASIDE EX PARTE SHOW CAUSE ORDER

BEFORE THE HONORABLE ROBERT W. BENNETT, CIRCUIT JUDGE

Roscommon, Michigan - Monday, October 21, 2019

APPEARANCES:

For the Movants:	MR. PHILIP LEE ELLISON (P74117) Outside Legal Counsel, PLC P.O. Box 107 Hemlock, Michigan 48626 (989) 642-0055
For the County of Roscommon:	MR. MATTHEW J. ZALEWSKI (P72207) Rosati, Schultz, Joppich, & Amtsbuechler, PC 27555 Executive Drive Suite 250 Farmington Hills, Michigan 48331 (248) 489-4100
For the Michigan Department of Environment, Great Lakes, and Energy; Michigan Department of Environment, Natural Resources, and Agriculture Division:	MR. DANIEL P. BOCK (P71246) Assistant Attorney General Michigan Dept of Attorney General 525 West Ottawa Street P.O. Box 30755 Lansing, Michigan 48933-1067 (517) 373-7540

APPEARANCES CONTINUED:

For the Eight Individuals: Anne and Richard Meeks, Elizabeth Wade, Don Correll, Philip Will, Julie and Gary Smith, and Stan Galehouse:	MR. CHRISTOPHER M. BZDOK (P53094) Olson, Bzdok, & Howard PC 420 East Front Street Traverse City, Michigan 49686 (231) 946-0044
For the Higgins Lake Property Owners Association and the Higgins Lake Conservancy:	MR. WILLIAM L. CAREY (P31602) Carey & Jaskowski, PLLC 2373 South I-75 Business Loop Grayling, Michigan 49738-2005 (989) 348-5232
For the Houghton Lake Improvement Board:	MR. JAMES R. DEAMUD (P23267) Attorney at Law 4419 West Nestel Road Houghton Lake, Michigan 48629 (989) 387-1458
RECORDED BY:	Ms. Jaimie L. Whisman, CER 7757 Certified Electronic Recorder (989) 387-3467

TABLE OF CONTENTS

WITNESSES:

None.

EXHIBITS:

None.

Roscommon, Michigan

Monday, October 21, 2019 - 1:01 p.m.

THE COURT: Okay. We'll call Water Level of Higgins Lake, 8 -- 81-3003-CF. Parties want to place an appearance on the record. Mr. Ellison?

MR. ELLISON: Yes. Good afternoon, your Honor. Philip Ellison appearing on behalf of all the movants.

MR. DEAMUD: James Deamud. I'm here on behalf of the Houghton Lake Improvement Board.

THE COURT: Thank you.

MR. CAREY: Your Honor, good afternoon. William Carey appearing on behalf of the Higgins Lake Property Owners Association and the Higgins Lake Land Conservancy, intervenors.

THE COURT: All right.

MR. ZALEWSKI: Good afternoon, your Honor. Matthew Zalewski on behalf of Roscommon County.

MR. BOCK: Good afternoon, your Honor. Dan Bock on behalf of the State of Michigan Department of Environment Great Lakes and Energy.

THE COURT: Okay.

MR. BZDOK: Good afternoon, your Honor. Christopher Bzdok on behalf of the intervening riparians on the northeast shore.

THE COURT: Okay. And does the County want to go first?

MR. ZALEWSKI: Yes, your Honor.

THE COURT: All right.

MR. ZALEWSKI: Good afternoon again. Your Honor, the Court is clearly familiar with the County's arguments that it's going to be bringing today, but today is ultimately the time for discussing its motion to strike or otherwise set aside the show cause order and dismiss the contempt proceeding that the County filed immediately after the petitioners in this case or the -- the movants for the contempt matter filed their motion for the show cause order.

Up to this point we've discussed some of these arguments in some different contexts so I don't necessarily want to just repeat all of them verbatim but hopefully structure them for you this afternoon in a way that really shows how narrow the inquiry is today in terms of what this contempt proceeding is trying to achieve, and why the County has filed this motion, and the different options that the Court has at this point in -- in front of it. Because for as many issues as are in front of the Court, it could dispose of this matter today on a very narrow issue. And that first issue is lack of personal jurisdiction over the alleged contemnor being the County.

As the County cites in its motion, a contempt proceeding, a show cause order, must be supported by an adequate affidavit. The petitioners acknowledge this. And if the affidavit is -- doesn't provide a sufficient factual foundation for contempt, then the court lacks personal jurisdiction over the contemnor that's the *Callahan v. Powers* case.

There is one affidavit submitted in support of the show cause order and that is the affidavit of Mr. Eric Ostegren. As we've noted in the past, it's a very short affidavit, six paragraphs long, only four of which have any attempts really at alleging facts.

As we talked about on the record last time, Mr. Ostegren persistently talks about the -- the County not achieving a minimum lake level. And as this process started, he talked about anything exceeding the -- essentially anything that would exceed the lake level established in 1982 would be okay, but anything that goes below would not. Petitioners backpedaled from that at the last hearing, and in their response brief for today's hearing said that the lake level is both a minimum and a maximum. How this supports contempt I'm not exactly sure at this point. If the petitioners themselves are not sure what the court order says, how can we understand what the alleged contempt is?

But even beyond that, if we look at the

operative factual allegations here, none of them show personal knowledge that contempt has occurred. Paragraph 2 of Mr. Ostegren's affidavit says that "it's commonly known and understood" that the County with its delegated authority has failed to keep the level at its legally mandated level. "Commonly understood" by whom? What are the factual foundations? What does this mean that the County has not maintained the level?

Attached to the motion is data from the US Geological Survey allegedly. This is -- the data that is attached is not directly from the US Geological Survey. It's not authenticated by anybody from the US Geological Survey. It's not interpreted by anybody from the US Geological Survey. In fact, it's not even interpreted by Mr. Ostegren, the person making the affidavit. Mr. Ostegren states that it's his attorney that complied this information, that attached these "notations of violation" or "in range," which we have no idea what that means or how those conclusions were drawn. Certainly Mr. Ostegren in the affidavit doesn't tell us. So where is the factual support for contempt based on Mr. Ostegren's personal knowledge? If there's any factual underpinning, perhaps it's from Mr. Ellison who is trying to make himself a witness in this case, which would create some interesting situations moving forward, but there clearly are no facts here just a lot of conclusions.

Mr. Ostegren states that County officials have been told repeatedly essentially that they're doing a bad job. Well, as I state in the motion, presumably he does know that, but how does that achieve contempt? If it was sufficient for any person who has an ax to grind with a government body to submit an affidavit that says, "I've yelled at the County government; and therefore, they should be held in contempt," well, we would be here all day long with every government entity that exists. That's not factual support for contempt.

And then, Item 5, going all the way back to when this proceeding started, Mr. Ostegren actually stated that the lake level had achieved it's minimum or its legal level had gone slightly above and that a gate was opened. That's actually consistent with not being in contempt, especially by their newest interpretation in their most recent response brief saying that the legal level is a minimum and a maximum. Well, if it exceeds the maximum, then opening the gate is the right thing to do. So on this basis alone, the affidavit is not indicating a sufficient basis for contempt. And the County's argument is therefore that it does not meet the standards for contempt.

The County also has an additional argument on this point with respect to the standing of Mr. Ostegren. He is not a riparian. He is not an interested party for purposes of NREPA. And in that case, if this were an actual lawsuit as opposed to a motion that was filed in a 38-year-old matter, I would probably be standing here moving to dismiss Mr. Ostegren from the lawsuit for lack of standing. Now, maybe the other people have standing, we're not exactly sure, we don't have a lot of facts about them. But for purposes of this very narrow question of contempt, this isn't a lawsuit, this is just a question of contempt, Mr. Ostegren is the only person who matters in this case. And if Mr. Ostegren does not have standing, well, then he has no basis for submitting an affidavit to support the contempt. That affidavit is improperly included in the motion supporting the show cause order and should be stricken from the record under Michigan Court Rule 2.115(B). In which case, there's no affidavit remaining to support the contempt order and the matter should be dismissed.

So those are the jurisdictional issues. It's just Mr. Ostegren's complaint that needs to be focused on. The nature of what he's alleging, the types of facts are very general, and the position is that this does not support contempt and it's not a properly included affidavit since he would not be otherwise a proper party to this type of a matter to begin with.

But let's suppose the Court decides to get past the jurisdictional issues and move on to the next question. That's when we start talking about the remedies. Is contempt the proper vehicle? Now, according to Mr. Ellison's response, we should stop here. We should stop and have the evidentiary hearing to first find out if the County is in contempt. More on that in a second. But I would argue that that's not necessary. Much like in a summary disposition context, we can stand here today and assume for purposes of the motion that the County is in contempt. If we're assuming that, of course without conceding it, if we assume that, what does it mean? What does it mean that the County is in contempt? And where do we go from there?

Now, of course the County has been pointing out from the beginning the extraordinariness of this remedy in that the entire County Board of Commissioners theoretically could be thrown in jail. That is an extraordinary remedy. Now, the petitioners are saying, "Well, we're maybe not going to advocate that." But in fairness to them, it's not their choice, it's the Court's. That threat of imprisonment will always be looming overhead any -- this proceeding as long as it's going on. And if this Court fashions a remedy that the County is unable to comply with, it is at risk of ultimately being imprisoned the -- or some representative of it for that ongoing alleged contempt.

So the question is: What would -- what type of remedy would the Court fashion? Based on what the petitioners here are asking for, they're asking for implementation of the Spicer Report recommendations, at least that seems to be the clearest statement that they've made, and those recommendations as we've come to learn are banking water in the spring time or installing a restrictor plate on the low-flow channel that was mandated by the State of Michigan back when the control structure was revised in 2007. The problem with both of these is that they would put the County in a position of either being in contempt for other purposes or running a foul of state law, state permitting requirements.

By petitioners' own characterization now of the level as a minimum and a maximum, if water is banked, well, then that is a violation of the lake level. They say that they don't want a review of the lake level, and in fairness, they haven't directly said that they want a review of the lake level, but that's certainly the effect of what they're asking for. And some of the law that we provided for you said if the Court enters any order that has that effect, well, then that's actually establishing a new lake level for which the whole process of evidence gathering would be required. So to order the County to exceed the lake level at this point would be to order it to purge its contempt through contempt, and that simply does not make sense.

So then the issue of the restrictor plate comes down to the State's requirements. We know based on the evidence that I attached to the brief that that low-flow channel was put into the dam based on a state permit and state statutory requirements saying that the County has to manage the level -- the control structure for the betterment of the entire watershed balancing all of these different factors: recreation, environment, erosion, etcetera. And the low-flow channel is part and parcel of that. That was mandated by the State under the statutes that I've cited in the motion. If this County messes with that low-flow channel, it's a violation of the permit and a potential criminal act. So certainly, the Court cannot require a criminal act.

Key to the issue of civil contempt and remediating it is that the alleged contemnor has to hold the keys to the prison in his pocket. He has to be able to say, "Yes, your Honor, I am going to comply with your order today and purge myself of my contempt." The County can't do that under the scenarios that are suggested by the petitioners. One would put them in contempt. Another they would have to make modifications to the control structure that requires state permitting approval, of course, require design. And we haven't talked much either about the financing. Somebody would have to pay for these modifications. Chances are it'd be through a special assessment district on the riparians, which Mr. Ostegren is not one. That too, has its own public hearing process and is subject to an entire County board vote. These are all processes that would have to go -- be gone through before any of these recommendations could be put into place. It would be impossible for anybody at the County to say, "Yes, your Honor, I will comply with the order today to stay out of jail."

So essentially at this point we also have potential concerns about, you know, can the judicial branch order the County to spend money on a project like this? There could be potential separation of power concerns there.

So even if we get past the jurisdictional issues and we assume the County is in contempt, it's not redressable. There isn't a remedy that would allow the County to purge itself of its contempt.

Part and parcel of that too, there's some disagreement between the petitioners and the County as to what's a discretionary act. I don't think the County has ever argued that its requirement to maintain the lake level is mandatory; however, what the petitioners are asking for, specific means of maintaining the lake level, are discretionary. As you look at the statute, the County "may" acquire property. The County "may" install a dam. The County "may" do a lot of different things. That language of discretion is in there on the issue of implementation.

And I point out, too, I think that the individual riparians, the intervening riparians, did a very nice job talking about the *Glen Lake* Case. Talking about how there is some level of discretion in managing from year-to-year for seasonal fluctuations that is baked in there.

When it comes to the County's mandatory responsibilities, the petitioners have not argued that the County is not drawing up the lake in the spring or drawing it down the fall. They're not arguing that the County is not doing its regular inspections. All things that would probably be within its mandatory responsibilities. They just don't like the way that the lake level's being provided for in the interim. They don't like the fact that mother nature draws it down and the County can't -- you know, there's only so much that the County can do in light of the circumstances. And as one of the cases I -- I cited in my brief said, the NREPA does not provide a cause of action for people who are dissatisfied with the County's exercise of its discretion.

So that not only is relevant to the issue of the remedy but then the ultimate question: Suppose we do get to that ultimate question of is the County in contempt? Should it show cause? Keep in mind a show cause hearing doesn't have to result in an evidentiary hearing and testimony. It can be resolved on the record in front of the Court today through this hearing if it -- the Court decides to get to the merits. And I think all those points that I've put out as to what the County has done to achieve its mandatory responsibilities shows that, no, the County is not in contempt; the County is doing exactly what it's required to do. Maybe some people don't like the way it's turning out. Maybe circumstances have changed since that low-flow channel has come in, but there are ways to look at that. As unsatisfying as it may be to dismiss this proceeding when we're all at the table and everyone's watching, there are proper ways to do it, and contempt is not one of those means of achieving what they want to achieve.

So on that point, I'm always loathed to do it, I very rarely do it, but I am asking the Court to consider if it grants the relief the County is asking for today and dismisses this matter for the -- any or all of the reasons that I've stated today and in my filings, I would ask the Court to entertain the County's request for sanctions under Michigan Court Rule 1.109(E)(6) and/or (E)(7). I think (E)(6) would be most appropriate today since it can be done without motion and it can be done on the Court's own will. (E)(7) is for frivolous matters and would probably require some motion practice. But the response that we received after four months of having the motion -- my motion available I think pretty clearly shows that there's no basis in law for pursuing this as a contempt hearing. There is no basis in fact under Mr. Ostegren's affidavit and the applicable law pertaining to what it takes to launch a contempt hearing. And, you know, you can look at the evidence yourself and determine whether there is any sign of potential ill will, but I don't even think we need to get there. This -- the papers have to be signed with a reasonable expectation that the allegations are supported by fact, by law, or a reasonable argument for the extension of law, and there simply is no viable case law that's cited to rebut the various arguments that the County has made and the intervenors have made as well. So unless the Court has any questions, I -- I thank you.

THE COURT: Thank you.

Mr. Bock, do you want to go next?

MR. BOCK: Yes, your Honor. Thank you, your Honor. I'm going to be brief here and for the most part rest on the arguments that were set forth in the state's brief. I do want to just make a few quick points:

First of all, as set forth in the brief, EGLE agrees with the arguments raised by the County. Ordinarily we would be here under a motion for summary disposition because it is EGLE's position that the movants' motion does not set forth any actual allegations of contempt even if we were to accept as true all the facts alleged in that motion. And the reason for this is that the movants' motion is premised entirely on what we've set forth in the brief as four fundamental errors.

First of all, the movants' motion does clearly argue that the legal lake level is a minimum which can be gone above but cannot be gone below. Now, the movants' counsel in their response and on the record here last time has done a complete 180 and said, "No, it's not just a minimum." And we've cited in our brief and I believe the County's cited, they specifically refer to it in the motion as a "minimum." Even if it is both a minimum and a maximum as the County argues in its response, the fact remains that a deviation of one one-hundredth of a foot from a low -- a court ordered lake level is not contempt of court. It's not illegal; it is unavoidable. We attached the -- the affidavit of Mr. Trumble, who's a dam safety engineer with EGLE, who works on these kinds of projects all the time and established that some fluctuation of lake levels is unavoidable. And if we're talking about a matter of a few inches north or south from time to time, routinely those are naturally occurring and -- and cannot be avoided.

Additionally, the movants' motion seems to, as Mr. Zalewski said, advocate for adoption of the Spicer Group recommendations. As Mr. Zalewski said and as we said in our brief, the low-flow channel or low-flow bay in the Cut River Dam is a requirement of an existing EGLE permit that has been in place since 2007. Now, I -- I never want to be in the position of telling a Circuit Court judge that he or she does not have the authority to do something, but the Court of Appeals has clearly stated that when one wants to alter a lake level there is both the court order that's a requirement and any necessary permits from the state that is a parallel requirement. And the Court simply would not have jurisdiction at this stage to order essentially or to excuse a breach of a state permit requirement particularly when that permit has been in place for 12 years, when the time for challenging it and seeking judicial review of it has long since passed.

Finally, the fourth point we made in the brief or EGLE made in the brief was simply that this appears to be a procedurally incorrect mechanism. We cited I believe it was five different cases, appellate cases, going back to the 1960s that show that a -- a complaint or petition for a writ of mandamus is the method to compel compliance with a court ordered lake level. Did not find a single case where contempt was alleged to seek compliance with a court ordered lake level. And, in fact, I was able to find albeit in dicta a published Court of Appeals case that said a post judgment contempt motion is presumably, usually if not always, brought by parties to a case against other parties to the case to enforce the court order. Here we don't have that. The movants were not parties to this case. And so, I just wanted to reiterate EGLE's position that this is probably not even the procedurally correct method for seeking compliance with the lake level order.

Finally, one point I want to make to address something that was in -- in the movants' reply brief that was filed and served last week regarding the US Geological Survey data. In EGLE's motion we made the point that this appears to be inadmissible hearsay. And the movants in response said, "Well, these are public records. These are records kept in the ordinary course of business. They're admissible." And the problem with that, which was addressed in EGLE's brief in I believe it was Footnote 2 on page 3 -- yes. I make this argument all the time representing a government agency. We routinely have public records admitted into evidence on the basis of those two hearsay exceptions: public records, records kept in the ordinary course of business. The problem is that the records attached as Exhibits E through H in the movants' motion were not the US Geological Survey records. They were compilations prepared by Mr. Ellison or I -- I believe that was what the -- their filings said Mr. Ellison prepared them in which he claims to have imported that US Geological Survey data into the document that he prepared. I don't doubt that he imported it accurately, but the fact is that is hearsay within hearsay. What they filed was not a government record. It was not a record kept in the ordinary course of business. It was a document that the movants themselves or their counsel prepared incorporating information from government records or records kept in the ordinary course of business. That's hearsay within hearsay and plainly inadmissible under Michigan Rule of Evidence 805.

And so, for a number of reasons, even if we accept everything in the movants' original motion and in

Mr. Ostegren's affidavit as true, they still would not have successfully alleged an actual contemptable offense on the part of the County. Even if it was all true, we would not have an act of contempt of court. For those reasons, EGLE supports the County's motion to strike. And if the Court has any questions for me, I'm happy to answer those. If not, that concludes what I have.

THE COURT: Okay. Thank you.

MR. BOCK: Thank you.

THE COURT: Mr. Bzdok, you want to go next?

MR. BZDOK: Thank you, your Honor, I would. Your Honor, on behalf of my clients, the intervening riparians, I first of all would echo and concur with for the record the arguments that were made by the County in its pleadings and here today and also by the State in its pleadings and here today. In addition to that I have four brief comments.

The first one -- the first two really are just to reiterate some items from the response that we filed to this motion that was attached to our original intervention pleading. And the first one deals with this question of the minimum level. For the reasons that are stated in our pleading, for the reasons that were outlined in the State's pleading, for the reasons that were concurred with by the County today and also in its supplemental response, the summer level is not a minimum level. The winter level does contain a specific boundary. The summer level is not a minimum level. And there's been a lot of shifting of position, right, that's been outlined here already by my colleagues. The movants' attorney in the initial -- in the original pleading said it was a "minimum level." At the first hearing said, "Well, it's not a minimum level." Then there was conferring and then he came back and said it was a "minimum level." And now in the supplemental pleading that he filed the other day, "Well, what we really want is not a minimum, but we want sort of like a best practices by the County." So there's been a -- there's -- there's been a very sort of situational or shifting of what the position is, but the -- the clearest way to resolve this and to not invite further wasteful proceedings on this is to issue a ruling that on the face of the order it does not require the County to maintain a minimum level in the summer. And all of the -- all of the arguments are teed up for that, and so in the process of dismissing this proceeding, which we would concur you should do, we would urge you to rule that that minimum level is -- is not -- sorry -- that that summer level is not a minimum. I think that will put certain issues to rest. I think that will improve the process of the County, give the County some clear guidance in implementing this going forward, assist the County in dealing with some of the engagement they're receiving from the supporters of this motion, and I think that would do a lot of good and -- and be very economical in the long run if you made that ruling.

Second point is just to reiterate again from our response pleading that if they want to have a late level proceeding, they need to initiate a lake level proceeding. And so for all the reasons that were already stated, this is not an appropriate thing to do by contempt. It is not appropriate to try to implement recommendations that were not well thought out in an engineer's report. It is not appropriate to urge banking of water, changing of lake level practices, higher water levels, all these other things through a contempt proceeding. They want to do a lake level proceeding. They need to find a way that that's statutorily authorized and do something along those lines. Having a ruling already in this proceeding on the question of the minimum would go a long way towards at least streamlining that if not -- excuse me -- making it unnecessary, which we believe that it would be. Excuse me.

The third comment, which is not in the pleadings but just an observation from the proceedings so far, I would expect that the movants presented with the arguments that they've been presented with are gonna ask you today for some kind of procedural lifeline. Well, you know, for some reason you should continue this proceeding and let them make new arguments at another hearing, a further hearing, let us get to evidentiary, I would urge you to -- to see through that and not to indulge that.

And the fourth comment is that I would again as an outside observer, who has done some of these lake level cases, I look at the care in the County's affidavit of Alisha Pastell and the diligence and the good faith that is involved in daily dealing with this lake level, and the way they handle it, and the people who are involved and the way they keep records, and -- and the way they do everything. And the idea that one could, you know, draw from this set of processes and procedures that the County is somehow acting contemptuous of lake level orders is absurd. It's outrageous. And so, we do think the Court should seriously consider the County's motion for standing. When I look -- when I contrast just the utter sort of reckless lack of planning that went into this motion, the shifting versions of well, what is contempt? And what is the County supposed to do? Is it a minimum? It's not a minimum. They're just supposed to do a better job. And then I look at how very much diligently, thoroughly, and contentiously -- is probably the best word for it -- that the County deals with this implementation, I think you should look at whether there ought to be some accountability for the way all this went down. And that's it.

THE COURT: All right. Thank you.

MR. BZDOK: Thank you.

THE COURT: Mr. Carey?

MR. CAREY: The Court will be pleased as we go down the line that the comments get shorter and shorter. I'll be consistent with that. I -- probably change when we get to Mr. Ellison, but we'll see.

MR. ELLISON: Hardy har har.

MR. CAREY: HLPOA and the land conservancy, we are -- we are advocates for maintaining the level of the lake as ordered by this Court on a daily basis as best current available practices will allow. We intervened because at least one reading of the initial request for an order to show cause, one interpretation of that writing, could be that that there was advocacy for changing the level of the lake. Whether on a seasonal basis or by banking water, one could reasonably interpret their -- the original petition filed with this Court as making a plea for that before this Court.

HLPOA represents more than 500 riparians on the lake. I'll bet we have at least 400 different opinions as to what the level of the lake should be on any given day. So what we wanted -- why -- why we intervened and -- and why at least on behalf of HLPOA we filed an amended response, that provided I hope greater clarity for HLPOA's position, is that if the Court were to entertain in the context of this proceeding a change in the lake level or a dramatic change in how the lake level was to be managed, then we wanted a seat at the table. We think it's fair that 500 riparians should have a seat at the table if that kind of consideration is given by the Court.

With respect to whether the movants had standing to file the paperwork that we -- that they -- that they did, with respect to whether the movants have selected the proper procedure to present their complaints to the Court, we take no position in our answer. Our amended answer particularly on behalf of HLPOA I think fairly lays that out. I think those issues have been well briefed by the County, by the State, and in -- in Mr. Ellison's response. But certainly we want to make it very clear why we're here today. And we're very protective of the current order of the court and would not see a mechanism that's been presented to the Court today that would allow the Court to alter that order.

THE COURT: All right. Thank you.

Mr. Deamud?

MR. DEAMUD: Now, I am the furthest downstream in the beginning of this long discourse. I think that the position of the Houghton Lake Improvement Board and the 600 plus people around the lake that we represent as we try and maintain Houghton Lake are in positions similar to those reflected by Mr. Carey and his people. As far as today's proceeding, I think that we really don't have a position to take. We're here more to protect the interests of the watershed and its effect on Houghton Lake in the event that this proceeding goes forward and that we then have some remedies that could directly affect us downstream. But for today's proceedings, I yield to the wisdom of the preceding --

THE COURT: Okay.

MR. DEAMUD: -- parties. Thank you.

THE COURT: Thank you.

Mr. Ellison?

MR. ELLISON: Well, I hope I'm not viewed as the fly in the soup based on the end of the line here but a --

THE COURT: Last time you were called a "gadfly."

MR. ELLISON: Gadfly, well, I was gonna say, it's getting better, I guess, getting better. Your Honor, I would point this Court first and foremost to statutory authority 30708 under the Natural Resource Environmental

Protection Act. It says:

"After the court determines the normal level of an inland lake…," which there's no dispute this is an inland lake, "…in a proceeding initiated by the County…," which is what happened originally back many moons ago and resulted in the 1982 order, "…the delegated authority of any County or counties in which the inland lake is located shall…," not may, "…provide for and maintain that normal level."

The current 1982 order establishes the order or establishes the lake level at a, you know, 1154 point whatever beyond -- above the -- the sea level. It's not an invitation by the County to ignore or to otherwise say, "Well, shucks, we're doing the best we can with what we've got." I would -- I would be the first to admit to you that if we did not have the Spicer Report available to us to know that the County is not doing a good a job as it could be or should be doing in maintaining, quote, "that level" I don't know we would be here today. The reason being, your Honor, is that the order itself provides for where that lake level is supposed to be at all times except for the exception created for the ice, you know, the -- the ice buildup, the ice wintertime level. So we've called this for shorthand "the summer level" and "the winter level" going forward. The winter level is clearly a minimum. The summer level, despite parsing my language out over and over and I -- and it was -- it's almost like trying to find a typographical error by a -- by an editor, the normal level, that level is both a minimum and a maximum level. Now, my clients have been harmed greatly by the level not being or being far too low than, quote, "that level" under 30 -- 30708. This is not an option for the County to decide what they'll maintain. They need to maintain that level.

Now, today's motion hearing and this proceeding today, as I understood it from the last hearing, is not a question of whether there's contempt and not a question as whether there's a remedy for that contempt because this Court clearly has a remedy if you're in violation of a court order. The statue -- the Revised Judicature Act says this Court may enter any order to effectuate its judgments and its prior judge -- and its prior orders going forward. The question today is: Is this is the right process? And I'll be the first to tell you, Judge, and I said this the last time I was here, I'm not -- I'm not a hundred percent certain this is the right process going forward because -- guess what? -- this has never been done before. Because most of the time most counties obey orders of courts. They don't purposely neglect them as the way it's been show here.

Now, couple of points in response to the County's arguments here today. They are taking the position, without any law or practice that I'm aware of, that says that each movant needs to provide an affidavit. And frankly, the affidavit is merely a -- a technicality that needs to be supplied under the court rule because we have publicly available data that proves that the County is not maintaining, quote, "that level" under 30708. And what that -- and as the affidavit points out and as we have listed, is that paragraph 3:

> "Attached to the motion is data compiled by the US Geological Survey and complied by our attorney which verifies that the County of Roscommon together with its delegated authority routinely failed to meet the minimum lake level as required by the January 24, 2008 or 1982 order."

Again, my client -- our clients themselves are not seeking for permission for this Court to be able to argue that exceeding the order is a violation. Because personally as a lawyer violating any order of the court in any capacity is a violation. But the harm that my clients are suffering is because the County is failing to meet the minimum requirement that is supposed to be kept during the summer months, which is that level under 30708. So, Judge, I mean, as I'm standing here today before you, the question is: Do you have an affidavit which supports the possibility that there is the possibility, the likelihood that the County is in contempt of court? And the answer is, is yes. You have the data. Now, I will be the first to tell you I complied the data, and I also included the HLPOA's date -- charting of this data, and it's very clear. When it gets -- when a water level gets up to any point close to that edge, they're treating it as a maximum level going forward. Then all of a sudden the gates open and the water level all winter or all summer long continues to drop at far greater deviations then it ever would exceed.

Now, if the County came to you and said, "Judge, we're within one standard deviation both ways of the line throughout the summer," I would have a hard time arguing that the County was in contempt, but it's not. You look at the charts, it plummets all summer long. Now, I've presented to you a copy of the Spicer Report. The Spicer Report, these are engineers out of Saginaw who do this kind of work all over the state, this is the County's own hired researchers and experts to provide recommendations as to what can -- what can we do to -- to improve and otherwise maintain that level. And the County or, excuse me, the Spicer Report both provides that you could bank water as an option. Now, it didn't say bank hundreds of feet of water, it -- if -- it advocated for a few inches; in fact, a few fraction of a few inches above the -- above the level. But also to install a restrictor plate during the summer months. And what I'm hearing the County say today is, Judge, we're -- and the data shows -- I think the data clearly shows on its face they're doing a bad job of not comply with, quote, "that order" under 30708. So the question before you today is: Is this Court going to allow a County who's purposely not doing the best job they can to simply stick their hands in their pocket and say, "Golly shucks?" And I think as write in the brief shrug their shoulders and say, "Ah, we're just -- golly shucks, we're just doing what we can." Court orders need to be obeyed, and they're not being obeyed here. And they're not being obeyed by many standard deviations when it comes to the summer months.

So if the -- if -- if you want to take that chart, Judge, if we had the hypothetical where we turn the chart upside down and the Court on the order -- the order that was entered in 1982 was being violated by being over or being above the maximum, I think the County would be equally amount in contempt of court. It has to be maintained at that level. So what's their relief? What should they have done? And that's -- let me -- and I'm gonna play a hypothetical here. What should the County have done when they were realizing they weren't meeting the levels that they were required to maintain? They should've come back to this Court and asked for a level change. And in fact, they did so twice. You were a part of the process on that for the original one for the winter draw down when they asked for the additional lake level drop during the winter months that ultimately expired under Judge Baumgartner. There are processes for the County to do. What they're doing here is they're just simply disregarding this Court's order.

And the argument I'm hearing from the County today is is that there's no mechanism by which the legislature has provided for a remedy. I disagree with that. The legislature put it in the court's authority to establish the lake level. Courts enter judgements and orders. Orders are to be obeyed and followed. And if they're not, another statute comes in to play 600.1701 et seq. the contempt statute. If you don't obey an -- a lawful order of the court, you are in contempt. And there are processes by which this Court can alleviate that contempt.

Now, clearly, clearly, we don't want this Court to send out the bailiff -- oh, he's not here today -- send the bailiff out to go arrest the County commissioners; that's ridiculous. Obviously the purpose of this hearing is not to slap cuffs on elected officials. The purpose of this hearing is to show to this Court and to have the opportunity at a future evidentiary hearing to be able to show that the County is not meeting the summer level, greatly, and has the means by which to improve that and to be more compliant but are simply ignoring their obligation to do so.

The last point or two additional points I'd like to make, unless the Court has any specific questions, is the -- the -- I keep calling them DEQ, they're EGLE now. New governor, new name -- EGLE's position is that this Court has no authority to be able to order them to change the -- the dam structure, and that might be right, that might be right. But it's clear this Court has the authority to establish and to require that that lake level be maintained. And if the County has to make some sort of adjustment to the -- the Cut River control level structure then the Court should order that. And it only -- then and only then if the County -- if the State denies that application, the County can come back and say, "Judge, we should be excused from this obligation because of impossibility." "Impossibility" is a defense to contempt, but here they haven't shown impossibility. What they've shown is, is complacency, and that cannot stand when this Court is require -- when this Court's order requires that it -- the lake level be maintained quote, again, at "that level."

Lastly, Judge, I would point out I did attach copies to my response the -- the property locations of my clients going forward. The County has provided no law whatsoever that requires that an affidavit be provided by every movant. We are certainly willing to do that if this Court believes it's necessary. I don't think it's necessary. I've look at the stat -- the applicable court rule, it says, "an affidavit." It doesn't say an affidavit of every movant or every person seeking a finding of contempt. And frankly, that doesn't make much sense anyways. What it is is that process is designed to move the -- the ball forward. However, I would also indicate to the record today that if the -- in fact the Court is inclined to believe that those affidavits need to come from each movant, my client does have lake access. He is a president of the Birch Lake Dock Association. He has a dock in Higgins Lake as well as the fact that he motors a boat and enjoys the boat -- and enjoys the boat all during the summer months. The important reason why I bring this up is because the County is purposely misreading the applicable statute. And I would point the Court, excuse me, to the definition section of an "interested person" to mean it is "the department," which we have here today, and also "a person who has a record interest in the title to, right of ingress to, or reversionary right to land" not adjacent -- they're arguing -- they're reading as as adjacent to Higgins Lake. It doesn't say that. It says -- now I just lost my spot here -- "Would be affected by a permanent change in the natural or normal level of the inland lake." My client certainly would be affected by that as someone who motor -- who motors a boat and enjoys the recreational aspect, has access to that lake, lives near that lake, and also has a dock as part of an association that docks boat at that particular lake.

But let's to one step further, right, what does the statute provide for that interested person to do in this instance? There's only one spot in that whole statute where the interested persons is involved, and that's establishing the initial lake level. And I would point the Court to Section 30707, which is under Subsection 3, requires that when the -- when the prosecutor brings this action to establish the initial lake level, the court has to consider the testimony and evidence of all interested persons. It just provides for the process. Now, it doesn't provide for who can enforce that. Now, the County's argument's gonna be, "Well, the silence means that no one can enforce it." That can't possibly be right. We don't enter meaningless orders, and we don't enter orders that are --

THE COURT: I think the State and the County answered that by a writ of mandamus.

MR. ELLISON: The problem with the writ -- if that's the case, Judge, I will say to you today, I have with me a copy of a writ of mandamus and a summons available today, and if you rule so, I'm gonna go right down to the clerk's office and file a complaint for mandamus today and continue this proceeding going forward. However, I don't think it's a mandamus action because the -- the duty here is created by a court judgment, and the law under mandamus as I read it is is that unless you -- if you don't have another remedy in some other way, that's the only time you can resort to mandamus as the last effect, the last chance. Here there is clearly the ability to enforce a court's order, and that's contempt. Contempt is provided for not by court rule but by statute. The legislature created that. So I think reading part 307 and the contempt statute by the fact that they entered these particular -- that the court enters these particular orders and judgments can be read in pari materia, together, and I would encourage the Court to do so. Otherwise why would the legislature have made it the -- the court's providence to enter such an order to begin with? And especially if it gave the court no enforcement mechanism by which to go -- by which to hold contemptuous. Now, now, when I say "contemptuous," do I mean they're out there shoveling buckets of water out of the lake trying to lower the level? No, but they're not doing a very good job. And they're not doing it to keep it at that level. Reading those two statutes together the Court can fashion an appropriate remedy in this instance.

Unless the Court has any other particular questions, I think we've addressed that here today. And if the Court -- I would ask the opportunity if the Court -- just for the sake of -- of expediency because we have -- these have -- this proceeding has gone on some time, if this Court does require a mandamus action is the appropriate, that you would require the County's attorney to maintain so we can serve that lawsuit on them at that time.

THE COURT: All right.

MR. ELLISON: Thank you.

THE COURT: Thank you.

Anyone wish to make a response? Looks like, yes.

MR. ZALEWSKI: I'll be very, very quick, your Honor. On -- in terms of the impossibility of the complying with a contempt order, I think the County -- I think that's what we were arguing. It's impossible to comply with any such contempt order today as would be required under the civil contempt law.

Spicer Report came out in 2010, not part of the 1982 order. Clearly an ordered in 1982 could not mandate anything that came out as the part of a recommendation in a study that was performed 28 years later. And to the extent that the petitioners characterize the report as saying the County's doing a bad job or it could be doing better, you know, that's one -- one opinion from one entity. A report that was compiled and maybe had some political elements to it. The County chose not to proceed with that report at that time, and it was within its discretion to -- to do that.

And then finally, I would point out to -- since Mr. Bzdok kindly mentioned it, where as I maybe overlooked it a little, attached to my supplemental brief I filed there is the affidavit of Alisha Pastell that talks about the process that the County follows, the day-to-day process that the County follows to provide for that lake level and attached some data. Which if you read it together with the putative data that was attached to the affidavit, what's really important -- Mr. Ellison just said he's not saying that the County's throwing buckets of water out. Well, they aren't, and I think that that's really important because once that lake level is achieved if it goes over, they bring it down a little then they close the gates. We need to be very clear that once they open the gate, one or more of them, it's not like it's open all summer. Once that lake level starts, you know, it gets to be close to that required lake level, the gates close. And then whoa and behold the water level goes down thanks to nature and maybe in part the low-flow channel has some portion to -- to do with that beyond the County's control, but it's not like there's some intentional opening of the gate. So there is a management process in place that complies with the court order.

As far as whether any other types of proceedings would be appropriate, I would certainly, you know, not concede that any, you know, without seeing a future lawsuit whether it would be appropriate in any particular form, but there's no doubt that I think that what the petitioners are describing has gone far afield from contempt. Thank you.

THE COURT: All right. Thank you.

Anyone else wish a response?

MR. BOCK: I -- very, very brief, your Honor, thank you. I just want to make I think two quick points in response to what Mr. Ellison said in his presentation. Even though he -- he complained about the other attorneys parsing his words over and over, I'm gonna do that just one -- a little bit more.

So first, your Honor, I'd point out Mr. Ellison said, "Okay. If the County goes back and applies for a permit from EGLE and gets denied, then it can come back here and say that compliance or -- or, you know, curing the contempt is impossible and that's an impossibility." And the fact is the County did apply for a permit from EGLE and received one with a condition in 2007; so that's already been done. The notion that the County is required to go seek another permit that may or may not be granted is not -- is not required here because the permit's already been obtained. So I just wanted to make that point.

Additionally, Mr. Ellison when discussing the Spicer Group's recommendation of banking water he said, "Well, I'm not talking about banking hundreds of feet of water, I'm talking about a few inches above the lake level or a few fractions of inches." Well, the movants entire case is that even one one-hundredths of a foot, less than a tenth of an inch, is a violation. And originally it was one one-hundredths of a foot below is a violation but above was okay. Now, he has said simultaneously, "A deviation in either direction is an act of contempt, but I'm only advocating for them to go a few inches or a few fractions of inches above the lake level order when banking water." That's entirely inconsistent. It's internally inconsistent, and it's simply not a convincing argument. That's all I had, thank you.

MR. BZDOK: One comment, if you would indulge me?

THE COURT: Sure.

MR. BZDOK: Your Honor, I just want to come back to this question of the minimum again because it sounds like there is a need to provide some guidance which perhaps could minimize the amount of process going forward or new process going forward, and so, I just would ask -- I would direct your attention again to -- to my Exhibit 4 of my response, Figure 1.3.1, this is that MSU Geology Department Report on the lake and the control structure which is data combined by -- complied by scientists, not a lawyer, and which shows over a remarkable period of time, decades, there's a very, very consistent pattern. It's all tight within less than 12 inches. It goes up. It goes down. There's a seasonal variation to it. There's a regularity to it. And that's -- that's the natural cycle of the lake. There is some influence on that cycle by the manmade structure. And if we have another proceeding, we can get into whether that, you know, that influence ought to be, you know, the -- the needle ought to be moved one way or another on that influence. We certainly have opinions about that. But the idea that this diligent, conscientious process which produces a very regular cyclical pattern over many, many decades is somehow suddenly a contempt emergency is just absurd.

THE COURT: Thank you.

Okay. Anyone else wish a response? None, thank you. All right. Thank you.

All right. Well, before me today is the contempt of court request. The Court issued a show cause order based on the petition that was filed for contempt of court.

> "The objective of a civil contempt of court is to bring compliance with a court order not punishment for an offender," based on *Sword v. Sword*, 399 Mich 367, 1976.

> "If an inadequate affidavit is the predicate which underlies contempt or if no affidavit at all accompanies the petition, the court lacks jurisdiction." Based on *Callahan v. Powers*, 97 Mich App 166, 1980.

> "In order for there to be a contempt of court it must appear there has been a willful disregard or disobedience of authority under an order." *People v. Matish*, 384 Mich 568, 1971.

"A remedy has to be possible for a contempt with meaning within the ability of the contemnor." *Fittante, F-I-T-T-A-N-T-E, v. Schultz*, 20 Mich App 259, 1969.

"Parties seeking enforcement of an order bears the burden by preponderance of the evidence to prove the contempt." *Porter v. Porter*, 285 Mich App 450, 2009.

Under MCL 600.1715 on a showing of civil contempt, the court can issue a fine of up to $7,500, jail not to exceed 93 days or until the contempt is purged, fine, costs, and expenses of proceeding.

Now, in this particular case, the Court is in agreement that there are several fundamental errors in the request for show cause contempt. The first one is pointed out by the state of Michigan and it appears to the Court that the petitioners erroneously assume that the court ordered summer lake level of Higgins Lake is a minimum level which can be exceeded at will but cannot be gone below by any amount. Now, that position has vacillated from the start of this case through the mid-portion of this case and has somehow vacillated back again from the last hearing in the Court's impression based upon Mr. -- what Mr. Ellison is saying today.

The second fundamental misunderstanding the petitioners fail to understand that some fluctuation of the lake level is unavoidable and a fluctuation of a few inches above or below a court ordered normal lake level typically does not constitute an act of contempt of court or a violation of the Natural Resources Environmental Protection Act. And no one from -- from the petitioners' side of the case here has presented any authority to contradict that statement.

Thirdly, the petitioners wrongly believe that the Court can order the County to raise the level of Higgins Lake by closing the low-flow channel in the Cut River Dam without regard to the requirements of other state laws and/or permitting requirements.

Fourth, petitioners has an -- have initiated this matter and are procedurally incorrect in a correct manner of moving to reopen a 38-year-old case to which they were not, and are not, nor have ever been, a party. And instead of filing a complaint for a writ of mandamus seek a contempt order of a civil order that they were not a party. Now, that presents an interesting problem down the road as we're gonna discuss in a minute. And again no one has indicated authority that gives them the ability to do that.

Now, addressing the minimum level problem, petitioner in their original motion pled very clearly, in the Court's opinion anyway, that the County is in contempt of court because during the summer months the lake level falls below the legal level for the summer as set by the 1982 court order. It is alleged that this fact creates a hardship for the petitioner. Now, the only affidavit the Court has -- and I don't know of any requirement that -- that says that every interested party needs to file an affidavit, but the state and the County's position is that, "Okay. Fine. But there is only one affidavit that's been filed, and that affidavit has problems." So I guess you proceed at your risk when you just file one affidavit is all I can speak to on that issue. But at any rate, it is alleged in that affidavit and in the petition that the fact that the level goes below the summer level that creates a hardship for the petitioner specifically -- specifically on this day, Mr. Ostegren, because somehow that deviation below that summer level makes it so that he cannot use and enjoy the lake.

They argue then that the County is at fault for this deviation; and therefore, in contempt of the court order setting a summer lake level. However, during the course of this case, as has been indicated, and Mr. Ellison is suggesting that we're flyspecking his pleadings in an edit -- like an editor would in a magazine, and that the implication of that is that it's unfairly being parsed in that manner, but in the course of this case the petitioner has seemingly changed their argument, which was the entire basis for their request for show cause, and now seemingly argue that that's not the case at all. It's not the fact that the County allows the summer level to fall below the legal level set out in the court order but rather there's a deviation of range from winter to summer and throughout the summer that is to great when compared to Houghton Lake, Lake Saint Helen, or any other lake in Michigan, I guess, that that then constitutes -- that deviation constitutes the contempt. Now, that's not in the petition, that's not in the affidavit, but that was argued here at the last hearing. It's plaintiffs' -- petitioners' position appears to be a moving target in the Court's opinion, and that's not how contempt of court works. And more importantly, that's not how lake levels work not only in Roscommon County but in the state.

Lake levels are sit by -- set by court order. They are not minimums rather they are levels set pursuant to the statute that are:

> "…levels of water of an inland lake that provide the most benefit to the public; that best protects the public health, safety, welfare; that best preserves the natural resources of the state; and that best preserve and protect the value of property

around the lake." That's based on MCL 324.30701(h).

This statutory provision does not set a minimum level. The statute does not require a governmental entity to have -- to keep the level within a certain range of deviation. The statute doesn't talk in terms of deviations or acceptable ranges. And it doesn't have a sanction section with regard to what would constitute a violation if a deviation exists. I suspect the statute doesn't go into that kind of detail because lake levels fluctuate by their very nature due to their location, geographical conditions, and the natural conditions that take place year-to-year.

Looking closer at petitioners' moving target of an argument, a petition for a show cause, there's been nothing presented in the motion or the affidavit to suggest or support that a naturally occurring deviation of Higgins Lake exceeds a range of deviations that one would otherwise expect for a lake of its size and location, or that the deviation is so irregular when compared to Houghton Lake, Lake Saint Helen, or any other lake in the state that the County in exercising their duty is doing so in a contemptuous manner. No one including the petitioner has argued that a 12-inch-to-6-inch deviation is unreasonable, although the petitioner is apparently making that argument as of the intervening motion and today.

Although in my opinion based on the comments that were made in court today, they're now backpedaling back closer to the original position with regard to zero tolerance on going below the summer level.

Now, this particular show cause is based on a February 24, 1982, lake level order that established the summer level at 1,154 feet point 11 and a winter level of 1,153.61 above sea level. The Court clearly has continuing jurisdiction over the matter. The plaintiff in their petition and affidavit claim that they are an interested person and they outline one, two, three, four, five, six, seven or so people as interested parties. One of those group -- isn't a person, it's a group, Citizens for Higgins Lake Legal Levels. The allegation in the petition and the affidavit is that the County has regularly and systematically failed to abide by legal levels for huge percentages of the year. The petition exceeds -- admits that the County generally is complaint with the winter levels but argues generally noncompliant with the summer levels. And in doing that, the petition creates, and I'm gonna use it in quotes, "a Michigan summer" and is -- and defines it as Memorial Day to Labor Day. That's not how the court order defines it, that's how petitioner defines it for some reason. And based on that truncated definition of a summer level, extrapolates certain data with regard to calendar years 2016, '17, and '18 in an effort to buttress their position that the lake levels are being violated to the point of contemptuous.

Looking at the data that the Court can discern at any rate, the levels appear to be no more than two-and-a-half-or-so inches off, particularly in 2019. For an example in April 15, 2019, the level was 1,153.85, 2.6 inches off. As of May 10, 2019, when the petition was filed, the level was in range. In other words, the level was at the lake legal level or above.

Paragraph 15 of the petition alleges that the -- that the County's below the summer level 75 percent of the time based on their truncated definition of summer.

Paragraph 16 alleges noncompliance is happening before the expected normal summer of operation which is predicted -- predictable and that the lever -- level would then further go down.

Paragraph 17 alleges that the County pulls the board out -- the boards in the dam out to lower the level to come into compliance when the level is to high or is just barely over the legal level.

Paragraph 19 alleges that there's no rational basis for the County to do this, i.e., removing the boards because it will cause a water loss further into the summer.

And that's the crux of their petition as filed with this Court. And that crux, the implication of that is one of two things: That the County needs to be banking water and/or in addition to removing or in addition to putting all the boards in the dam in the spring also blocking the flow of the low-flow channel. Neither one of those remedies does the Court necessarily have jurisdiction to order at this time as a contempt proceeding. As indicated by the intervening parties and the County, banking presents a whole another level of issues. Potentially violating the court order by maintaining the level well above the legal summer level and/or violating the permit that was issued in 2007 if the plan is to put a board across the low flow.

Paragraph 20 of the petition again specifically argues for banking.

Paragraph 21 alleges damage to the Petitioner Mr. Ostegren to be that they are not able to enjoy the full extent of recreational and water-based activities due to the failure of the County to meet its legal obligation to maintain the summer level. The Court doesn't know what that means. What actual damage to Mr. Ostegren has taken place? How are they -- how is Mr. Ostegren or any other interested party named in this petition not able to enjoy the lake because of a six-or-less inch loss of water in the summer? That's now explained nor defined anywhere in the petition nor the affidavit. Further, the petition and affidavit does not explain how this loss of water level affects any other person in this state that is using Higgins Lake differently than it affects them.

Paragraph 26 of the petition looks at the statutory contempt rules: MCL 600.1701, etcetera.

Paragraph 30 lists the civil contempt that they're seeking and the sanction for their contemptuous behavior and inability to comply.

Now, as raised by the County in their response to this petition for show cause, they raise the issue of standing. For contempt allegedly committed outside the Court's view, an order to show cause may only be issued on a proper showing on ex-parte motion supported by an affidavit, based on MCR 3.606(a). If an affidavit is inadequate or there's no affidavit, the court lacks jurisdiction, as the Court's previously indicated. Affidavits must be made with personal knowledge and state admissible facts establishing grounds stated in the motion required by MCR 2.119. The only affidavit the Court has before it is that of Mr. Ostegren, which was Exhibit 2 to the defendants' petition.

Paragraph 2 of that affidavit indicates that "it's commonly known" that the County doesn't comply. The

Court doesn't know if it's "commonly known" or not. There's no factual allegations in that affidavit to support that conclusion.

Paragraph 3 refers to data from US Geological Survey that was put together not by the US Geological Survey but my Mr. Ellison or Mr. Ostegren, which presents problems as presented by the State and the County with regard to hearsay.

Paragraph 4 of the affidavit Mr. Ostegren complains -- indicates that he's complained about these issues to the County and the lake levels. So it's clear that Mr. Ostegren feels that the levels need to be different.

Paragraph 5, Mr. Ostegren testifies that the County is attempting to comply with the court order by removing boards but because the level is to high. Now, again the implication with that paragraph that the Court draws is that the County should not be removing boards thereby banking water, potentially putting itself in violation of the level on the high end.

And that's all that affidavit sets out. So the question becomes is that enough factual predicate upon which to confer contempt jurisdiction on the Court? And the Court has concluded the answer is no. The affidavit is not adequate.

There's a question as to whether Mr. Ostegren is an interested party under the Natural Resources Environmental Protection Act. Mr. Ellison has argued that the fact that he has lake access on either a road end or an easement or some association in -- in a lake association gives him standing. Now, he may be right on that, I don't know. To have standing under the statute petitioners must demonstrate a special injury or right or substantial interest that would be detrimentally affected in a manner different from the citizens -- citizenry at large or if the statutory scheme implies that the legislator intended to confer standing on that litigant. That's the requirement for standing as an "interested party." The statute defines "interested person" as "the department and a person who has a record interest in title to, a right of ingress to, or reversionary right to land that would be affected by a permanent in the natural or normal level of an inland lake." Based on MCL 324.30701(g). This seems to support the standing to a riparian owner, but Mr. Ellison may be correct that it -- the -- it's a broader approaches in mind. But even with that taken as true, to have standing under the statute, the interested party still needs to show a legally protected interest that is in jeopardy of being adversely affected. In other words, the interested party must show a sufficient personal stake or injury that will affect them in a manner different from the citizens -- citizenry at large if the statute is not enforced, and that's based on the ruling from *Lansing School Education Association v. Lansing Board of Education*, 487 Mich 349, 2010 case.

Petitioners and Mr. Ostegren have not alleged in the motion or the affidavit that the personal stake requirement that differentiates them from the general public at large has been met here. Mr. Ostegren is not a riparian, has not shown sufficient stake in the enforcement of the statute that is different from the public at large. The only harm alleged by the affidavit is found in paragraph 21 of the motion that says that he is not able to enjoy the full extent of the recreational use of the water-based activities due to the failure to address the legal lake level. This allegation is vague to say the least, but more importantly it does not explain it in what way specifically Petitioner Ostegren cannot fully use Higgins Lake because of a six-inch-or-less deviation in lake level. More importantly, this vague allegation does not show a sufficient stake in the enforcement of the statute that differentiates him or any other petitioner outside the affidavit that differentiates them from anyone else in the public that uses Higgins Lake for recreational purposes during the summer months. Based on that, the

Court finds the petitioner lacks standing to bring this show cause.

In addition, contempt of court is not an appropriate action here. The proper method by which a person can compel a government official to preform a legally required duty is to file a complaint for writ of mandamus, MCL 600.4411 and MCR 3.305. This is also supported by numerous cases as the State has presented in their brief. Plaintiffs here did not file a writ of mandamus; instead, decided to reopen a 38-year-old case and file a show cause for contempt of court. In doing so, it is important to note that plaintiff -- petitioners were not, and are not parties, to that original case. Petitioners have failed to cite any authority, statutory case law or court rule that permits a nonparty to seek contempt of court or otherwise enforce a court order, which further supports the proposition that the correct legal procedure here should be a writ of mandamus not contempt of court.

In addition, the contempt of court is not an appropriate action here because as of May 10, 2019, when this was filed, the County was in compliance with the lake level as set out in the order.

But more importantly, the petitioners failed to show what purposeful action the County took or failed to take that caused a violation of the court's order. The County, for an example, going back to June 4, 2018, had closed all the boards in the dam and they remained closed till October 31, 2018. Despite that, the level dropped a half inch below that legal level, and the Court finds that that is not caused by the County's doing but rather nature and potentially a result of the low-flow channel. So on the outset, the petitioner has not established that the County did not perform a duty they were required to under the statute. They did everything they could by putting every board in in the Cut River Dam without modifying the dam without the state's approval and/or modification of the -- permit.

Further, the petitioners have not alleged a proper or possible remedy, and that's an important link that needs to be made before the Court can move forward on a contempt proceeding. Before a party can be found to be in contempt, the court must determine there is something possible for the contemnor to do to purge the contempt. Petitioner implies two things the County can do to comply with the summer level: One, put a restrictor plate in the Cut River Dam. And two, bank water. Neither of those remedies work, however, as indicated in the County's response and the State's response. Banking presents a whole nother issue with regard to further potential violations of the court order, and also does not adequately consider the ramifications of the damage banking could cause to the lakefront owners and the natural resources of Higgins Lake. And the Court can't arbitrarily order that as a remedy without contravening the statute that requires the Court to take a look at those issues before changing lake levels.

Although the Spicer Report suggests a restrictor plate will help ensure the lake level stays at legal level for the summer and petitioner implies the County should do this, the remedy to purge the contempt is not legally possible at this time. The Court -- the County does not have the right to modify the dam without modifying its permit that was issued in 2007. The Court has no authority at this time to order the County as part of a finding of contempt to modify the dam or seek modification of the permit.

So for those reasons, this contempt of court action as filed by the petitioners fails to confer jurisdiction on this Court to go forward with a civil contempt proceeding. As such, the Court vacates its May 28, 2019, show cause order at this time.

Now, I understand the County's position with regard to sanctions. I thought -- since I received that brief, I've thought long and hard about that sanction requirement. I cannot determine on the face of it that the matter was frivolous. There's obviously some arguments that petitioner has made. Some of those arguments may be justified, some of them may not be. But I can't, based on that, find this frivolous. The closer call comes to the statutory and legal framework for going forward in contempt matter, and that cuts it real close to the line in the Court's opinion. Whether that was not well planned or thought out in lieu of a mandamus action, which is pretty clear cut, but I'm not gonna award sanctions at this time. So thank you.

MR. ZALESKI: Thank you, your Honor.

MR. BOCK: Thank you, your Honor.

MR. ELLISON: Judge, if I may?

THE COURT: Yes.

MR. ELLISON: Your Honor, you mentioned that you lack standing or you lack jurisdiction to make a determination on this particular case. Under the established case law, which I don't have in front of me right now, if you lack jurisdiction, that's as far as you can go, and the rest of your ruling can't be -- is abas dicta, and the following rest of it, it can't be upheld. The only thing you can do in that ruling is to simply dismiss for the lack of jurisdiction. So I would --

THE COURT: I made my explanation to try to make my reasoning clear for the benefit of you, counsel, and the people in this courtroom.

MR. ELLISON: Fair enough. I just -- I just want to make clear because I want -- I want that to be an objection for preservation purposes going forward.

THE COURT: All right. So you -- you can make of it as you will, but that's why I made my ruling. Thank you.

THE CLERK: Who prepares the order, Judge?

THE COURT: Mr. Ellison, will you prepare the order?

MR. ELLISON: I will.

THE COURT: Thank you.

MR. ELLISON: Judge, one last point, as I mentioned -- you mentioned that mandamus is the appropriate action. I intend to file that right now. Will you require the County to -- attorney to stay for this service or do I have to do it in the normal course?

MR. ZALEWSKI: Your Honor, I need to confer with my client to determine if I have authority to accept.

THE COURT: Okay.

MR. ELLISON: Very good. Then that's all I need. Thank you.

THE COURT: Thank you.

(At 2:26 p.m., proceeding concluded)

COUNTY OF ROSCOMMON)

SS)

STATE OF MICHIGAN)

I certify that that this transcript, consisting of 61 pages, is a complete, true, and correct record of the Respondent Roscommon County's Motion to Strike Affidavit of Eric Ostegren and/or to Set Aside Ex Parte Show Cause Order hearing and testimony taken before the Honorable Robert W. Bennett, Circuit Judge, in this case on Monday, October 21, 2019.

December 17, 2019

Jaimie L. Whisman, CER 7757
P.O. Box 665
West Branch, MI 48661
(989) 387-3467

EXHIBIT 20

STATE OF MICHIGAN
IN THE CIRCUIT COURT FOR THE COUNTY OF ROSCOMMON

CITIZENS FOR HIGGINS LAKE LEGAL LEVELS, ERIC OSTERGREN, STEVE RICKETTS, THOMAS THOMSON, CAROL THOMSON, GLENN R. FAUSZ, ROBERT OBRYAN, DRU OBRYAN, THOMAS THOMSON, CAROL THOMSON, and JANICE JAMESON as trustee of the JANICE JAMESON TRUST
Petitioners/Plaintiffs,

v.

BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON,
Respondent/Defendant
_______________________________/

Case No.: 19-724711-AW
Honorable Robert W. Bennett

FIRST AMENDED COMPLAINT/PETITION

JURY DEMANDED

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FIRST AMENDED COMPLAINT/PETITION
FOR ISSUANCE OF WRIT OF MANDAMUS

NOW COMES Petitioners/Plaintiffs, by and through counsel, and complains upon to this Court and seeks the issuance of a Writ of Mandamus as follows:

PARTIES

1. Petitioner/Plaintiff CITIZENS FOR HIGGINS LAKE LEGAL LEVELS is a domestic nonprofit corporation whose purpose and existence are to promote and defend the legal lake levels on Higgins Lake.

2. Each Petitioner/Plaintiff inhabits, owns, uses, and/or accesses land near or abutting Higgins Lake.

a. Petitioner/Plaintiff ERIC OSTERGREN is an inhabitant of and owns property in Roscommon County at 2779 West Higgins Lake Drive, Roscommon, MI 48653 near Higgins Lake, regularly maintains and uses a recreational watercraft upon Higgins Lake, has access to and enjoys a private dock upon Higgins Lake, and serves as an officer of the Birch Road Dock Association (for a Higgins Lake dock).

b. Petitioner/Plaintiff STEVE RICKETTS is an inhabitant of and owns property in Roscommon County at 107 Jays Drive, Higgins Lake, MI 48653 near Higgins Lake.

c. Petitioner/Plaintiff THOMAS THOMSON is an inhabitant of and co-owns littoral (lake front) property on Higgins Lake in Roscommon County at 214 Lake Shore Drive, Roscommon, MI 48653.

d. Petitioner/Plaintiff CAROL THOMSON is an inhabitant of and co-owns littoral (lake front) property on Higgins Lake in Roscommon County at 214 Lake Shore Drive, Roscommon, MI 48653.

e. Petitioner/Plaintiff JANICE JAMESON, as trustee of the JANICE JAMESON TRUST, owns littoral (lake front) property on Higgins Lake in Roscommon County at 150 Flagpoint, Roscommon, MI 48653.

f. Petitioner/Plaintiff GLENN R. FAUSZ is an inhabitant of and dwells at property, held in trust, in Roscommon County at 359 Chaney Point Drive, Roscommon, MI 48653 littoral (lake front) property on Higgins Lake.

g. Petitioner/Plaintiff ROBERT OBRYAN is an inhabitant of and dwells at property, held in trust, in Roscommon County at 202 Columbine, Higgins Lake, MI 48653 littoral (lake front) property on Higgins Lake.

h. Petitioner/Plaintiff DRU OBRYAN is an inhabitant of and dwells at property, held in trust, in Roscommon County at 202 Columbine, Higgins Lake, MI 48653 littoral (lake front) property on Higgins Lake.

3. Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON is an entity existing under the laws of the State of Michigan and subject to a Legal Lake Level Order issued under what is today Part 307 of the *Natural Resources and Environmental Protection Act*, MCL 324.30701 et seq.

JURISDICTION

4. This Court has jurisdiction pursuant to MCL 600.601, MCL 600.605, and MCR 3.305(A)(2).

5. Venue is proper in this county.

GENERAL ALLEGATIONS

6. On February 24, 1982, this Court established the legal lake levels for Higgins Lake via what is now codified as Part 307 (Inland Lake Levels) of the *Natural Resources and Environmental Protection Act*, Public Act 451 of 1994.

7. This Court, by Circuit Court Judge Carl L. Horn, memorialized that order[1] in written form on February 24, 1982 (hereafter "Legal Lake Level Order"); a copy of said order is attached as **Exhibit A**.[2]

8. In addition to establishing legal lake levels on Houghton Lake and Lake St Helen, the Court decreed that the legal lake level of Higgins Lake is "established at 1154.11 feet above mean sea level." ***Id.***

9. The Court also provided and set a lower "winter" level be mandated to be no lower than 1153.61 feet, above mean sea level (i.e. a six inch reduction) from on or about November 1st of each year and running until April 14th (or after "ice-out") for the following year. ***Id.***

10. For the last several years, Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and/or its delegated authority has regularly and systematically failed to abide by the Legal Lake Level Order for huge percentages of the year, particularly during the summer months when Higgins Lake is used the most for various recreational pursuits.

11. For the last several years, Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and/or its delegated authority has regularly and systematically failed to abide by failing to employ known best practices and available technology to properly and/or at least more properly maintain the actual level of Higgins Lake consistent with the actual ordered summer legal level each and every day of the summer time period.

12. The United States Geological Survey monitors the water levels of Higgins Lake and publishes its data on its website at https://waterdata.usgs.gov/mi/nwis/dv?referred_module=sw&format=gif&period=60&site_no=442805084411001.

13. That public authority collected data, consisting of thousands of pages of data, has been organized and correlated for the ease of the parties and the Court, see Rule 1006 of the Michigan Rules of Evidence.

14. A review of this compiled and organized data from the United States Geological Survey (**Exhibits E, F, G, and M**) shows and confirms that Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF

[1] Part 307 was formerly the *Inland Lake Level Act*.

[2] Two additional orders were issued since 1982 which temporarily changed the legal lake level but have expired of their own accord. See **Exhibits B and C**.

ROSCOMMON has been generally *non-compliant* with the Legal Lake Level Order during the normal (summer) months.[3]

15. Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and its delegated authority has been in considerable daily violations of the Legal Lake Level Order each of the previous three summers in 2016, 2017, 2018 and 2019:

	2016	2017	2018
Number of Normal (Summer) Level Daily Violations	114	82	163
Number of Days In Normal (Summer) Level	194	200	199
% of Normal (Summer) Level Season Daily Violations	**58.76%**	**41.00%**	**81.91%**
Number of "Michigan Summer" Days	99	99	99
"Michigan Summer" Number of Daily Violations	64	26	87
% of "Michigan Summer" Daily Violations	**64.65%**	**26.26%**	**87.88%**

16. As such, during the desirable and important recreation times of Michigan's summertime (i.e. Memorial Day through Labor Day), the County of Roscommon and its delegated authority was in regular violation of (i.e. below) the Legal Lake Level Order two-thirds (2/3) of the time in 2016, over one quarter (1/4) of the time in 2017, and nearly ninety percent (90%) of the time in 2018.

17. A review of the data from the Higgins Lake Property Owners Association and the United States Geological Survey reveals that Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and its delegated authority are essentially never in actual or reasonable compliance with the Legal Lake Level Order during the normal/summer months. See **Exhibits M and N**.

18. Each Plaintiff has suffered adverse, negative, and loss-causing effects by the failure of Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and its delegated authority to comply within the Legal Lake Level Order.

19. Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and its delegated authority are not properly maintaining and supporting sufficient lake levels in the matter utilizing all known reasonable practices and available technology, and thereby is intentionally causing the mid to later summer lake levels to repeatedly drop below the level mandated by the Legal Lake Level Order to the detriment of the users of Higgins Lake, including each Plaintiff.

---

[3] The Higgins Lake Property Owners Association maintains graphical and numerical records of the lake level (see **Exhibit N**, years 2007-2018 taken from http://hlpoa.org/lake-level-charts-data/) and the depictions are consistent with the information depicted in **Exhibits E, F, G, and M.**

20. Lake users, like Plaintiffs, are not able to enjoy the full extent of recreational and water-based activities due to the failure of Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and its delegated authority to actually and/or reasonably meet its legal obligation to keep and maintain the water level of Higgins Lake as required by the Legal Lake Level Order.

21. Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and its delegated authority have been formerly put on notice of its ongoing violations and still refuses to comply with the Legal Lake Level Order. See **Exhibits I, J, K, and L**.

COUNT I
WRIT OF MANDAMUS

22. The prior paragraphs are alleged word for word herein.

23. The benefit and advantage of the Legal Lake Level Order is the clear legal right of these plaintiffs and is entitled to specific duty of keeping the summer lake level of Higgins Lake at 1154.11 feet above mean sea level.

24. Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON and/or its delegated authority has violated that legal obligation by failing to employ reasonable and best practices and available technology to reasonably maintain the actual level of Higgins Lake consistent with the actual ordered summer legal level each and every day of the summer time period. See **Exhibit H.**

25. When "a court-determined normal level is established pursuant to this part, the delegated authority of the county or counties in which the lake is located *shall* maintain *that* normal level." MCL 324.30702(3).

26. A county, by its Board of Commissioners, may delegate the county's responsibilities of the Legal Lake Level Order to an agent as provided by Part 307 of the *Natural Resources and Environmental Protection Act*, Public Act 451 of 1994.

27. However, "after the court determines the normal level of an inland lake in a proceeding initiated by the county, the delegated authority of any county or counties in which the inland lake is located *shall* provide for and maintain *that* normal level." MCL 324.30708(1).

28. Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON has the clear legal duty, pursuant to Part 307, to maintain or have its delegated authority maintain the lake level of Higgins Lake during the summer months at 1154.11 feet above mean sea level.

29. Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON has breached that clear legal duty.

30. The obligation of compliance is ministerial and, in accordance with prior dicta explanations of this Court, no other remedy exists that might achieve the same result.

JURY DEMAND

31. This matter is requested to be heard and decided by a duly-empaneled Roscommon County jury pursuant to MCR 3.305(F) and all other applicable law for all triable issues.

RELIEF REQUESTED

32. WHEREFORE, Petitioners/Plaintiffs respectfully requests this Court to—

a. Empanel a Roscommon County jury pursuant to MCR 3.305(F) and hold an evidentiary hearing/trial to adjudicate the breach of the clear legal duty of Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON by not maintaining the required "normal level" as provided by the Legal Lake Level Order;

b. Issue upon Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON a writ of mandamus directing it to meet its legal obligation to keep and maintain the water level of Higgins Lake to the level mandated by the Legal Lake Level Order throughout the entire year;

c. Order Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON to implement of the Spice Group's recommendations and/or establish guidance and operational practices for the devices used to control the lake level of Higgins Lake;

d. Impose a fine not exceeding $250 upon every elected member of Respondent/Defendant BOARD OF COMMISSIONERS OF THE COUNTY OF ROSCOMMON pursuant to MCL 600.4411;

e. Award all damages, if any;

f. Award costs incurred and applicable interest; and

g. Award any other relief warranted or justified by the facts and law of this case.

Date: November 30, 2019

PROOF OF SERVICE

The undersigned certifies that a copy of the foregoing document(s) was served on parties or their attorney of record by mailing the same via US mail to their respective business address(es) as disclosed by the pleadings of record herein with postage fully prepaid, on the

30th day of November, 2019.

Philip L Ellison

PHILIP L. ELLISON
Attorney at Law

RESPECTFULLY SUBMITTED:

Philip L Ellison

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**Electronic signature(s) now authorized by MCR 1.109(E)(4)*

EXHIBIT 21

1998 WL 1988726
Only the Westlaw citation is currently available.

UNPUBLISHED OPINION. CHECK COURT RULES BEFORE CITING.

Court of Appeals of Michigan.

Tom BALDWIN, Harold Banks, Donald Nutter, Lori Nutter, Peter Seibert, Kathryn Ann Seibert and Geraldine N. Versluis, Plaintiffs,
and
Marvin ANSON, Rufus Bosma, Eunice Bosma, Robert Chamberlain, Fred Hinga, a/k/a M.M. Hinga, William C. Holloway, Helen A. Holloway, Larry Klerk, a/k/a Larry Clerk, Susan Klerk, a/k/a Susan Clerk, Clifford Leonard, Marlene Leonard, Mike McGuire, Kamran Moghissi, Ida-Laura Moghissi, Larry Nyberg, Patsy Nyberg, Robert Pence, Judy Pence, James H. Simonds, Ray Tiffany, Mike Weyenberg, Jack Wilson, Maxine Wilson, and Philip D. Wineland, Plaintiffs-Appellants,
v.
BARRY COUNTY DRAIN COMMISSIONER, Barry County, Allegan County Drain Commissioner, Allegan County and Michigan Department of Natural Resources, Defendants-Appellees,
and
PINE LAKE ASSOCIATION, Rosemary Decker, Constance Hubbell, Daniel Jamieson, Larry Montei, William Schma, Ross Stancati and Nancy Troff, Intervenors-Appellees.

No. 201604.
|
Dec. 1, 1998.

Before: WHITBECK, P.J., and CAVANAGH and NEFF, JJ.

Opinion

PER CURIAM.

***1** Plaintiffs appeal as of right the trial court's order establishing the normal level of Pine Lake at 890.5 feet above sea level, subject to seasonal variations and precipitation. We affirm.

I

In 1969, the Barry Circuit Court, in response to a petition from the boards of supervisors of Barry and Allegan counties and pursuant to the Inland Lake Level Act ("ILLA"), M.C.L. § 281, 61 *et seq.;* MSA 11.300(1) *et seq.,*[1] established the normal level of Pine Lake at 890.5 feet above sea level, and ordered that the maximum level of the lake not exceed 891 feet and the minimum level not fall below 890 feet. In 1992, plaintiffs filed an action against defendants Barry County and Barry County Drain Commissioner to enforce the 1969 judgment because plaintiffs experienced flooding due to a rise in the lake's level. The circuit court determined that the 1969 judgment was too old to be enforced. On appeal, this Court reversed the trial court and remanded to the trial court to determine whether the lake level set in 1969 remained beneficial to the public. *Anson v. Barry Co Drain Comm'r,* 210 Mich.App 322; 533 NW2d 19 (1995).[2]

On remand, the trial court concluded that the minimum lake level of 890.5 feet set in 1969 should remain as the lake's normal level, but amended the 1969 judgment by removing the minimum and maximum level requirements. Plaintiffs now appeal, insisting that the trial court erred by failing to establish a maximum lake level and by refusing to award them attorney fees.

II

Plaintiffs first argue that the ILLA requires a trial court set a normal lake level with both an upper and lower limit, and that the trial court erred in simply determining that the normal level of Pine Lake should remain at 890.5 feet, subject to seasonal variations and precipitation. After reviewing this issue of statutory construction de novo, *In re Ballard,* 219 Mich.App 329, 331; 556 NW2d 196 (1996), we disagree.

The primary goal of statutory interpretation is to ascertain and give effect to the intent of the Legislature. *Farrington v. Total Petroleum, Inc,* 442 Mich. 201, 212; 501 NW2d 76 (1993). The first criterion in determining intent is the specific language of the statute itself, *House Speaker v. State Administrative Bd,* 441 Mich. 547, 567; 495 NW2d 539 (1993), and the Legislature is presumed to have intended the meaning it plainly expressed. *Nation v. WDE Electric Co,* 454 Mich. 489, 494; 563 NW2d 233 (1997). If the statutory language is clear and unambiguous, judicial construction is neither required nor permitted, and courts must apply the statute as written. *Barr v. Mt Brighton Inc,* 215 Mich.App 512, 517; 546 NW2d 273 (1996).

The ILLA defines "normal level" as follows:

> "Normal level" means the level or levels of the water of an inland lake that provide the most benefit to the public; that best protect the public health, safety, and welfare; that best preserve the natural resources of the state; and that best preserve and protect the value of property around the lake. A normal level shall be measured and described as an elevation based on national geodetic vertical datum. [MCL 324.307001(h); MSA 13A.30701(h).]

***2** MCL 324.30707(5); MSA 13A.30707(5) allows for the court to determine seasonal variances to the "normal level":

> The court shall determine the normal level to be established and maintained, shall have continuing jurisdiction, and may provide for departure from the normal level as necessary to accomplish the purposes of this part. The court shall confirm the special assessment district boundaries within 60 days following the lake level determination. The court may determine that the normal level shall vary seasonally.

The plain and ordinary meaning of the language contained in the ILLA does not define "normal level" to include a minimum and a maximum level. Rather, the ILLA permits trial courts to be flexible and provide for seasonal departures from the normal lake level as necessary to accomplish the purpose of the act, which is to provide for the control and maintenance of inland lake levels for the benefit and welfare of the public. *In re Van Ettan Lake,* 149 Mich.App 517, 525; 386 NW2d 572 (1986). Accordingly, we find that the trial court was not required to set a maximum level for Pine Lake in addition to reaffirming the normal level of 890.5 feet above sea level.[3]

III

Plaintiffs also challenge the trial court's denial of their motion for attorney fees. Specifically, plaintiffs argue that the ILLA mandates the award of such fees. We disagree.

Generally, a party may not recover attorney fees, either as costs or damages, unless such recovery is expressly authorized by statute or court rule. *Oscoda Chapter of PBB Action Committee, Inc v DNR,* 115 Mich.App 356, 363; 320 NW2d 376 (1982). In the present case, plaintiffs contend that the trial court ignored the mandate in M.C.L. § 324.10711-30712; MSA 13A.30711-30712 that their legal fees must be included within the costs assessed as part of a normal lake level project. To the contrary, these sections allowing for the payment of legal fees are restricted to special assessments to reimburse the county for all or part of the project's cost.[4]

The focus of the ILLA is on the public welfare, not individual riparian rights, and it "does not create a civil cause of action for individuals who are dissatisfied with the county's exercise of authority." *In re Matter of Van Ettan Lake, supra* at 526. To enable riparian owners to vindicate their personal property rights, and then charge their legal fees to the other members of the special assessment district, or the county, is not consistent with the public purpose of the ILLA. In short, nothing in the ILLA supports plaintiffs' contention that they, as individual lake residents, are entitled to an award of attorney fees.

Affirmed.

All Citations

Not Reported in N.W.2d, 1998 WL 1988726

Footnotes

1 The Inland Lake Level Act of 1961, M.C.L. § 281.61 *et seq.;* MSA 11.300(1) *et seq.,* was repealed by 1994 PA 51, and reenacted as part of the Natural Resources and Environmental Protection Act, 1995 PA 59, without any substantive changes. Although the present case was commenced in 1992 under the former Act, we will use the current section numbers where applicable.

2 On remand, the trial court ordered that Allegan County, Allegan County Drain Commissioner and the Michigan Department of Natural Resources (DNR) be added as defendants. The trial court also allowed two groups of landowners to intervene.

3 If the trial court had set a maximum level, then the county would have had to maintain it. MCL 324.307088(1); MSA 13A.307088(1). Our review of the record reveals that the proposed project to maintain the lake level would cost upwards of $600,000 and could injure the environment, while at the same time benefiting only 4 ½ percent of the houses on the lake. We believe that the trial court properly refused to set a maximum lake level which could not be maintained or to approve a project which did not benefit the public welfare.

We further note that the trial court's order instructed the Barry County Drain Commission to operate the existing drain and leave it "open and unobstructed until further Order of the Court." Therefore, defendants are left with some ability to maintain the normal lake level reaffirmed by the trial court.

4 MCL 324.30711(1); MSA 13A.30711(1) provides:

The county board may determine by resolution that the whole or a part of the cost of a project to establish and maintain a normal level for an inland lake shall be defrayed by special assessments against the following that are benefited by the project: privately owned parcels of land, political subdivisions of the state, and state owned lands under the jurisdiction and control of the department. If the county board determines that a special assessment district is to be established, the delegated authority shall compute the cost of the project and prepare a special assessment roll.

The following costs may be defrayed by a special assessment against the landowners benefited by the project:

(1) Computation of the cost of a normal level project shall include the cost of all of the following:

(a) The preliminary study.

(b) Surveys.

(c) Establishing a special assessment district, including preparation of assessment rolls and levying assessments.

(d) Acquiring land and other property.

(e) Locating, constructing, operating, repairing, and maintaining a dam or works of improvement necessary for maintaining the normal level.

(f) Legal fees, including estimated costs of appeals if assessments are not upheld.

(g) Court costs.

(h) Interest on bonds and other financing costs for the first year, if the project is so financed.

(i) Any other costs necessary for the project which can be specifically itemized. [MCL 324.30712; MSA 13A.30712.]

End of Document

EXHIBIT 22

2003 WL 21480712
Only the Westlaw citation is currently available.

UNPUBLISHED OPINION. CHECK COURT RULES BEFORE CITING.

Court of Appeals of Michigan.

TAWAS LAKE IMPROVEMENT ASSOCIATION, Plaintiff-Appellee,
v.
IOSCO COUNTY BOARD OF COMMISSIONERS, Defendant-Appellee,
and
ATTORNEY GENERAL and Department of Environmental Quality, Intervening Defendants-Appellants.

No. 237007.
|
June 26, 2003.

Before: SMOLENSKI, P.J., and GRIFFIN and O'CONNELL, JJ.

[UNPUBLISHED]

PER CURIAM.

*1 Intervening defendants Michigan's Attorney General and Department of Environmental Quality (DEQ) appeal by leave granted the trial court's order that Defendant Iosco County Board of Commissioners (the County) were not required to obtain a DEQ permit before constructing a dam on Tawas Lake. We reverse.

In 1959, the Iosco County Circuit Court issued a decree setting the level of Tawas Lake at 582.5 feet above sea level. 1939 PA 194, which survives today as part of the Natural Resources and Environmental Protection Act (NREPA),[1] gave the court authority to set the level of the lake.[2] The order also stated that departures from the set level were permitted if the Department of Conservation deemed it necessary and if the parties petitioned the court to allow a departure. Despite the decree, no steps were taken to bring the lake to the level set by the court.

In 1994, plaintiff Tawas Lake Improvement Association petitioned the court for a writ of mandamus to order the County to take the necessary actions to establish and maintain the ordered lake level, which essentially would mean constructing a lake level control structure or dam. Plaintiff and the County then stipulated to hire an independent engineering firm to conduct a feasibility study and advise the parties whether establishing and maintaining the lake level was feasible. The parties agreed as follows:

> 11. Upon completion and submittal of the engineering study, the parties will determine if the engineering study provides a feasible means in which to establish the normal lake level as ordered by the 1959 Circuit Court for the County of Iosco.
> 12. If a feasible means by which to establish the lake level exists, Defendant will proceed with the necessary steps to maintain the Tawas Lake level at 582.0 feet above sea level. All necessary expense to maintain the Tawas Lake level at 582.0 feet above sea level, shall be special assessed through the Special Assessment District currently in existence.[3]

An engineering firm conducted the feasibility study and issued a report in May 1997. The firm concluded that the feasibility of establishing and maintaining the lake level at 582.5 feet above sea level was "favorable." However, the firm informed the parties that five permits were "likely to be required" before dam construction could proceed.[4]

Plaintiff then submitted a proposed consent judgment to order the County to proceed with construction of the dam. The court entered an order instructing the County to "proceed with the necessary steps to engineer, construct, and maintain [the dam] as is necessary to control the Tawas Lake level at 582.5 feet above sea level...." The County then applied to the DEQ for the necessary permits pursuant to the NREPA. The DEQ refused to issue the permit, reasoning that the benefits of the proposed dam project were significantly outweighed by the adverse effects the dam would have on the floodplains, wetlands, and lake and river levels of Tawas Lake and the surrounding areas.[5]

*2 Plaintiff filed a petition for contested case hearing with the DEQ's Office of Administrative Hearings. However, the DEQ held the internal appeal in abeyance pending the final outcome of the court case. After the permit denials, the County then moved to vacate the court's judgment on the ground that it could not continue with construction of the dam after having been denied the required permits. Plaintiff then filed a motion for an order to show cause as to why the County was not proceeding as ordered by the consent judgment. For the first time, plaintiff alleged that no permits were needed because the court had ordered the lake level. Before hearings were held, apparently as a result of plaintiff's new position, the Attorney General and the DEQ moved to intervene and was allowed to do so "for the limited purpose of briefing and arguing the issue of whether permits under the Natural Resources and Environmental Protection Act are required for the lake level project at issue." The court ordered the parties to submit briefs on this limited issue.

The court heard the matter on April 27, 2001, and decided that a DEQ permit was not required by the statute. Intervening defendants filed an appeal by right, which was rejected by this Court. This Court determined that the trial court's April 27, 2001 order was a post-judgment order, the final judgment having been entered on January 12, 1998. Thereafter, intervening defendants filed a delayed application for leave to appeal, which this Court granted. The County has adopted intervening defendants' position on appeal.

I

The main issue on appeal is whether the trial court erred in concluding that permits were not required under the NREPA for the Tawas lake level project, where decades before the court had ordered that the lake be maintained at a certain level. This Court reviews matters of statutory construction de novo. *Omelenchuk v. City of Warren,* 466 Mich. 524, 527; 647 NW2d 493 (2002).

This Court's primary concern in construing statutes is to give effect to the intent of the Legislature. *Id.* at 528. The first step in determining intent is to review the specific language of the statute. *Id.* Where the language of the statute is clear, judicial construction is neither necessary nor permitted. *Id.* An act must be "construe[d] as a whole to harmonize its provisions and carry out the purpose of the Legislature." *Macomb Co Prosecuting Attorney v Murphy,* 464 Mich. 149, 159; 627 NW2d 247 (2001). The construction should be reasonable and comport with the purpose of the act. *Id.* at 158. The Supreme Court has also instructed:

> "Statutes in pari materia are those which relate to the same person or thing, or the same class of persons or things, or which have a common purpose. It is the rule that in construction of a particular statute, or in the interpretation of its provisions, all statutes relating to the same subject, or having the same general purpose, should be read in connection with it, as together constituting one law, although enacted at different times, and containing no reference one to the other." [*State Treasurer v. Schuster,* 456 Mich. 408, 417; 572 NW2d 628 (1998), quoting *Detroit v. Michigan Bell,* 374 Mich. 543, 558; 132 NW2d 660 (1965) (citations omitted).]

II

*3 The Natural Resources and Environmental Protection Act, M.C.L. § 324.101 *et seq,* was enacted to "protect the environment and natural resources of the state...." 1994 PA 451. The Act is a consolidation and recodification of the "laws relating to the environment and natural resources." *Id.* A circuit court's authority to set the level of lakes within its jurisdiction is set forth in Part 307 of the NREPA, inland lake levels, M.C.L. § 324.30701-MCL 324.30723. The specific section states:

> (1) The county board of a county in which an inland lake is located may upon the board's own motion, or shall within 45 days following receipt of a petition to the board of 2/3 of the owners of lands abutting the inland lake, initiate action to take the necessary steps to cause to be determined the normal level of the inland lake.
>
> (2) Unless required to act by resolution as provided in this part, the county board may delegate powers and duties under this part to that county's commissioner, road commission, or other delegated authority.
>
> (3) If a court-determined normal level is established pursuant to this part, the delegated authority of the county or counties in which the lake is located shall maintain that normal level. [MCL 324 .30702.]

When the trial court held that a DEQ permit was not required in this case, it only considered Part 307 of the NREPA, and reasoned that the part did not "condition the Court's authority to set and maintain lake levels upon the permission of the DEQ." The court stated that "[n]owhere within said Act is there a requirement for a permit," and that the only requirement involving the DEQ was the agency's obligation to assist with plans and specifications for the dam, characterizing the DEQ's role as one of "affirmative duty" rather than "final authority." However, the court did not address or discuss the language of M.C.L. § 324.30723, the last provision in Part 307, that provides: "This part does not abrogate the requirements of other state statutes."

We believe that the court's failure to consider M.C.L. § 324.30723 was error. This provision clearly indicates the Legislature's recognition that permits may be required under other parts of the NREPA, and, in fact, other parts of the act do require permits. In Part 301, M.C.L. § 324.30102 provides, in pertinent part, that a permit issued by the DEQ is required in order to engage in any of the following actions: (a) dredge or fill bottomland; (b) construct, enlarge, extend, remove, or place a structure on bottomland; (c) erect, maintain, or operate a marina; (d) create, enlarge, or diminish an inland lake or stream; and (e) structurally interfere with the natural flow of an inland lake or stream. Section 30104 further provides in part:

> (1) Before a project that is subject to this part [Inland Lakes and Streams] is undertaken, a person shall file an application and receive a permit from the department. The application shall be on a form prescribed by the department and shall include any information that may be required by the department. If a project includes activities at multiple locations, 1 application may be filed for the combined activities. [MCL 324.30104(1).]

***4** In deciding whether to issue a permit, the act requires that:

> The department shall issue a permit if it finds that the structure or project will not adversely affect the public trust or riparian rights. In passing upon an application, the department shall consider the possible effects of the proposed action upon the inland lake or stream and upon waters from which or into which its waters flow and the uses of all such waters, including uses for recreation, fish and wildlife, aesthetics, local government, agriculture, commerce, and industry. The department shall not grant a permit if the proposed project or structure will unlawfully impair or destroy any of the waters or other natural resources of the state. [MCL 324.30106.]

Also, M.C.L. § 324.3104, which covers water resources protection, states that the DEQ "shall have control over the alterations of natural or present watercourses of all rivers and streams," and that a person "shall submit an application for a permit to alter a floodplain." Additionally, M.C.L. § 324.30311(1), which involves wetland protection, provides: "A permit for an activity listed in section 30304[6] shall not be approved unless the department determines that the issuance of a permit is in the public interest, that the permit is necessary to realize the benefits derived from the activity, and that the activity is otherwise lawful."

Plaintiff acknowledges that ordinarily permits would be required, but argue that, in this case, the County could maintain the level without obtaining a DEQ permit. Plaintiff asserts that if the Legislature intended for a permit to be required under Part 307, where the court sets the lake level, it would have included such a provision in Part 307. However, such a conclusion would ignore one of the tenets of statutory construction. Statutes that relate to the same subject or share a common purpose are in pari materia and must be read together as one law, even if they contain no reference to one another and were enacted on different dates. *Schuster, supra* at 417. The Legislature is presumed to be familiar with the rules of statutory construction. *In re Messer Trust,* 457 Mich. 371, 380; 579 NW2d 73 (1998). MCL 324.30723 specifically states that the provisions in Part 307 do not "abrogate the requirements of other state statutes." Adopting plaintiff's position would render M.C.L. § 324 .30723 nugatory, a construction that we must avoid if at all possible. *People v. Borchard-Ruhland,* 460 Mich. 278, 285; 597 NW2d 1 (1999).

As noted above, many provisions in the NREPA give the DEQ authority to control changes to the state waters. Most notably, the NREPA provides that dams are under the jurisdiction of the DEQ, M.C.L. § 324.31506, and a permit is required for any new dam construction, M.C.L. § 324.31509. In fact, in Part 307, M.C.L. § 324.30722 provides for periodic inspections of dams constructed on inland lakes where a normal water level has been established, and subsection(2) confers approval of plans and specifications of a dam's repair or replacement on the DEQ. The DEQ is required to confirm any report that "discloses a need for repairs or a change in condition of the dam that relates to the dam's safety or danger to the natural resources." MCL 324.30722(2). Additionally, M.C.L. § 324.31519(2) confers on the DEQ the authority to order the removal of a dam "[w]here significant damage to persons, property, or natural resources or the public trust in those natural resources occurs as a result of the condition or existence of a dam." Therefore, it follows that, as in this case, where the dam was never constructed, the DEQ's authority to require a permit for new dam construction is not abrogated by the court's prior lake level determination.

*5 Furthermore, the NREPA does delineate certain instances in which a permit is not required. See, e.g., M.C.L. § 324.30103; MCL 324.30305; MCL 324.31506(3). Yet, none of the exceptions are applicable in this case. Therefore, giving effect to M.C.L. § 324.30723, we hold that the trial court erred in concluding that the County was not required to obtain permits from the DEQ before constructing the dam.[7]

Plaintiff also argues that where a court has determined a lake level and ordered its maintenance pursuant to its authority in Part 307 of the NREPA, requiring a person to obtain a permit from the DEQ violates the separation of powers doctrine. We disagree.

The separation of powers doctrine exists "to preserve the independence of the three branches of government." *Hopkins v. Michigan Parole Bd,* 237 Mich.App 629, 636; 604 NW2d 686 (1999). Some overlap in powers is contemplated. *Id.* Under the NREPA, the circuit courts can still determine inland lake levels, though their ultimate power to enforce their orders is curtailed by the DEQ's power to protect natural resources. However, neither branch is prohibited from exercising their authority. "If the grant of authority to one branch is limited and specific and does not create encroachment or aggrandizement of one branch at the expense of the other, a sharing of power may be constitutionally permissible." *Id.* Here, the grant of power to determine lake levels is limited and specific (the power may be exercised in concert with the DEQ's power to protect natural resources), and the grant does not encroach on or aggrandize the DEQ's power or vice versa. Therefore, we find that there is no separation of powers violation.

Reversed.

All Citations

Not Reported in N.W.2d, 2003 WL 21480712

Footnotes

1 1994 PA 451, M.C.L. § 324.101 *et seq.*

2 Specifically, the court's authority to set inland lakes level is currently codified as part 307, M.C.L. § 324.30701 *et seq,* of the NREPA.

3 It is unclear as to why the parties stipulated to 582.0 feet instead of 582.5 feet, the court established lake level; though the 1959 court order did state that if a party appealed its judgment, the level could not be raised above 582.0 feet above sea level pending the appeal.

4 The required permits were to be obtained from the DEQ, Army Corp of Engineers, and Iosco County.

5 The County also applied to the Army Corps of Engineers for the required permit which was likewise denied.

6 The activities included in this section are: depositing fill material, dredging or removing material, use or development, and draining surface water. MCL 324.30304.

7 We do not decide the propriety of the DEQ's refusal to issue a permit in this case, as that issue is not before us.

End of Document

EXHIBIT 23

1997 WL 33352825
Only the Westlaw citation is currently available.

UNPUBLISHED OPINION. CHECK COURT RULES BEFORE CITING.

Court of Appeals of Michigan.

Michael SPOONER and Debra Spooner, Plaintiff-Appellants,
v.
Paul LEIDER, St. Clair County Drain Commission and Thomas Donahue, St. Clair County Drain Commissioner, Defendant-Appellees.

No. 175965.
|
April 25, 1997.

Before: YOUNG, P.J., and HOLBROOK, and J.R. ERNST,* JJ.

[UNPUBLISHED]

PER CURIAM.

***1** Plaintiffs appeal as of right from orders denying their request for writ of mandamus against Commissioner Thomas Donahue, granting defendants' motions for summary disposition, and denying their motion for reconsideration. We affirm.

I. Facts and Proceedings

A. Plaintiffs' Property

Plaintiffs entered an "as is" agreement to purchase property from defendant Paul Leider in November 1989.[1] Plaintiffs allege that they informed Leider that they planned to build a house on the property. The deal was closed in February 1990, and plaintiffs began construction on their house. In April 1990, after extensive rainfall, waters from the Graham Drain backed into the culvert adjacent to plaintiffs' land which then flooded onto plaintiffs' land. In January 1991, thawing snow and rain caused flood waters to cover plaintiffs' property. In November 1992, the land was flooded again, and flooding recurred in March 1993.

Paul Leider purchased the property for investment purposes in April 1989 from Jim Herman. In an affidavit, Leider testified that he rarely visited his property and had no knowledge of a flooding problem. Herman testified in his deposition that he told all prospective purchasers "the same thing", but could not recall whether he mentioned a water problem to Leider.

B. Problems with the Graham Drain

In 1979, Berlin Township filed a petition with Commissioner Donahue's office to clean Branch 1 of the Graham Drain. Commissioner Donahue testified at his deposition that the cleaning could not be accomplished due to an insufficient outlet, and he advised the township to either drop the project or petition to extend the drain. According to Commissioner Donahue, the township elected to drop the project.

In 1989, property owners from St. Clair County filed a petition to clean and extend the Graham Drain to the Macomb County Line, and clean Branch 1 of the drain. After the project was approved, Commissioner Donahue hired a surveyor to survey the land and prepare a plan to clean the entire drain and extend it to the Macomb County line. The surveyor reported that there was an insufficient outlet. Commissioner Donahue testified that after receiving this report, he inspected the land with the surveyor in order to find a sufficient outlet. When none was found, he contacted the Public Works Commissioner in Macomb County. Macomb County's commissioner was unable to identify a sufficient outlet and informed Commissioner Donahue that Macomb County would not help with the drain problem.

On June 10, 1991, Commissioner Donahue met with residents at a Berlin Township meeting and reported that the drain had a history of problems. Commissioner Donahue explained that a petition filed by St. Clair County residents would be futile because the water drains into Macomb County, and Macomb County did not wish to cooperate in solving the problem. Commissioner Donahue said that the only options available to citizens were to clean the drain themselves or petition the county to do it, but Donahue cautioned that either option could result in liability to downstream residents.

C. Plaintiffs' Case

***2** After their property flooded in 1993, plaintiffs filed this complaint, alleging inverse condemnation, trespass-nuisance, and mandamus against Commissioner Donahue. Plaintiffs also brought a claim against Paul Leider for fraudulent concealment. After a show cause hearing, the plaintiffs' request for a writ of mandamus against the Commissioner was denied. The court explained that, because plaintiffs failed to petition the drain commission, plaintiffs did not exhaust their administrative remedies, and thus failed to show cause to support a writ of mandamus.

Commissioner Donahue and the drain commission then moved for summary disposition as to the mandamus count and the remaining counts of plaintiffs' complaint, trespass-nuisance and inverse condemnation. The trial court granted summary disposition to these defendants as to the mandamus count for the same reasons stated at the hearing, i.e., failure to exhaust administrative remedies. However, the court denied summary disposition as to the inverse condemnation and trespass-nuisance counts, reasoning that these counts remained viable despite plaintiffs' failure to petition the drain commission. Commissioner Donahue and the drain commission then filed another motion for summary disposition as to the remaining counts. The court granted summary disposition for defendants as to the inverse condemnation count, reasoning that Commissioner Donahue had not directed any action towards plaintiffs' property, as well as the trespass-nuisance count, concluding that plaintiff failed to establish that the nuisance was caused or controlled by defendants. Leider also moved for summary disposition as to the fraudulent concealment claim. The trial court granted this motion also, finding that plaintiff failed to establish that Leider had actual knowledge of flooding problem. The trial court subsequently denied plaintiffs' motion for reconsideration, concluding that the motion for reconsideration raised the same arguments which were made in response to the motions for summary disposition.[2]

Plaintiffs contend on appeal that the trial court erred in denying their request for mandamus against Commissioner Donahue. They argue that the Commissioner had a clear legal duty to maintain and/or clean the Graham Drain. Alternatively, plaintiffs argue that, if filing a petition is required, plaintiffs were excused from any obligation to file a petition, since filing a petition would have been futile. In addition, plaintiffs challenge the orders dismissing their claims of inverse condemnation, trespass-nuisance, and fraudulent concealment.

II. Denial of Mandamus

Plaintiffs claim that denial of mandamus was error because the Drain Code mandates that the drain commissioner assess for additional funds to clean and extend a county drain in the absence of a petition. Alternatively, plaintiffs argue that any duty to file a petition is excused based on futility and/or constructive fraud.

A trial court's decision to deny a writ of mandamus will not be reversed absent an abuse of discretion. *Michigan Waste Systems, Inc v Department of Natural Resources,* 157 Mich.App 746, 760; 403 NW2d 608 (1987). Since mandamus is an extraordinary remedy, a plaintiff must fulfill the following requirements to warrant relief: "(1) the plaintiff must have a clear legal right to performance of the specific duty sought to be compelled; (2) the defendant must have the clear legal duty to perform such act; and (3) the act must be ministerial, 'where the law prescribes and defines the duty to be performed with such precision and certainty as to leave nothing to the exercise of discretion or judgment." ' *Delly v. Bureau of State Lottery,* 183 Mich.App 258, 260-261; 454 NW2d 141 (1990) (quoting *Carlson v. City of Troy,* 90 Mich.App 543, 547; 282 NW2d 387 (1979) and *Toan v. McGinn,* 271 Mich. 28, 34; 260 NW 108 (1935)). Mandamus is properly granted only when there is, in practical terms, no other remedy, legal or equitable, which might achieve the same result, and the party seeking the writ must prove entitlement to relief. *Delly, supra,* 183 Mich.App 260-261.

***3** Plaintiffs sought mandamus to require that Commissioner Donahue clean the Graham Drain of brush and overgrowth. Plaintiffs contend that such action is mandated by section 196 of the Drain Code, whenever a drain commissioner deems that *maintenance and repair* is necessary for the drain. MCL 280.196; MSA 11.1196. Commissioner Donahue and the drain commission respond that the action requested by plaintiffs actually involves *cleaning and extending* the Graham Drain. To *clean and extend* a county drain, a petition is required. MCL 280.191; MSA 280.1191. We conclude that under either section, plaintiff cannot establish entitlement to mandamus relief.

A. Mandamus Unavailable for Discretionary Action

County drain commissioners have jurisdiction over all drains within their respective counties. MCL 280.23; MSA 11.1023. The Drain Code provides that the commissioner or his duly appointed delegate may inspect the drain annually. MSA 280.196(1); MSA 11.1196(1). If the inspection reveals the necessity for maintenance and repair, the Commissioner may, without petition, expend funds for maintenance and repair as long as the cost does not exceed $2,500 per mile. MCL 280.196(4); MSA 11.1196(4). If the Commissioner determines that the needed repairs require funding in excess of $2,500 per mile, the Commissioner cannot spend in excess of this amount unless the expenditure has been approved by resolution of the governing body of each township, city and village affected by more than twenty percent of the cost. MCL 280.196(5); MSA 11.1196(5). Also, if the drainage fund does not contain sufficient funds, the drain commissioner shall reassess the drainage district for the funds for the inspection, maintenance, and repair "according to the benefits received." MCL 280.196(6); MSA 11.1196(6).

Plaintiffs argue that in the absence of a petition, Commissioner Donahue was required to reassess the district for the necessary funds because he acknowledged the need for cleaning the drain, estimated that the cost would exceed the statutory maximum of $2,500 per mile, and found that the drainage fund did not contain sufficient funds. Although the statute authorizes this action in the absence of petition, plaintiffs ignore the requirement that such an expenditure be approved by the governing body which will be affected, and that the drain commissioner's assessment is based upon determining the "benefits received."

We hold that denial of mandamus is proper for two reasons. First, plaintiffs' have not shown that Berlin Township or other local governments, which could be liable for the cost of this project, have approved this expenditure.[3] Second, even if there was approval by the affected townships, Commissioner Donahue's determination of the extent of the benefit received and thus, the amount to be reassessed, is an exercise of discretion. Because the actions plaintiffs believe the Commissioner should have undertaken were ministerial actions, involving no exercise of discretion or judgment, denial of mandamus was proper on this basis alone. *Delly, supra,* 183 Mich.App 261.

B. A Petition Was Required to Extend the Drain

*4 The lower court's denial was also proper on the basis that it actually denied plaintiffs' request, i.e., failure to exhaust administrative remedies. In that the relief plaintiffs sought involved *cleaning and extension* of the drain, a petition must be filed by at least five of the affected property owners or 50% of the landowners that would be affected by the project, which requested cleaning and extension of the drain. MCL 280.191; MSA 11.1191. As such, plaintiffs cannot establish, as a condition precedent to mandamus, that they had a clear legal right to *cleaning and extension* of the Graham Drain.

The Drain Code of 1956, M.C.L. § 280.1 et seq; MSA 11.1001 et seq, represents the Legislature's attempt to codify all laws regarding drains and to provide for detailed, specific, and exclusive procedures to be followed in proceedings to construct and maintain drains. *Toth v. Waterford Twp,* 87 Mich.App 173, 176; 274 NW2d 7 (1978); *Muskegon Twp v Muskegon County Drain Comm'r,* 76 Mich.App 714; 257 NW2d 224, lv den 402 Mich. 834 (1977). Absent fraud, all matters pertaining to the locating, constructing, cleaning, extending, etc., of drains are to be determined according to the procedures set forth in the Drain Code. *Toth, supra,* 87 Mich.App 176.

Plaintiffs argue that despite petitions filed 1979 and 1989, Commissioner Donahue has failed to resolve the problem, such that a petition would have been futile. A failure to exhaust administrative remedies will not preclude judicial review where the procedural requirements do not afford the aggrieved an adequate remedy. See M.C.L. § 24.301; MSA 3.560(201); *IBM v. Department of Treasury,* 75 Mich.App 604, 610; 255 NW2d 702 (1977). That is not the case here.

For *cleaning* or *extending,* the Drain Code provides that a petition may be filed by five property owners, or 50% of the landowners that would be affected by the project. MCL 280.191; MSA 11.1191; see also M.C.L. § 280.2; MSA 11.1002. The petition instigates other procedures under the code which outline the manner in which funding and approval for a project is raised.[4] Hence without the proper petition, a drain commissioner simply cannot undertake a project to clean and extend a drain. See M.C.L. § 280.194; MSA 11.1194; cf. *Bridgeport Charter Twp v Saginaw County Drain Comm'r,* 118 Mich.App 334, 339; 324 NW2d 618 (1982); *Tinsman v. Monroe Probate Judge,* 82 Mich. 562, 564; 46 NW 780 (1890).

Plaintiffs alternatively argue that their failure to file a petition should be excused based upon their detrimental reliance on Commissioner Donahue's alleged statements that filing a petition would be futile. Specifically, plaintiffs contend that statements made by Commissioner Donahue at a 1991 Berlin Township meeting constituted constructive fraud. Constructive fraud provides an equitable remedy to persons who detrimentally rely on false information although the person representing the false information did not intend to deceive. *Goodrich v. Waller,* 314 Mich. 456, 462; 22 NW2d 862 (1946). Proof of actual dishonesty or fraudulent intent is not necessary. Instead, a plaintiff must prove that the person gained a substantial benefit from the plaintiff's reliance on the false information. *Id.* Hence, plaintiffs must initially prove that the information they relied upon was false. Plaintiffs have failed to do so.

*5 According to the record, in the minutes from the relevant meeting, the Commissioner explained the history of problems associated with the drain, and that a petition by St. Clair County residents would be futile because Macomb County would not cooperate. He also advised that cleaning the drain would cause further flooding downstream, and that the citizens' only options were to file a petition with the county or clean the drain themselves. But he cautioned the residents that "downstream" residents may sue them for damage caused by the increased flooding on their property. Plaintiffs cite these minutes as evidence that they should be excused from filing a petition with the drain commissioner under a constructive fraud theory.

Plaintiffs failed to demonstrate how the statements attributed to the Commissioner in the minutes were false. As stated above, under the Drain Code, a petition instigates the procedures for cleaning and extending a county drain. Moreover, the Drain Code allows the drain commissioner to extend a drain into another county "to secure a proper outlet, *provided* such extension is approved by the drain commissioner and board of supervisors in each county" that would be affected. MCL 280.23; MSA 11.1023 (emphasis supplied). Further, the statements are consistent with a letter sent to plaintiffs, dated August 12, 1991, in which Commissioner Donahue clarified that there were problems with Macomb County's recalcitrance, and emphasized that plaintiffs were required to file a petition to initiate legal action. Plaintiffs failed to establish that the Commissioner's statements were false. Consequently, plaintiffs are not excused from their failure to file a petition with the drain commission.

C. Summary

In sum, we hold that a drain commissioner's duty to *maintain and repair* a drain exists in the absence of a petition. However, the duty to seek additional assessments is an act requiring the exercise of discretion to determine the necessity and the amount of the assessments. Moreover, in the absence of a petition, plaintiffs have not established a clear legal right to mandate that the drain commission *clean and extend* the drain. Accordingly the court did not abuse its discretion when denying plaintiffs' request for mandamus, and later dismissing the mandamus count from plaintiffs' complaint.

III. Governmental Liability for Intrusion on Plaintiffs' Property

Plaintiffs maintain that even in the absence of a petition, Commissioner Donahue and the drain commission are subject to liability for their failure to solve the problems with the Graham Drain. Plaintiffs contend that Commissioner Donahue's refusal to act has caused the flooding, thereby depriving them of the use and enjoyment of their property. We disagree and hold that plaintiffs have failed to establish a basis to maintain their claims of inverse condemnation or trespass-nuisance.

A. Inverse Condemnation

Plaintiffs argue that dismissal of their inverse condemnation action requires reversal because Commissioner Donahue's inaction amounted to government interference that deprived them of the use and enjoyment of their property. We disagree.

***6** The trial court granted defendants' motion regarding this count for failure to state a claim. MCR 2.116(C)(8). A motion pursuant to MCR 2.116(C)(8) tests the legal sufficiency of the pleadings alone. *Marcelletti v. Bathani,* 198 Mich.App 655, 658; 500 NW2d 124 (1993). The court accepts all well-pleaded facts as true and considers any reasonable inferences or conclusions which can be drawn from these facts. *Id.* The motion should be granted only when the claim is so clearly unenforceable as a matter of law such that no factual development could justify recovery. *Wade v. Department of Corrections,* 439 Mich. 158, 163; 483 NW2d 26 (1992); *Marcelletti, supra,* 198 Mich.App 658.

Proof of inverse condemnation requires that the government action is specifically directed toward the landowner's property, and that it permanently deprives the property owner of possession or use of their property. *Charles Murphy, MD v. Detroit,* 201 Mich.App 54, 56; 506 NW2d 5 (1993). Alternatively, a property owner must show that government action was a substantial cause of the decline of his property's value and that the government abused its legitimate powers in affirmative actions directly aimed at the plaintiff's property. *In re Acquisition of Virginia Park,* 121 Mich.App 153, 160-161; 328 NW2d 602 (1982).

Plaintiff urges government interference is shown by Commissioner Donahue's refusal to act, as evidenced by his response to the 1979 and 1989 petitions, and in his statements at the Berlin Township meeting in 1991. Inasmuch as plaintiffs' claim is based on Commissioner Donahue's alleged *inaction,* plaintiffs cannot establish that damage caused by the flooding resulted from action directed *toward* their property. Plaintiffs have also failed to demonstrate that Commissioner Donahue's actions were an abuse of his legitimate powers. *Virginia Park, supra,* 121 Mich.App 161; see also discussion, *supra,* section II. Thus, plaintiff cannot maintain a claim of inverse condemnation.

B. Trespass-Nuisance

The trial court found that while the evidence established that Commissioner Donahue had jurisdiction over the Graham Drain, plaintiffs failed to prove that the flooding was caused or controlled by Commissioner Donahue. The trial court concluded that plaintiffs did not establish the trespass-nuisance exception to governmental immunity and granted defendants motion for summary disposition pursuant to MCR 2.116(C)(7) and (C)(10).

This Court reviews a trial court's grant of summary disposition de novo to determine whether the moving party was entitled to judgment as a matter of law. *Stehlik v. Johnson (On Rehearing),* 206 Mich.App 83, 85; 520 NW2d 633 (1994). If a governmental body or agent moves for summary disposition pursuant to MCR 2.116(C)(7), the court reviews the complaint to see whether facts have been pleaded justifying a finding that recovery in a tort cause of action is not barred by governmental immunity. *Vermilya v. Dunham,* 195 Mich.App 79, 81; 489 NW2d 496 (1992). A motion pursuant to MCR 2.116(C)(10) tests the factual basis underlying the plaintiff's claim. *Radtke v. Everett,* 442 Mich. 368, 374; 501 NW2d 155 (1993). In reviewing a (C)(10) motion, a court considers pleadings, affidavits, depositions, admissions, and any evidence in favor of the nonmoving party, granting that party the benefit of any reasonable doubt. *Id* . Summary disposition is appropriate when there is no genuine issue as to any material fact, and the moving party is entitled to judgment as a matter of law. *Id.*

***7** A landowner, who seeks recovery of damages under the trespass-nuisance exception to governmental immunity, must prove that a physical intrusion caused a trespass or interference with the use or enjoyment of his or her land and that it was set in motion by the government or its agents, resulting in personal or property damage. *Hadfield v. Oakland County Comm'r,* 430 Mich. 139, 169; 422 NW2d 205 (1988). The *Hadfield* Court held that by virtue of the Takings Clause, governmental agents could be liable for personal and property injury arising from a government caused nuisance. *Id.,* 168-169. The elements of trespass-nuisance include: condition (nuisance or trespass); cause (physical intrusion); and causation or control (by government). *Hadfield, supra,* 430 Mich. 169. Causation can be established by government's failure to act as well as direct action. *Id.,* 185.

Relying on *Hadfield,* plaintiffs argue that Commissioner Donahue was clearly liable for trespass-nuisance because, as drain commissioner, he "controlled" the Graham Drain, and hence, the nuisance. Specifically, plaintiffs argue that Commissioner Donahue's failure to solve the Graham

Drain problem in 1979 and 1989, created the condition that caused the flooding on their property. Plaintiffs contend that this establishes that Commission Donahue's failure to act caused the flooding, and conclude that per *Hadfield,* he is clearly liable for the damage caused by the flooding. We disagree.

Liability cannot be imposed simply when a government agent has authority over an instrumentality causing the nuisance. In *McSwain v. Redford Township,* 173 Mich.App 492, 498; 434 NW2d 171 (1988), this Court emphasized that liability for trespass-nuisance turns upon whether the defendant was in control either through ownership or otherwise.

" 'We have found no authority imposing liability for damage caused by a nuisance where the defendant has not either created the nuisance, owned or controlled the property from which the nuisance arose, or employed another to do work which he knows is likely to create a nuisance.' But, the governmental unit has the requisite control, and therefore may be subject to liability, if it has a statutorily imposed obligation to abate the nuisance but fails to do so. See, *Hadfield, supra,* pp 177-185. Moreover, the governmental unit cannot escape liability for a nuisance created by a third person on property which it does not own if, by statute, it is charged with the responsibility of performing the activity which gave rise to the nuisance. In such case, the governmental unit against has the requisite control over the nuisance. *Id."* [*McSwain, supra,* 173 Mich.App 499 (quoting *Stemen v. Coffman,* 92 Mich.App 595, 598; 285 NW2d 305 (1979), lv den 408 Mich. 875 (1980)).]

In the instant case, plaintiffs have relied on *Hadfield* in support of their allegations that Commissioner Donahue's refusal to act caused the flooding.[5] Although the *Hadfield* Court dealt with an apparently analogous factual setting, plaintiffs' evidence actually refutes their contention that *inaction caused* the flooding on their property.[6] Unlike the inactive drain commissioner in *Hadfield,* Commissioner Donahue had taken affirmative steps within his authority under the Drain Code to resolve the problem since 1979. In fact, after the 1989 petition, Commissioner Donahue successfully completed a project to clean the upper end of Branch 1 of the Graham Drain.

***8** The record establishes that the flooding on plaintiffs' property cannot be alleviated unless the drain is cleaned *and* extended. However, the core obstacle to solving the problems with the Graham Drain is the absence of a sufficient outlet in St. Clair County to which accumulated water could pass. Per M.C.L. § 280.23; MSA 11.023, Commissioner Donahue cannot extend the drain into another county without the approval of the drain commissioner and board of supervisors in the affected county. In light of Macomb County's recalcitrance in solving the problem, Commissioner Donahue has no meaningful options. For example, Commissioner Donahue testified in his deposition that without a sufficient outlet, a clean drain would transfer the flooding problem to downstream residents. He also explained that a clean drain would simply delay, but not prevent water from accumulating on plaintiffs' property.

Plaintiffs have not refuted this evidence. Indeed, plaintiff Michael Spooner testified in his deposition that an inspection after he purchased the property disclosed that there was a water table under the property and that he was advised to "build up." Also, plaintiffs' property is lower than the culvert such that the risk of flooding exists whenever the culvert flows over its capacity. As such, simply cleaning the drain would not prevent flooding on plaintiffs' property.

Therefore, plaintiffs cannot establish that Commissioner Donahue failed in his statutory obligation to abate the nuisance. Consequently, they cannot establish that he has the requisite control over the nuisance to succeed in their claim of trespass-nuisance. *McSwain, supra.*

The undisputed facts do not establish a trespass or interference set in motion by the government or its agents. *Hadfield, supra.* Therefore, the trial court correctly concluded that defendants were not subject to liability under the trespass-nuisance exception to governmental immunity.

IV. Fraudulent Concealment

Plaintiffs next argue that the lower court erred in dismissing their fraudulent concealment claim against defendant Leider. The trial court dismissed the claim after finding that plaintiffs' proofs were insufficient to create a disputed issue of fact that Leider knew of a flooding problem prior to selling to plaintiffs. After reviewing the evidence in a light most favorable to plaintiffs, we affirm. MCR 2.116(C)(10); *Radtke, supra,* 442 Mich. 374.

Plaintiffs contend that Leider knew that there was a flooding problem on the property and failed to disclose this problem before selling the property to plaintiffs. A purchaser may allege fraudulent concealment based on the seller's failure to disclose a hidden defect. *Lorenzo v.*

Noel, 206 Mich.App 682, 687; 522 NW2d 724 (1994) (this is so even in the context of an "as is" sale); *Shimmons v. Mortgage Corp of America,* 206 Mich.App 27, 29; 520 NW2d 670 (1994). To prevail, plaintiffs must prove that at the time of the sale, defendant Leider knew of a hidden defect, and that they had no knowledge of the defect. *Clemens v. Lesnek,* 200 Mich.App 456, 459-461; 505 NW2d 283 (1993).

***9** Leider purchased the property in April 1989 from Jim Herman. Herman testified that he owned the property for seven years before Leider, and that he observed flooding a few times after the snow thawed in the Graham Drain. Herman also testified that he told Leider that he would have "to build it up when he builds or dig a pond," but he could not recall if he explained to Leider any reasons for this advice or whether there was a water problem. Herman recalled that Leider told him that he was buying the land as an investment. After entering an "as is" purchase agreement in November 1989, Leider conveyed the property to plaintiffs in February 1990. Plaintiff Michael Spooner testified in his deposition that he neither asked Leider about a water problem nor did Leider make any statement regarding the existence or absence of a water problem. In his affidavit, Leider averred that he rarely visited the property during his ownership and that he had no knowledge of a flooding problem.

To prove that Leider knew of the flooding, plaintiffs rely primarily on Herman's deposition testimony in which he stated "I told him about the flooding; I told everyone I sold to the same thing." However, Herman made this statement in response to a question asking what he stated to *plaintiff* Michael Spooner, not Leider. As stated, Herman could not recall what, if anything, he mentioned to *Leider* about a water problem. Therefore, the trial court correctly concluded that plaintiffs' evidence was insufficient to create a disputed issue of fact regarding Leider's knowledge of the flooding.

V. Conclusion

In summary, we affirm the lower court's orders granting summary disposition to all defendants. First, plaintiffs' request for mandamus was improper as it sought to compel discretionary action, and further, plaintiffs' failure to file a petition precluded finding that plaintiffs had a clear legal right to mandamus. Second, plaintiffs cannot maintain their inverse condemnation claim based on Commissioner Donahue's alleged *inaction.* Third, plaintiffs' evidence was insufficient to show that Commissioner Donahue's actions or alleged inaction caused the flooding on their property, such that the trespass-nuisance claim was properly dismissed. Finally, plaintiffs could not proceed against defendant Leider for fraudulent concealment because the evidence was insufficient to establish that defendant Leider had actual knowledge of the flooding problem.

Affirmed.

ERNST, J. (concurring in part and dissenting in part).

ERNST, J.

I respectfully dissent from that part of the majority opinion which concludes that defendant Thomas Donahue, St. Clair County Drain Commissioner, has no liability for flooding of plaintiffs' land caused by overflow from a drain under the jurisdiction of said defendant.

The majority finds that defendant Drain Commissioner lacks the ability to establish a sufficient outlet for Graham Drain within St. Clair County and that he is without statutory authority to provide such outlet by extension of said drain into neighboring Macomb County. Because defendant appears unable to abate the nuisance, the majority concludes that plaintiffs "cannot establish that he has the requisite control over the nuisance to succeed in their claim of trespass nuisance."

***10** I submit that an inability to restore the genie into the bottle is no defense against liability for damages caused by its intentional release. Here, Graham Drain is a public drain under the jurisdiction of defendant. Therefore, defendant by law does have control over the property from which the nuisance arose.

Plaintiffs allege that waters collecting in said drain seasonally rise due to an inadequate outlet, overflowing unto plaintiffs' property. The Supreme Court found that identical facts in *Hadfield* represent "a clear example of an actionable trespass-nuisance" * * * "for which the county drain commissioner may be held liable." *Hadfield, supra,* p 184. "Since the duty of a municipal corporation in respect to sewers and drains constructed by it is not performed until it has given them an outlet, it will be liable for damages caused by the insufficient capacity of an outlet to permit the escape of such water as may reasonably be expected to come to it." 18A McQuillin, Municipal Corporations, 3rd Edition Revised, § 53.123 p 228 (footnotes omitted).

Notwithstanding defendant's asserted inability to abate the condition causing plaintiffs' injury by improvement to the drain outlet, he does remain capable of responding to a claim for monetary damages for injury to plaintiffs' property caused by waters overflowing from Graham Drain, a public drain under his control.

I would reverse and remand for trial on this issue.

All Citations

Not Reported in N.W.2d, 1997 WL 33352825

Footnotes

* Circuit judge, sitting on the Court of Appeals by assignment.

1 The property is located in Berlin Township, St. Clair County.

2 Generally, a motion for reconsideration must demonstrate a "palpable error" by which the court and the parties have been misled. MCR 2.119(F)(3). A motion which merely presents the same issue as ruled on by the court, either expressly or by reasonable implication, will not be granted. *Id.* The grant or denial of a motion for reconsideration is a matter within the discretion of the trial court. *Carson v. Auto-Owners Ins Co,* 181 Mich.App 600, 605; 450 NW2d 6 (1989). We hold that plaintiffs failed to show "palpable error" which would justify relief for the reasons set forth in this opinion. Because we affirm the trial court, we find the court did not abuse its discretion when denying plaintiffs' motion for reconsideration.

3 Commissioner Donahue testified in his deposition, that after property owners filed a petition in 1989, his office determined that the necessary cleaning and extension of the drain would cost $20,000 per mile of the drain.

4 Under the Drain Code, after receiving a petition, the drain commissioner may proceed in the manner provided for locating and constructing drains. MCL 280.191; MSA 11.1191; see procedures in M.C.L. § 280.51 et seq; MSA 11.1051 et seq. This requires hiring a surveyor to inspect and prepare a plan for the project, M.C.L. § 280.52; MSA 11.1052, and appointing an independent review board to conduct a hearing and determine the necessity of the project and find that it is conducive to the public health, convenience, and welfare, M.C.L. § 280 .72; MSA 11.1072. If the petition is approved, the Drain Code provides specific procedures to determines the taxes to be assessed, notifying governmental bodies that will be affected by the cost of the project, and obtaining rights of way over the lands that will be affected. MCL 280.72-75; MSA 11.1072-1075; see also M.C.L. § 280.261 et seq; MSA 11.1261 et seq.

5 Commissioner Donahue argues that plaintiffs' failure to file a petition deprived him of jurisdiction to clean the drain, and thus, precludes a finding that Commissioner Donahue had control over the cause of the flooding. The plaintiffs in *Hadfield* had not filed a petition with the drain commissioner. Nevertheless, the Court imposed liability on the drain commissioner based on his awareness of the problem and its cause and continuous apathy towards the problem. *Id.,* 178 n 20, 184. Thus, we concur with the lower court, that plaintiffs' failure to have a petition filed would not preclude a claim of trespass-nuisance if plaintiffs could establish that the flooding was caused by Commissioner Donahue's failure to act.

6 In *Hadfield,* the plaintiffs' land flooded repeatedly. *Hadfield, supra,* 430 Mich. 177. The flooding was caused by water backing onto their land from clogged drains, a condition created by neighboring landowners who installed culverts along the county drain. *Id.,* 177-178. The drain commissioner essentially ignored the construction when some of the culverts were installed, and when plaintiffs alerted the commissioner to the problem as early as 1964, the commissioner took no action. *Id.,* 178 & n 19. However, the plaintiffs did not petition the drain commissioner to clean out the drains. Instead, they resorted to cleaning the drain themselves, and employing other temporary solutions. *Id.,* 178. The drain commissioner's office finally took action in 1973, and at that point, simply notified the owners, who had installed the culverts, that the culverts had to be removed. After unsuccessful attempts at negotiating removal of the culverts, the drain commissioner eventually sued those landowners in 1976. *Id.* at 179.

In 1976, the plaintiffs sued the drain commissioner, alleging that the drain commissioner should have prevented those landowners from installing the culverts, and was also liable for the subsequent failure to remove them. *Id.,* 178-179. The *Hadfield* Court held that the facts represented a clear example of trespass-nuisance and specifically found that the flooding was "caused by the county drain commissioner's failure to act." *Id.,* 184.

Commissioner Donahue's repeated attempts at solving the problem sharply contrast the apathetic drain commissioner in *Hadfield.* Instead, Commissioner Donahue's "control" over the problem is similar to that of the township board in *McSwain.*

In *McSwain,* the defendant township issued building and occupancy permits to residential homeowners in a subdivision who installed septic tank systems on their land. When many of the septic systems failed, raw sewage rose to the surface and collected on the plaintiffs' property. The plaintiffs, also residential homeowners, sued the township for issuing permits knowing the land was unsuitable for septic systems. *McSwain, supra,* 173 Mich.App 494. This Court held that the township did not have "control" over the nuisance because the collection of sewage was not caused by the township's action or inaction; the fault was with the owners of the septic systems. *Id.,* 499. The township merely issued permits to those residents, and this Court found this connection to the nuisance too tenuous to impose liability. *Id.* This Court also reasoned that no statutory obligation existed to abate the nuisance. *Id.,* 500. The statute in question merely vested authority in the township to make public improvements with public approval. Local residents had defeated a referendum proposal for a sewer system, and although the township could have taken other steps to install a sewer system, there was no mandate to do so. *Id.,* 499-500. The township did not have an affirmative duty to clear up the problem. *Id.,* 500-501.

Like the *McSwain* township board, Commissioner Donahue acted within his authority to solve the problems created by an insufficient outlet for the Graham Drain. However, because Commissioner Donahue did not have authority to extend the drain without Macomb County's approval, the problem could not be abated.

End of Document

EXHIBIT 24

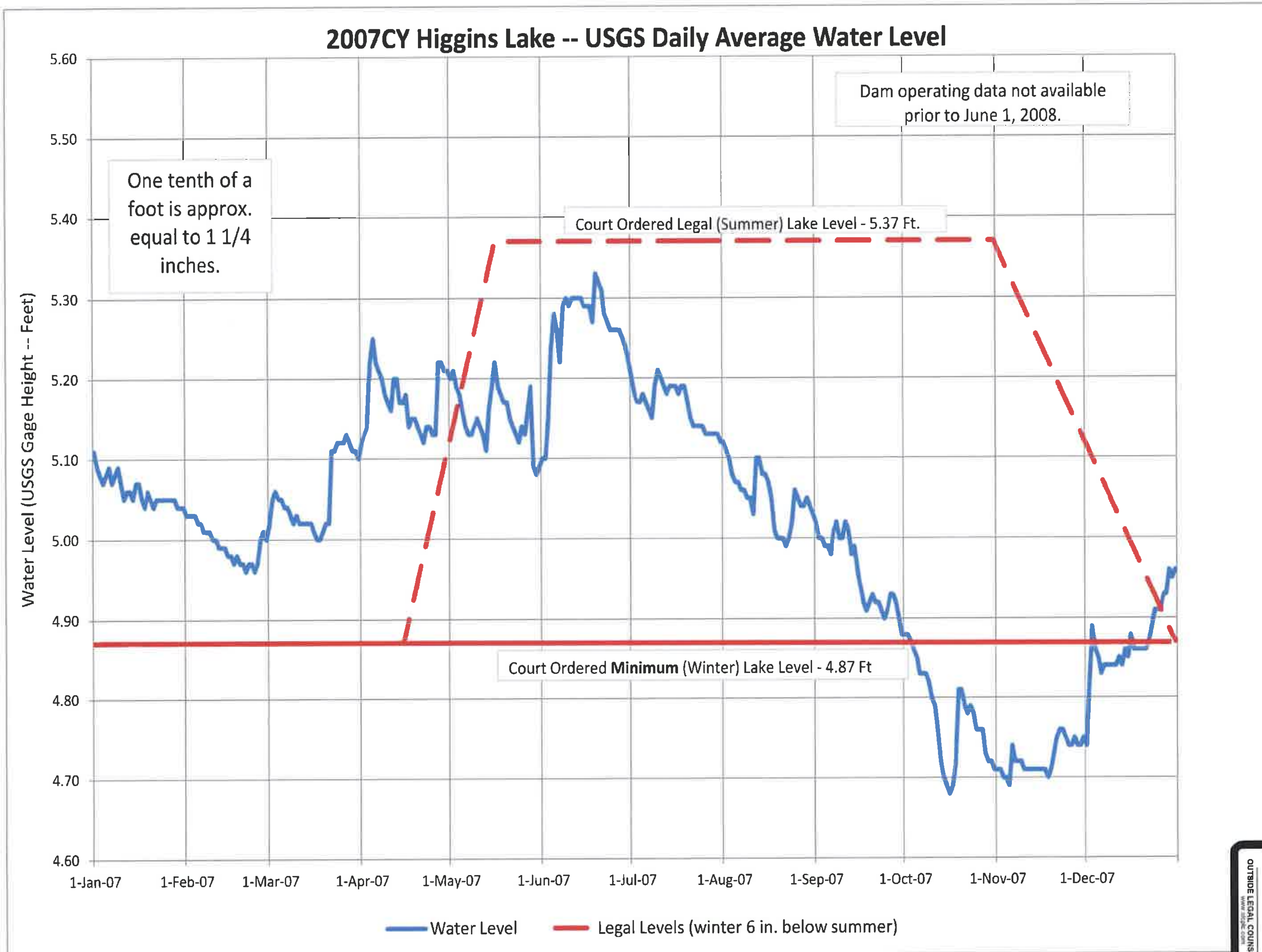
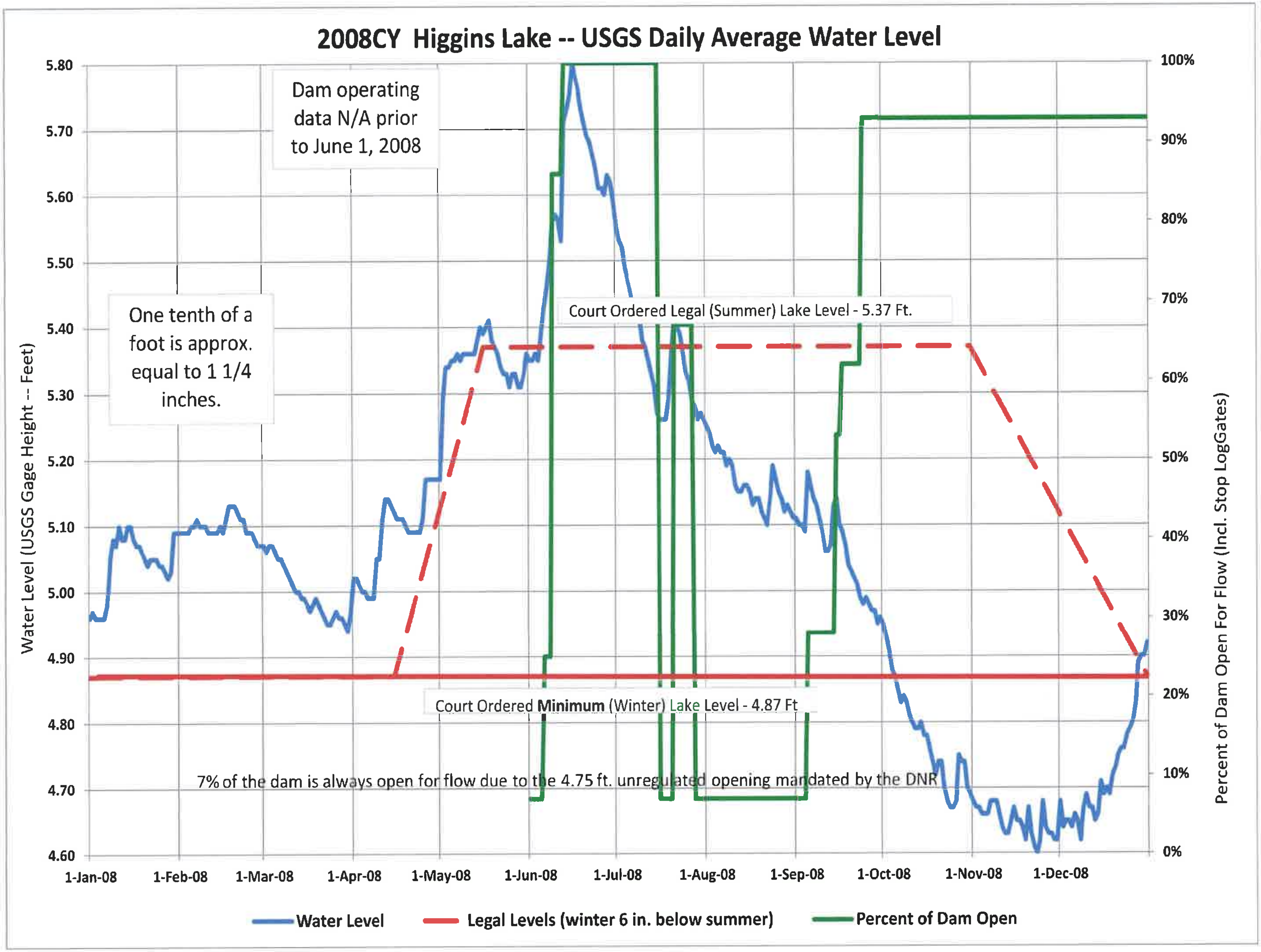
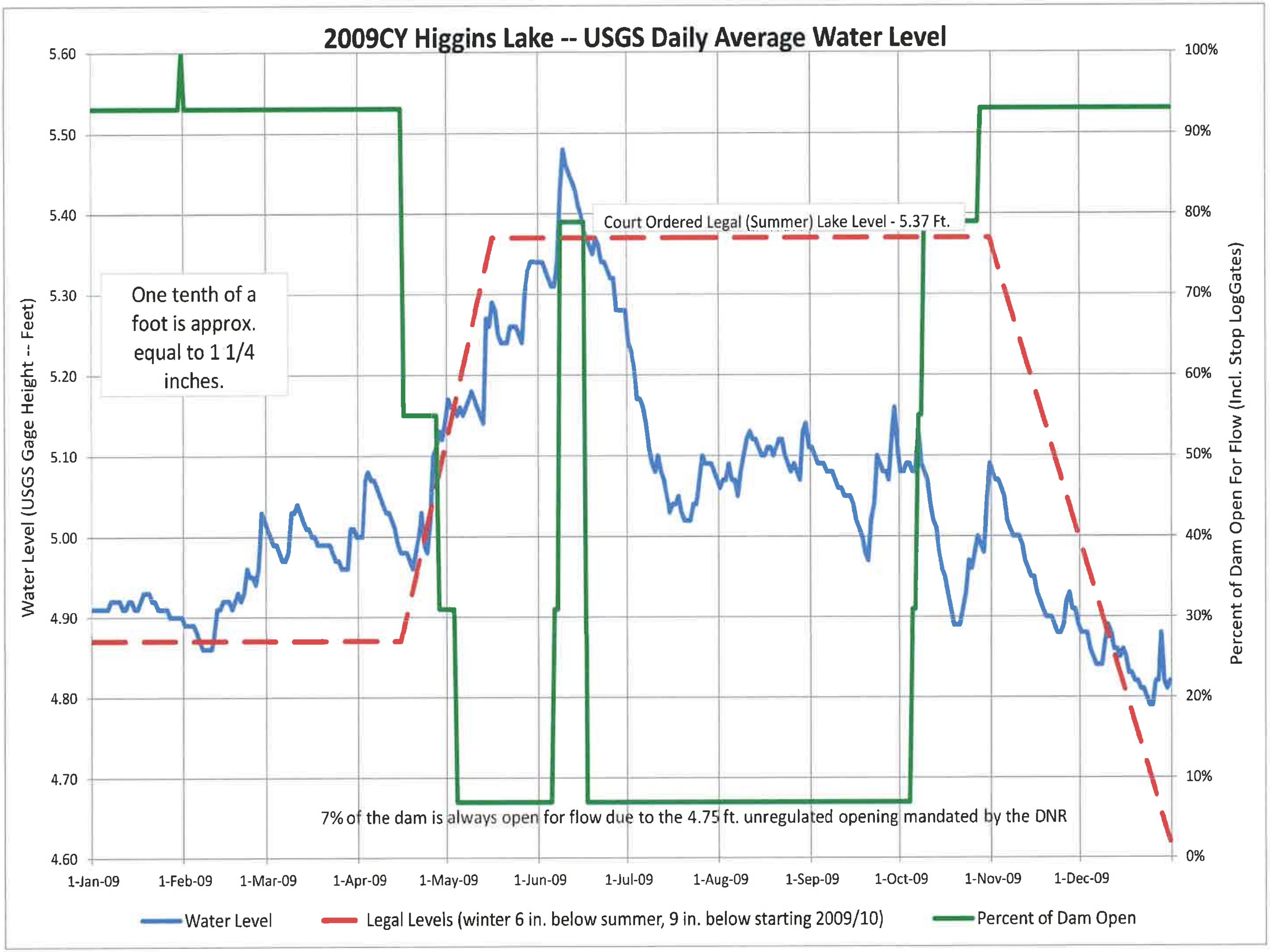
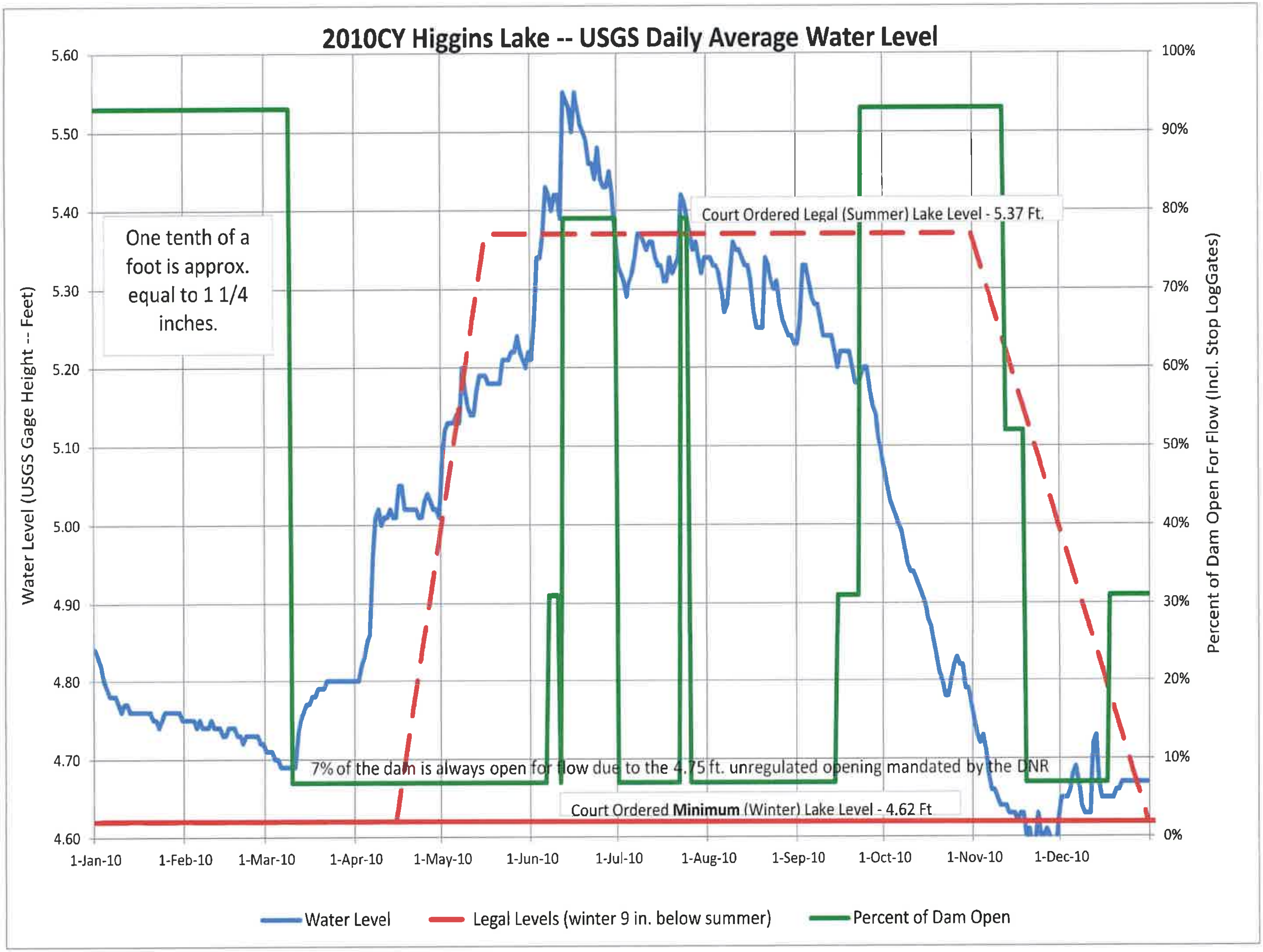


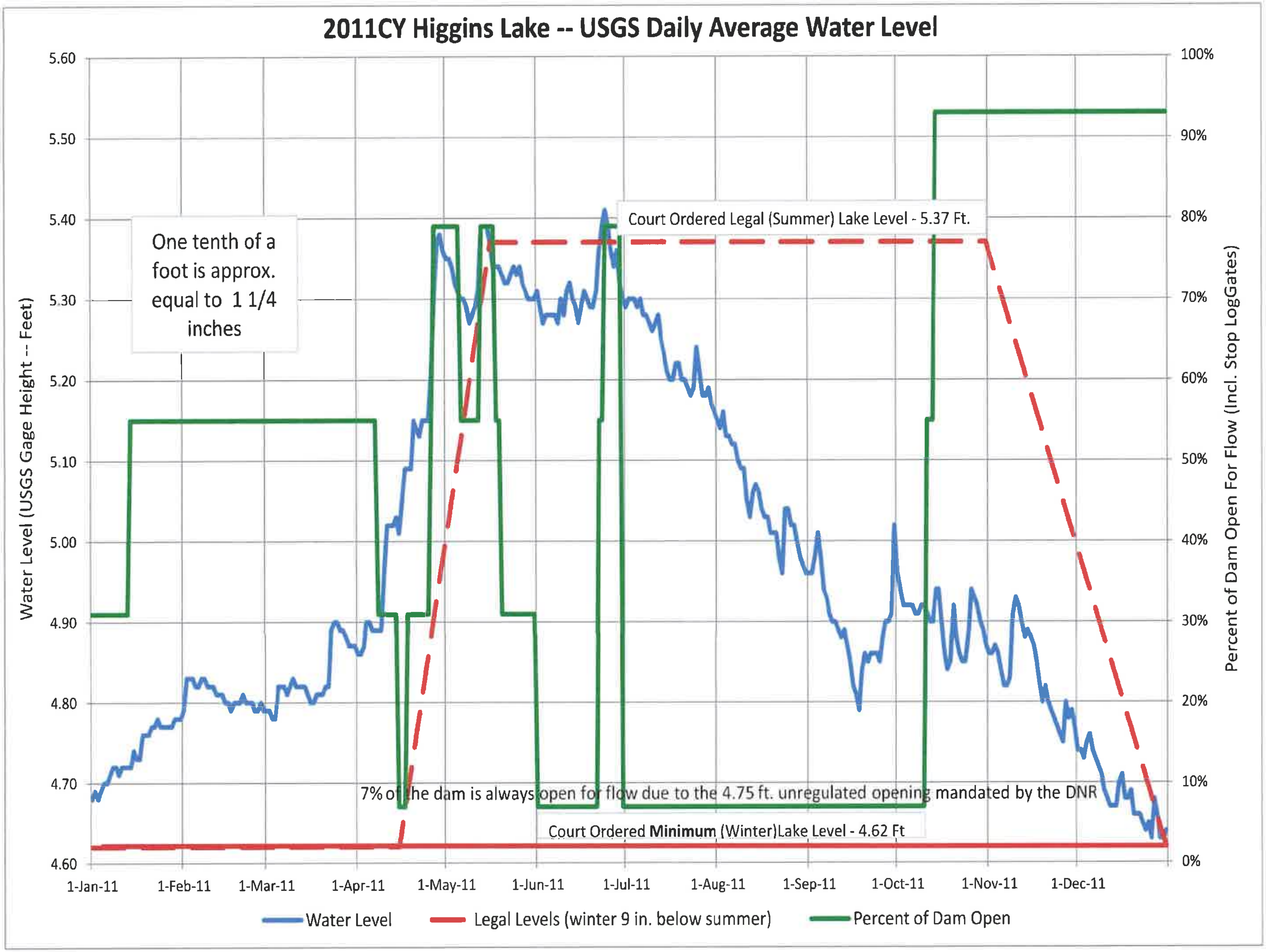
EXHIBIT
N
OUTSIDE LEGAL COUNSEL PLC

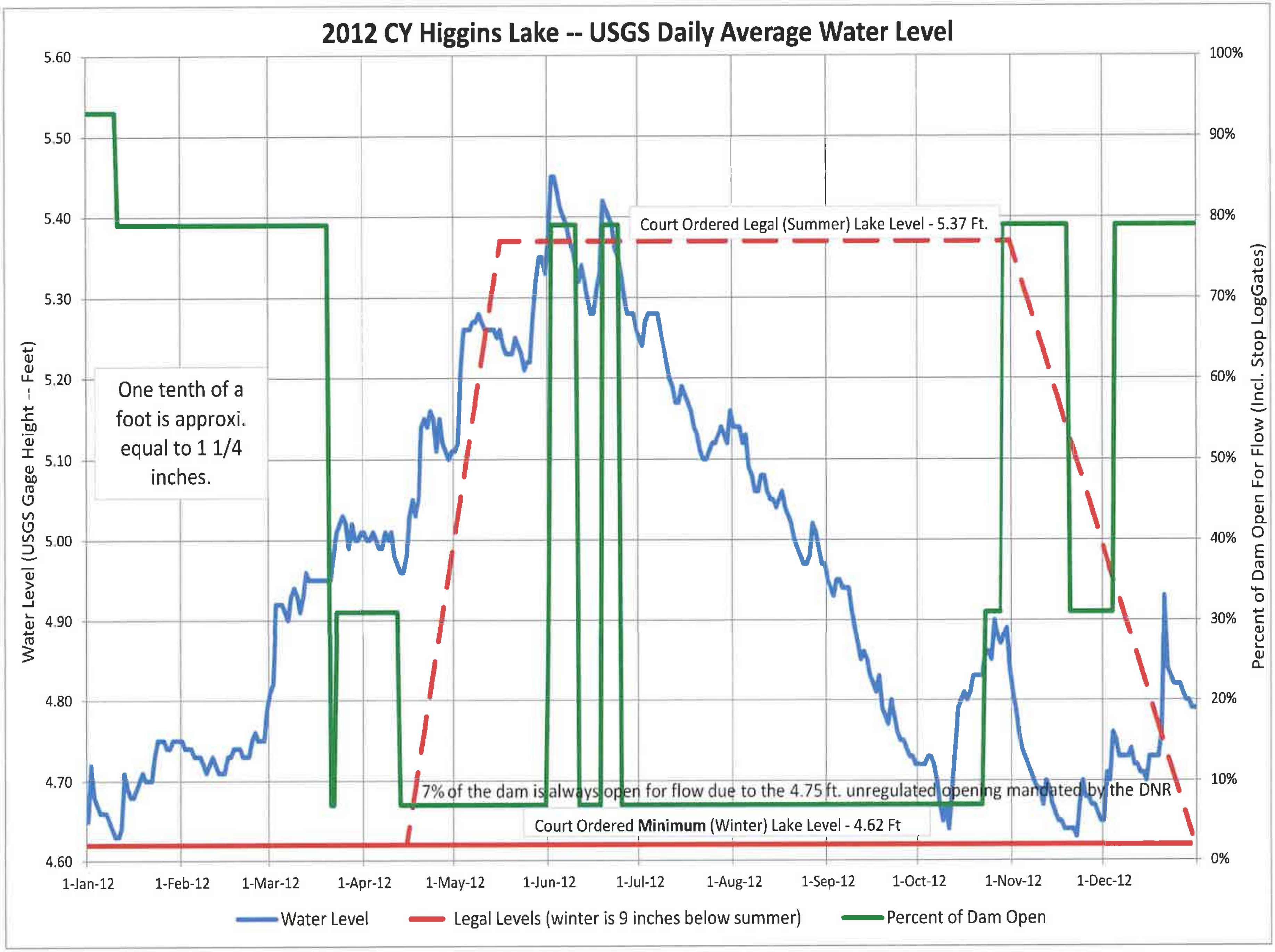

2008CY Higgins Lake -- USGS Daily Average Water Level
Dam operating data N/A prior to June 1, 2008
One tenth of a foot is approx. equal to 1 1/4 inches.
Court Ordered Legal (Summer) Lake Level - 5.37 Ft.
Court Ordered Minimum (Winter) Lake Level - 4.87 Ft
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop LogGates)
5.80
5.70
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1-Jan-08
1-Feb-08
1-Mar-08
1-Apr-08
1-May-08
1-Jun-08
1-Jul-08
1-Aug-08
1-Sep-08
1-Oct-08
1-Nov-08
1-Dec-08
Water Level
Legal Levels (winter 6 in. below summer)
Percent of Dam Open

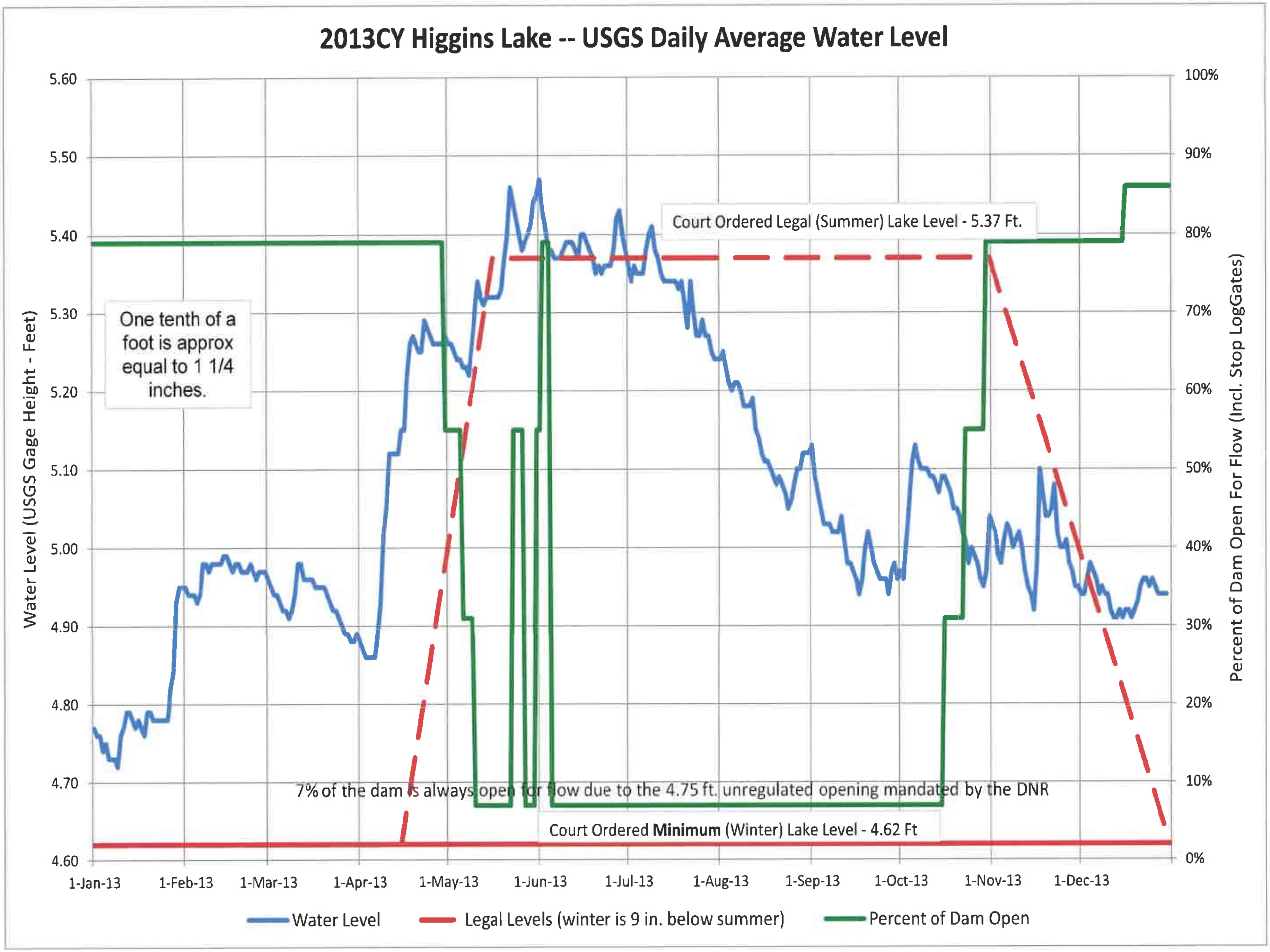

2009CY Higgins Lake -- USGS Daily Average Water Level
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop LogGates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1-Jan-09
1-Feb-09
1-Mar-09
1-Apr-09
1-May-09
1-Jun-09
1-Jul-09
1-Aug-09
1-Sep-09
1-Oct-09
1-Nov-09
1-Dec-09
One tenth of a foot is approx. equal to 1 1/4 inches.
Court Ordered Legal (Summer) Lake Level - 5.37 Ft.
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Water Level
Legal Levels (winter 6 in. below summer, 9 in. below starting 2009/10)
Percent of Dam Open

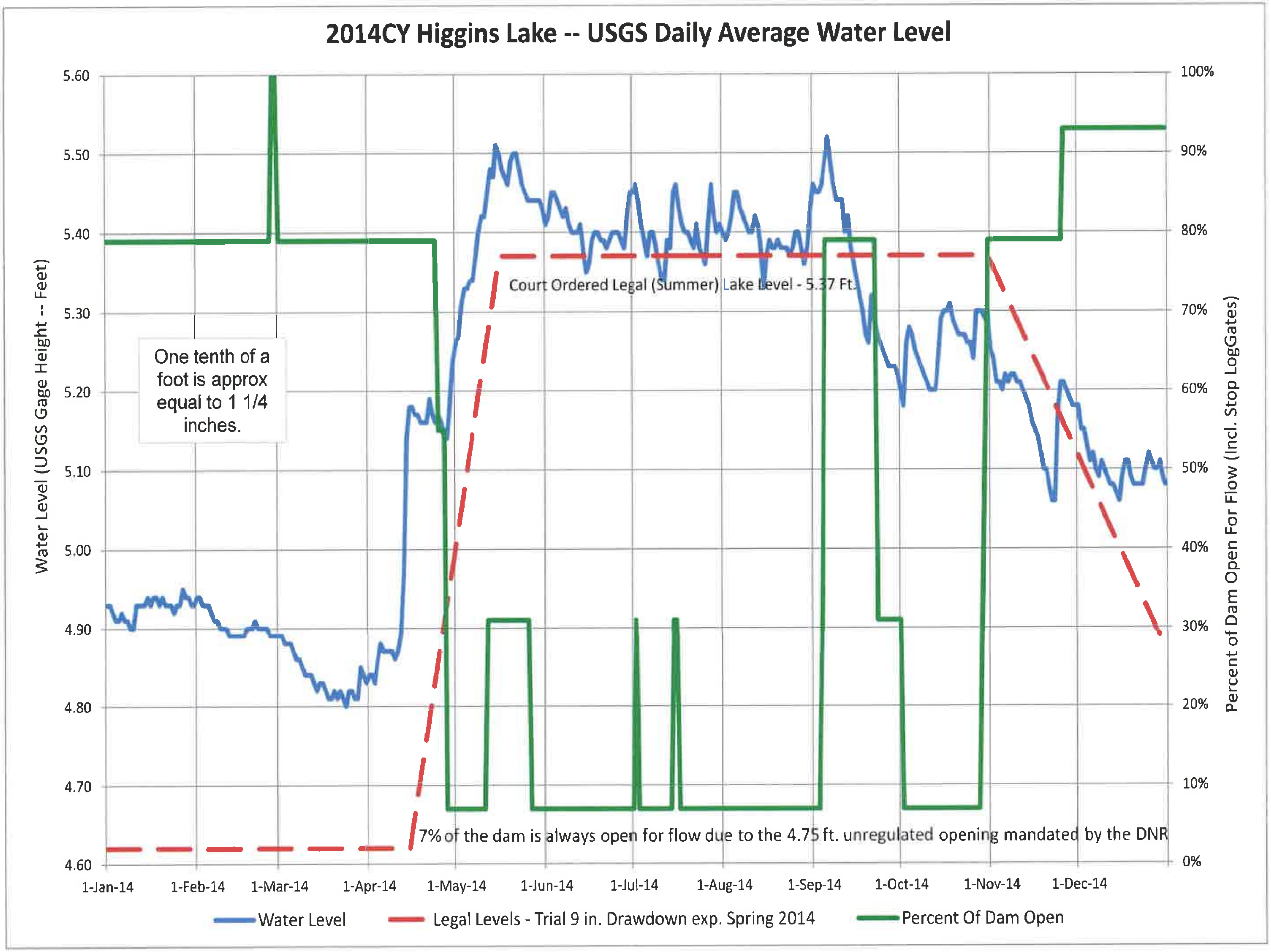


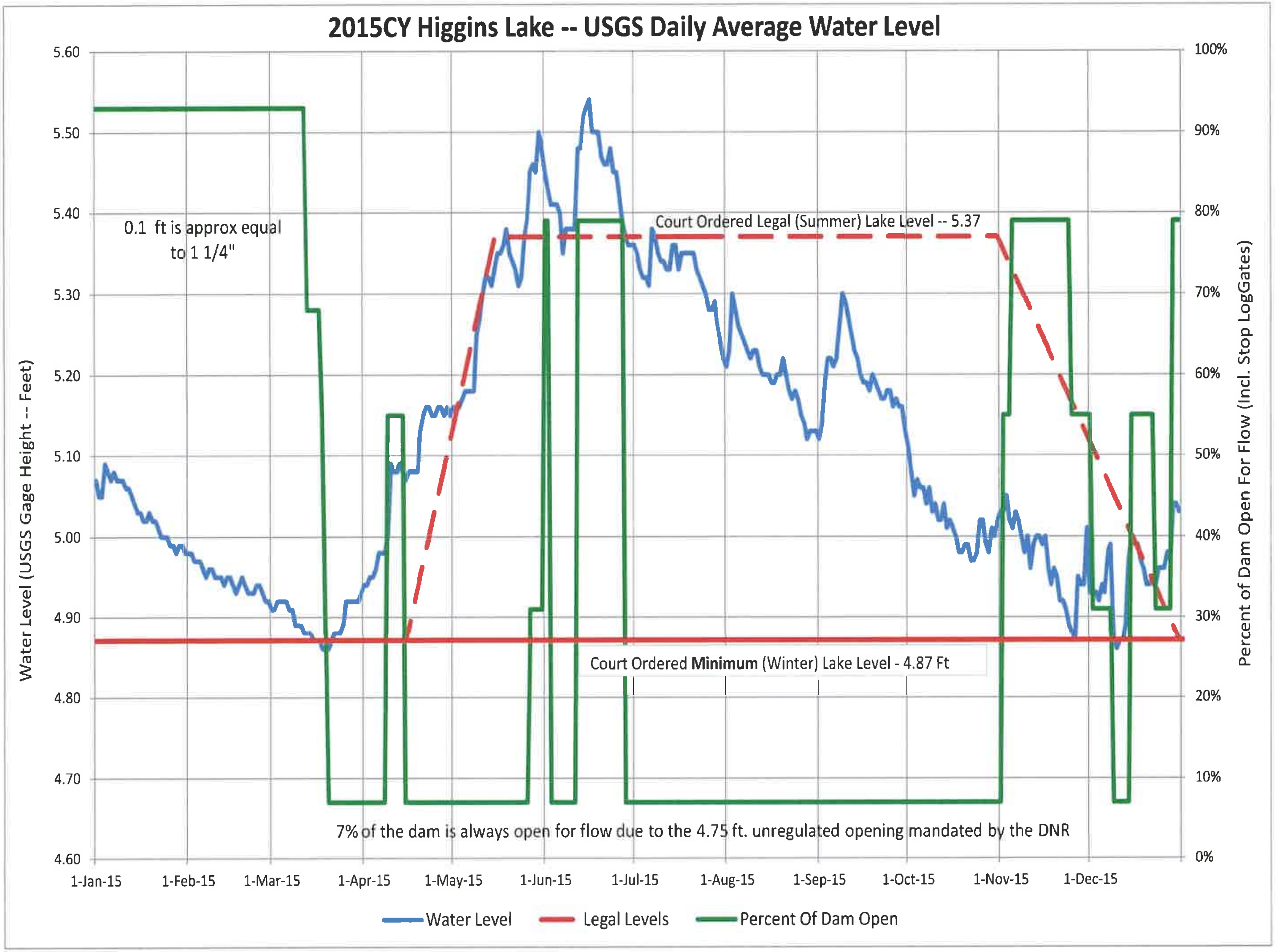
2010CY Higgins Lake -- USGS Daily Average Water Level
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop LogGates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1-Jan-10
1-Feb-10
1-Mar-10
1-Apr-10
1-May-10
1-Jun-10
1-Jul-10
1-Aug-10
1-Sep-10
1-Oct-10
1-Nov-10
1-Dec-10
One tenth of a foot is approx. equal to 1 1/4 inches.
Court Ordered Legal (Summer) Lake Level - 5.37 Ft.
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Court Ordered Minimum (Winter) Lake Level - 4.62 Ft
Water Level
Legal Levels (winter 9 in. below summer)
Percent of Dam Open

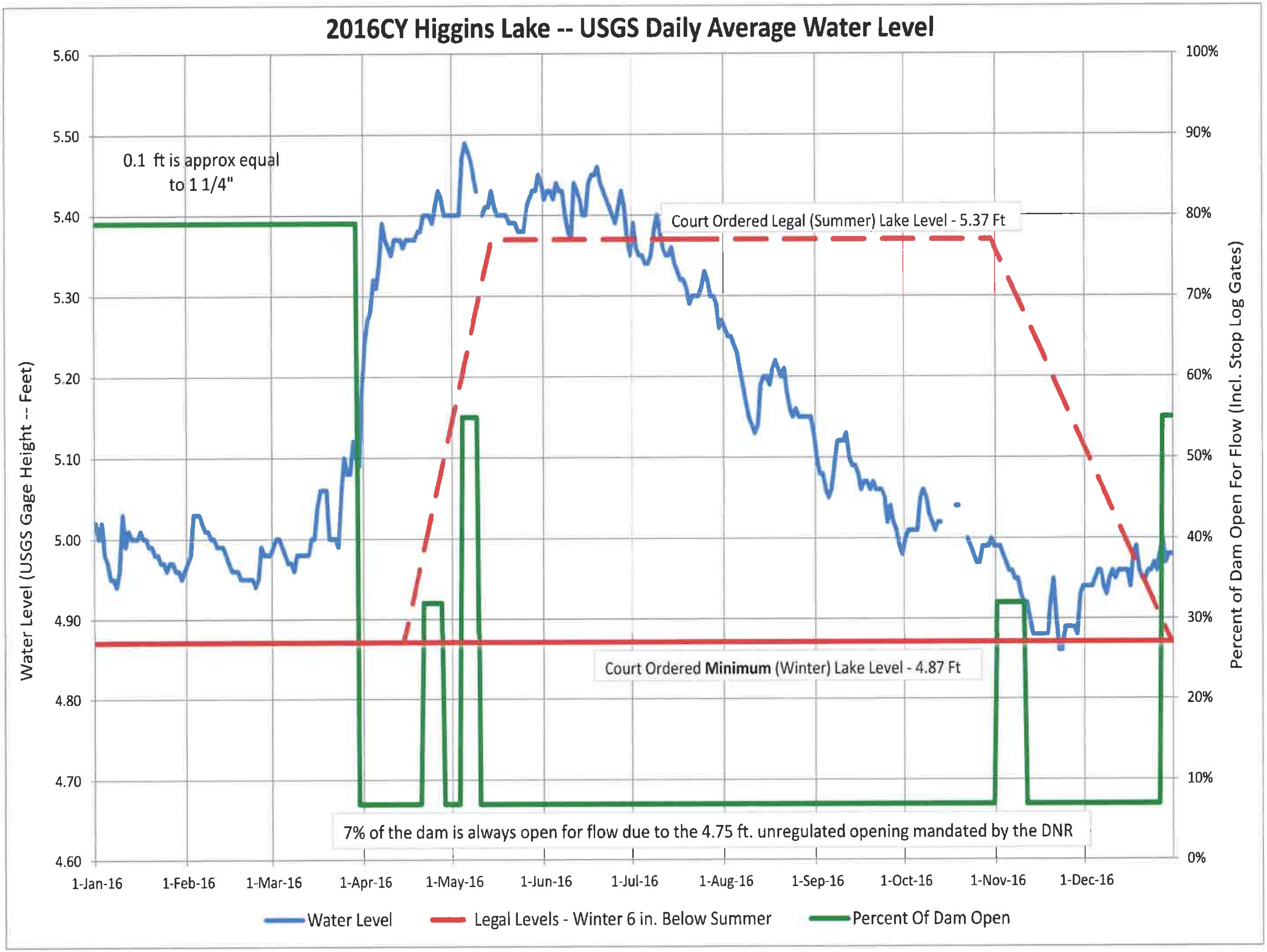

2011CY Higgins Lake -- USGS Daily Average Water Level
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop LogGates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1-Jan-11
1-Feb-11
1-Mar-11
1-Apr-11
1-May-11
1-Jun-11
1-Jul-11
1-Aug-11
1-Sep-11
1-Oct-11
1-Nov-11
1-Dec-11
One tenth of a foot is approx. equal to 1 1/4 inches
Court Ordered Legal (Summer) Lake Level - 5.37 Ft.
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Court Ordered Minimum (Winter)Lake Level - 4.62 Ft
Water Level
Legal Levels (winter 9 in. below summer)
Percent of Dam Open


2012 CY Higgins Lake -- USGS Daily Average Water Level
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop LogGates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
One tenth of a foot is approxi. equal to 1 1/4 inches.
Court Ordered Legal (Summer) Lake Level - 5.37 Ft.
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Court Ordered Minimum (Winter) Lake Level - 4.62 Ft
1-Jan-12
1-Feb-12
1-Mar-12
1-Apr-12
1-May-12
1-Jun-12
1-Jul-12
1-Aug-12
1-Sep-12
1-Oct-12
1-Nov-12
1-Dec-12
Water Level
Legal Levels (winter is 9 inches below summer)
Percent of Dam Open

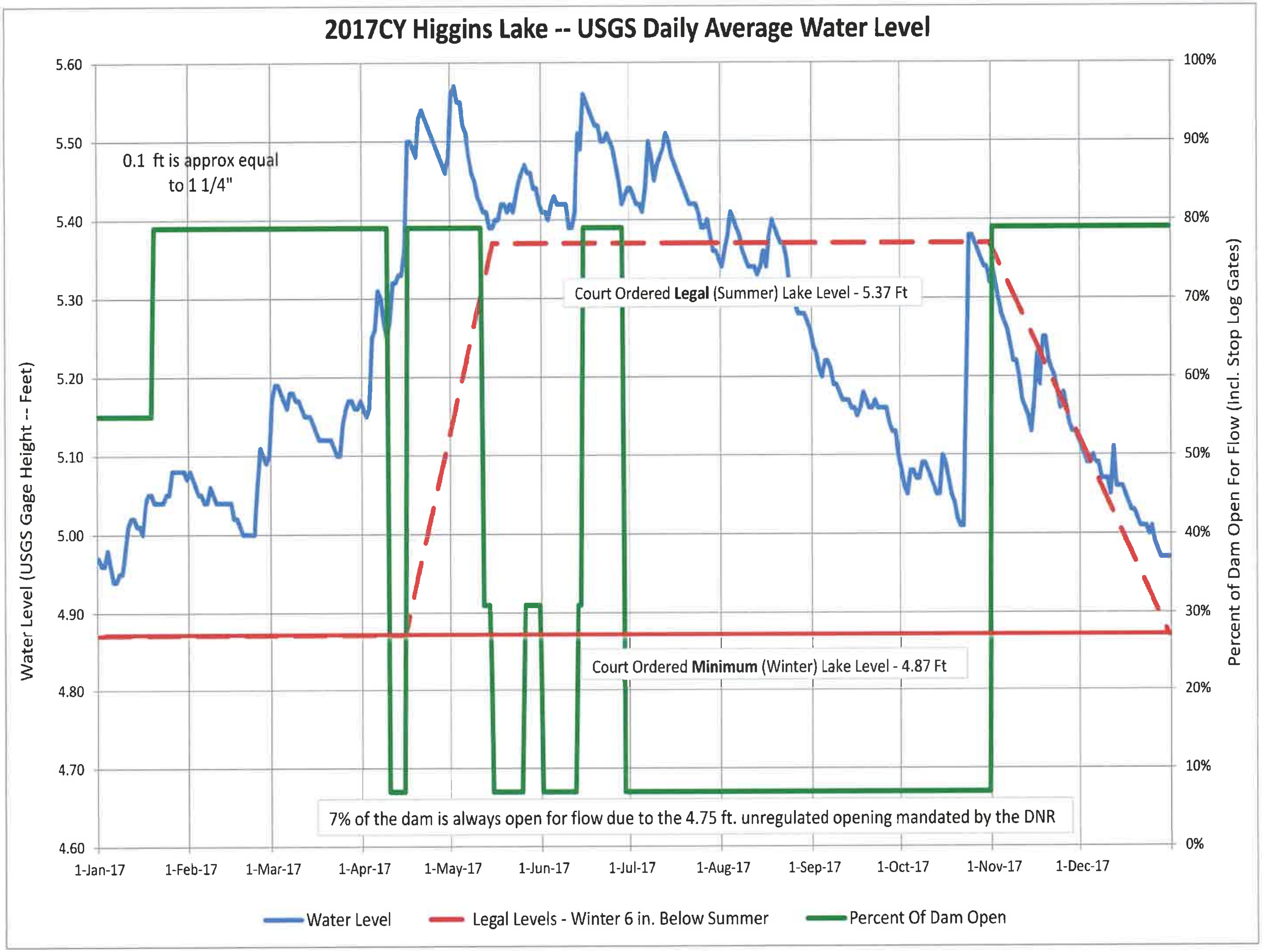

2013CY Higgins Lake -- USGS Daily Average Water Level
Water Level (USGS Gage Height - Feet)
Percent of Dam Open For Flow (Incl. Stop LogGates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1-Jan-13
1-Feb-13
1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
One tenth of a foot is approx equal to 1 1/4 inches.
Court Ordered Legal (Summer) Lake Level - 5.37 Ft.
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Court Ordered **Minimum** (Winter) Lake Level - 4.62 Ft
Water Level
Legal Levels (winter is 9 in. below summer)
Percent of Dam Open


2014CY Higgins Lake -- USGS Daily Average Water Level
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop LogGates)
One tenth of a foot is approx equal to 1 1/4 inches.
Court Ordered Legal (Summer) Lake Level - 5.37 Ft.
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Water Level
Legal Levels - Trial 9 in. Drawdown exp. Spring 2014
Percent Of Dam Open


2015CY Higgins Lake -- USGS Daily Average Water Level
0.1 ft is approx equal to 1 1/4"
Court Ordered Legal (Summer) Lake Level -- 5.37
Court Ordered Minimum (Winter) Lake Level - 4.87 Ft
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop LogGates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1-Jan-15
1-Feb-15
1-Mar-15
1-Apr-15
1-May-15
1-Jun-15
1-Jul-15
1-Aug-15
1-Sep-15
1-Oct-15
1-Nov-15
1-Dec-15
Water Level
Legal Levels
Percent Of Dam Open



2016CY Higgins Lake -- USGS Daily Average Water Level
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop Log Gates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1-Jan-16
1-Feb-16
1-Mar-16
1-Apr-16
1-May-16
1-Jun-16
1-Jul-16
1-Aug-16
1-Sep-16
1-Oct-16
1-Nov-16
1-Dec-16
0.1 ft is approx equal to 1 1/4"
Court Ordered Legal (Summer) Lake Level - 5.37 Ft
Court Ordered Minimum (Winter) Lake Level - 4.87 Ft
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
Water Level
Legal Levels - Winter 6 in. Below Summer
Percent Of Dam Open



2017CY Higgins Lake -- USGS Daily Average Water Level
Water Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (incl. Stop Log Gates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.1 ft is approx equal to 1 1/4"
Court Ordered Legal (Summer) Lake Level - 5.37 Ft
Court Ordered Minimum (Winter) Lake Level - 4.87 Ft
7% of the dam is always open for flow due to the 4.75 ft. unregulated opening mandated by the DNR
1-Jan-17
1-Feb-17
1-Mar-17
1-Apr-17
1-May-17
1-Jun-17
1-Jul-17
1-Aug-17
1-Sep-17
1-Oct-17
1-Nov-17
1-Dec-17
Water Level
Legal Levels - Winter 6 in. Below Summer
Percent Of Dam Open

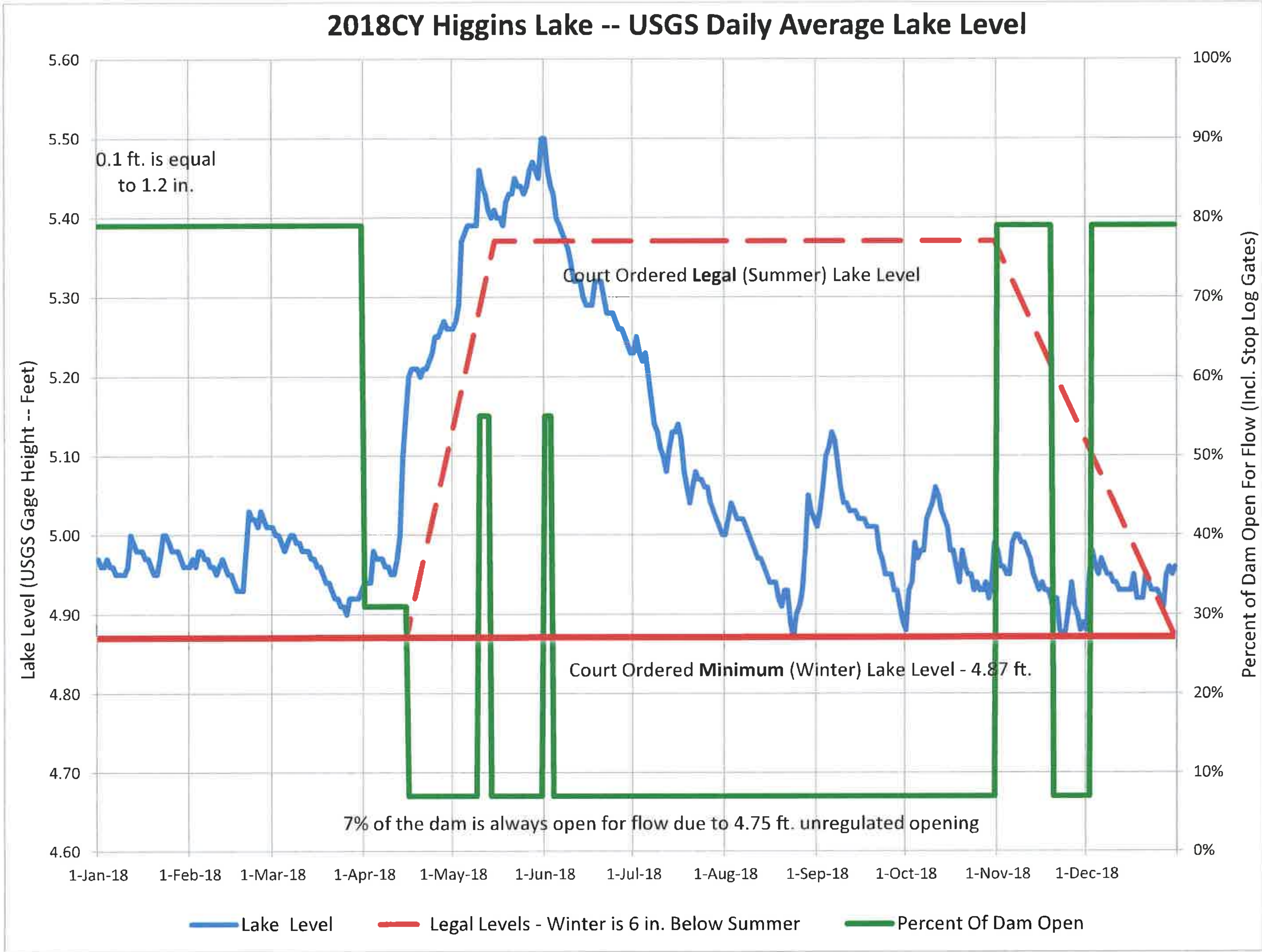
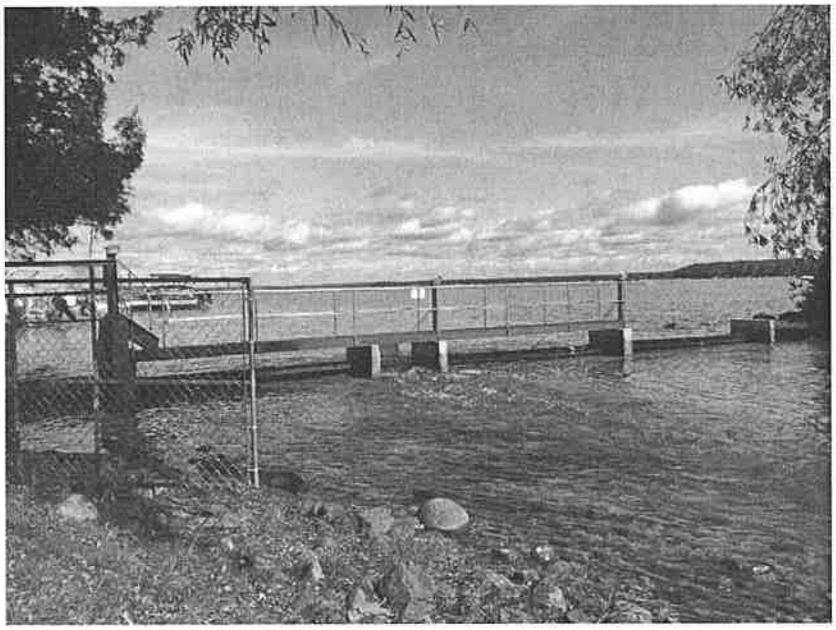

2018CY Higgins Lake -- USGS Daily Average Lake Level
Lake Level (USGS Gage Height -- Feet)
Percent of Dam Open For Flow (Incl. Stop Log Gates)
5.60
5.50
5.40
5.30
5.20
5.10
5.00
4.90
4.80
4.70
4.60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.1 ft. is equal to 1.2 in.
Court Ordered Legal (Summer) Lake Level
Court Ordered Minimum (Winter) Lake Level - 4.87 ft.
7% of the dam is always open for flow due to 4.75 ft. unregulated opening
1-Jan-18
1-Feb-18
1-Mar-18
1-Apr-18
1-May-18
1-Jun-18
1-Jul-18
1-Aug-18
1-Sep-18
1-Oct-18
1-Nov-18
1-Dec-18
Lake Level
Legal Levels - Winter is 6 in. Below Summer
Percent Of Dam Open

EXHIBIT 25



2019 DAM INSPECTION REPORT
FOR
HIGGINS LAKE LEVEL CONTROL STRUCTURE

ROSCOMMON COUNTY

Submitted to:
ROSCOMMON COUNTY BOARD OF COMMISSIONERS
500 Lake Street
Roscommon, Michigan 48653
bobschneider@roscommoncounty.net

Submitted by:
J.E. TIFFANY AND SONS, LLC
1707 N. 39 Road
Manton, MI 49663

July, 2019

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND AND WATER MANAGEMENT DIVISION
DAM INSPECTION REPORT

This form is to be used for inspection reports required by Part 307, Inland Lake Levels, for those dams that do not meet the size criteria as defined by Part 315, Dam Safety, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Dams six (6) feet or more in height, as defined by Part 315, and impounding five (5) acres or more at the design flood elevation, must meet the inspection report format as outlined in Section 31518 of Part 315.

A person failing to comply, or falsely representing dam conditions, is guilty of misconduct in office.

DAM NAME		DAM ID	COUNTY
Higgins Lake Level Control Structure		2011	Roscommon
DATE OF INSPECTION July 15, 2019	NAME OF WATERBODY Higgins Lake/The Cut River	SECTION, TOWN, RANGE Sec. 34 T 24N. R 03W.	LEVEL THIS DATE 1154.04 +/-
DATE ELEVATION SET BY COURT 3/19/1982	LEGAL LEVEL 1154.11 (Starting 4/15 or Ice Out)	DRAWDOWN LEVEL 1153.61 (Starting 11/1)	HIGH WATER MARK ELEVATION N/A

EARTH EMBANKMENTS (LOOKING DOWNSTREAM) LEFT EMBANKMENT ≈20 FT. RIGHT EMBANKMENT N/A FT. TOTAL LENGTH 20 FT.

	UPSTREAM	CROWN	DOWNSTREAM
VEGETATIVE COVER	Grass & Wetland Plants	N/A	Wetland Plants
EROSION	None	None	None
SEEPAGE			N/A
SLIDES, SLUMPS & CRACKS	None	None	None
ANIMAL BURROWS	None	None	None
WAVE ACTION PROTECTION	Plain & Heavy Riprap		Plain & Heavy Riprap
REMARKS*	/	Sheet piling L. of spillway-Fair condition (no problem now)	/

CONTROL STRUCTURE

TYPE	YEAR CONSTRUCTED	STRUCTURAL HEIGHT (top of dam elevation minus stream invert)
3 Stoplog Bays Plus 3 Gates & 1 Open Bay	1950	38". Top of concrete to stream invert.
LENGTH OF SPILLWAY Left & Middle Gate 17'-3" Ea. Right Gate 15'-8" 3 Stoplog Bays ≈5' Each Open Bay 4'-9"	FREEBOARD N/A	HYDRAULIC HEIGHT (design flood elevation minus stream invert) N/A
VERTICAL PIPE SIZE N/A	HORIZONTAL PIPE SIZE N/A	HEAD (normal headwater minus normal tailwater) ≈8" 7/15/2019

DESCRIBE CONDITION OF THE FOLLOWING ITEMS.

STOPLOG VALVES AND GATES (open and close to check condition): Check location of top stoplog in relation to top of riser pipe intake box or fixed crest, for leakage, and condition of stoplogs, valves and gates. Everything is in excellent condition. Gate height has been increased since last inspection with extension plates.
OUTLET PIPE: Check for damage from ice, logs, vandalism; inside discharge pipe for settlement and/or joint separation; condition of pipe coating. N/A

CONTROL STRUCTURE (continued)

CONCRETE STRUCTURE: Check for erosion; location of cracking or spalling. If old or new; settlement; need for crack repairs. Excellent Condition	
WALKWAY & RAILING: Check if in place or removed, condition, and if adequate protection provided. Older catwalk/rail at right end-Good Condition Left catwalk/newer rail-Good condition overall. Some corrosion where rail was bent or welded during fabrication.	TRASHRACK OR LOG BOOM: Check if operable. N/A
EMERGENCY SPILLWAY: Size, type, and condition. N/A	

INLET & OUTLET CHANNELS

	INLET	OUTLET
SIZE	Lake	≈60'
EXISTING CONDITION	Good	Good
EROSION	None	None
DEBRIS & OBSTRUCTIONS	None	None
RIPRAP PROTECTION	Significant Plain and Heavy Riprap	Significant Plain and Heavy Riprap
REMARKS*	/	/

RECOMMENDATIONS

List work needed, how to be done, by whom, estimated cost, source of funds, recommended completion date. If emergency, to what extent. ADDITIONAL COMMENTS.

None

Inspection Ordered By: Mr. Bob Schneider

Roscommon County Delegated Agent

James E. Tiffany, P.E.

INSPECTOR'S NAME (PRINTED)

ADDRESS 1707 N. 39 Road

CITY, STATE, ZIP CODE Manton, MI 49663

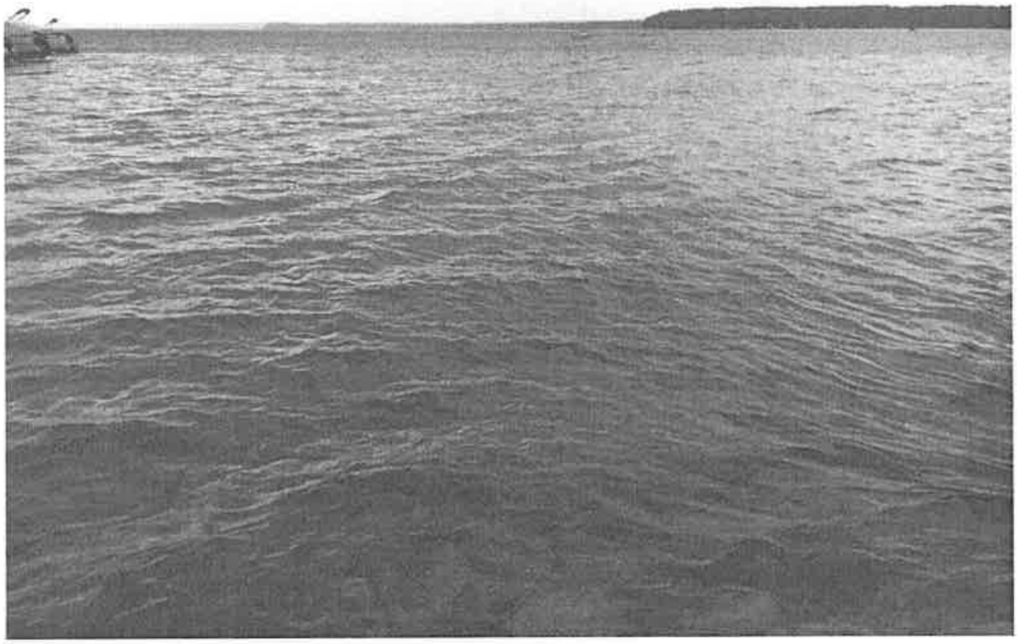
TELEPHONE NUMBER 231-735-4546

JAMES E. TIFFANY
ENGINEER
NO. 43942

SIGNATURE

6201043942

P.E. REGISTRATION NO.

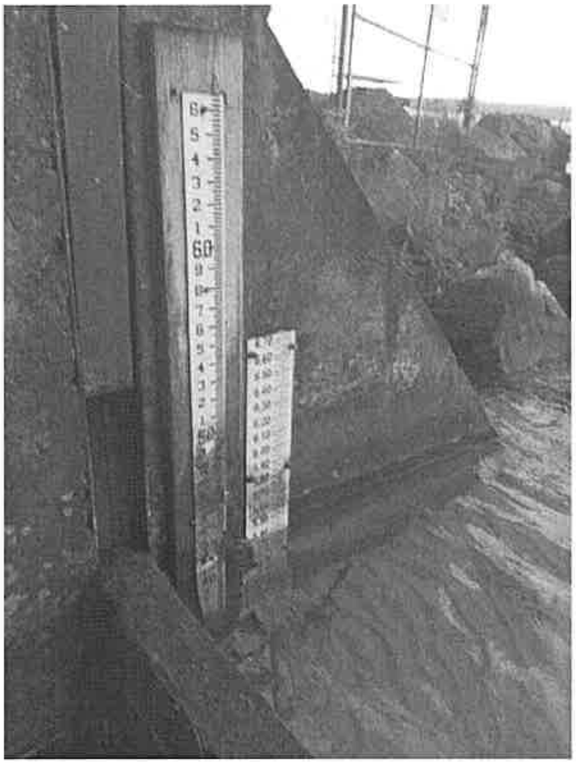


Higgins Lake

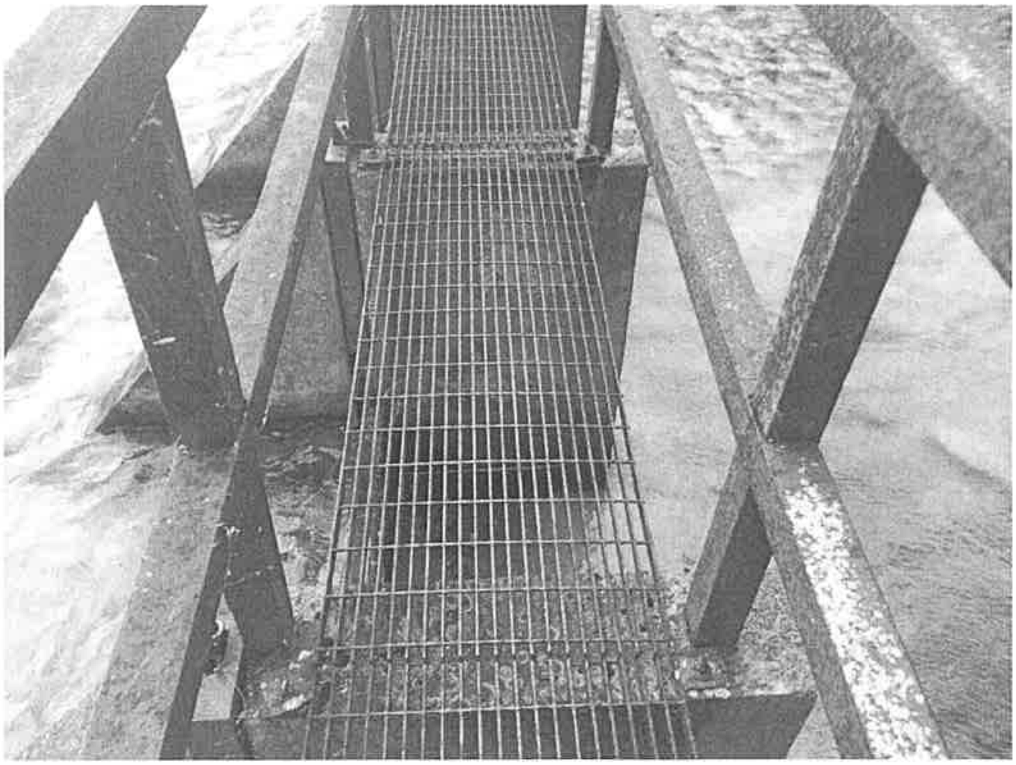
Downstream Channel

Structure from Right Bank

Right Bank



Right Abutment Wall, Staff Gage



Catwalk

Typical Stoplog Bay

Typical Gated Bay (Note Gate Extension Plate on Right)

Left Catwalk with Newer Railing

Sheet Piling, Left End of Structure

EXHIBIT 26

STATE OF MICHIGAN
CIRCUIT COURT FOR THE 34TH JUDICIAL CIRCUIT
ROSCOMMON COUNTY

IN THE MATTER OF: THE WATER LEVELS OF HOUGHTON LAKE, HIGGINS LAKE, AND LAKE ST. HELEN

No. 81-3003-CF

HON. ROBERT W. BENNETT

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AFFIDAVIT OF LUCAS A. TRUMBLE

STATE OF MICHIGAN)
)SS
COUNTY OF INGHAM)

I, Lucas A. Trumble, P.E., Environmental Engineer with the Michigan Department of Environment, Great Lakes, and Energy (EGLE) (formerly the Department of Environmental Quality (MDEQ)), Water Resources Division, Hydrologic Studies and Dam Safety Unit hereby swear and attest under penalty of perjury as follows:

1. I have been employed as an Environmental Engineer by EGLE since September 2010.

2. As an Environmental Engineer for EGLE's Water Resources Division's Hydrologic Studies and Dam Safety Unit, my responsibilities include administration of Part 315, Dam Safety, and Part 307, Inland Lake Levels, of the Michigan Natural Resources and Environmental Protection Act, MCL 324.31501 *et seq.* and MCL 324.30701 *et seq.*, respectively. Administration of these statutes includes inspection of dams; review of inspection reports, operation and maintenance plans, and emergency action plans; permitting; and compliance and enforcement activities related to regulated dams.

3. In my professional capacity, I am extremely familiar with Part 307, Inland Lake Levels, of the Michigan Natural Resources and Environmental Protection Act, MCL 324.30701 *et seq.*

4. I have reviewed the motion filed by the Movants in this matter, which seeks an order requiring the Roscommon County Board of Commissioners to show

cause why it should not be held in contempt of court for its maintenance of the Court-ordered normal lake level of Higgins Lake.

5. As part of my review of the file in this matter, I reviewed the range of water surface elevations provided by the Movants as Exhibits E through H to their brief in support of their motion.

6. Based on my review of the Movants' motion and attached exhibits, it appears to me that the Movants' argument is premised on the notion that the Court-ordered Summer lake level is a minimum level, and that any deviation of the measured level of Higgins lake which goes below the Court-ordered Summer lake level constitutes an act of contempt of court, even if the deviation is as small as 1/100th of a foot.

7. EGLE has never interpreted or enforced a "normal level" as defined under Part 307 as an exact water surface elevation that must be maintained, but rather as a target elevation. In fact, it is virtually impossible to maintain a lake level exactly within 1/100th of a foot due to the natural fluctuations of lake levels caused by increased or decreased flow into the lake from upstream sources or direct runoff, wind and waves, irrigation or evaporation, physical limitations of dams to provide this level of precision in controlling discharges and water levels, or physical limitations of water level recording devices.

8. The range of water surface elevations set forth in Exhibits E through H to the Movants' motion (which are generally within six inches of the Court-ordered level) is reasonable and is consistent with the degree of variation that is

both expected and, given the dynamic nature of stream flows and dam operations, virtually unavoidable. As a result, significant resource impacts to Higgins Lake would not be expected.

9. Other legal lake level control structures in place in other lakes, including dams with fixed crests, have flow variations that cause the lake level to fluctuate up or down more than the six inches or so that the water surface elevation information provided by the movants claims occurred at Higgins Lake.

10. Based on the information provided by the Movants, the operator of the dam at Higgins Lake appears to be doing a reasonable job operating the dam and maintaining the lake level near the Court-established normal level.

11. I have personal knowledge of the facts stated in this affidavit and, if called as a witness, I am competent to testify accordingly.

Lucas A. Trumble

Subscribed and sworn to before me
this 27th day of September 2019

Laura Smith

Acting in and for Ingham County

My Commission Expires: 8-2-25

LF:

Laura Smith
Notary Public of Michigan
Ingham County
Expires 08/02/2025
Acting in the County of Ingham