

# **OPERATION & MAINTENANCE PLAN**

## **LMKP LID-DLD LID PUMP STATION OUTLET TO OTTER TAIL RIVER**

**Lake level drawdown for Little McDonald, Kerbs, Paul,  
Devils & Little Devils Lakes**

**Near Perham, MN**

May 2017

Little McDonald, Kerbs & Paul Lake Improvement District

Devils-Little Devils Lake Improvement District

Otter Tail County

## **I. Introduction**

This operation and maintenance plan is for the Little McDonald, Kerbs & Paul Lake Improvement District (LMKP LID) and Devils-Little Devils Lake Improvement District (DLD LID) lake drawdown project (the "Project"). The purpose of the Project is to ultimately reduce the water surface elevations of the lakes within both Districts to their respective Ordinary High Water (OHW) elevations. These lakes do not have a natural outlet, so an artificial means of removing water from the lake is required.

The Project proposes to collect and filter water through separate systems on Little McDonald Lake and Devils Lake and pump it through a shared 30 inch forcemain that will discharge into the Otter Tail River. Once in the Otter Tail River it will naturally flow downstream to the Mud Lake/Little Pine group of lakes, and then to Big Pine Lake, Rush Lake, and Otter Tail Lake. The river naturally flows through all of these lakes and they all have sufficient surface water outlets. The maximum capacity of the water transfer system proposed is 20 cubic feet per second (cfs) and this would be the total combined amount pumped from the two collection and filtration systems. The water will be filtered through DNR approved filtration systems prior to being pumped downstream in order to prevent the transfer of aquatic invasive species (AIS). Kerbs Lake and Paul Lake are already connected to Little McDonald Lake and their connections would be enhanced as needed and likewise for Little Devils Lake and Devils Lake.

This plan has been prepared with input and cooperation from Otter Tail County and is consistent with plans prepared for similar water level management projects implemented throughout the county. The Project will be operated and controlled by the Otter Tail County Public Works Division.

## **II. Background**

Historic flooding is occurring on the lakes within the Project area. Water levels in Little McDonald, Kerbs, Paul and Devils Lakes have risen considerably in recent years, consistently exceeding the OHW levels of the lakes and causing considerable flood damage to homes and infrastructure and severe bank erosion. The most recently published DNR lake level readings show Little McDonald Lake and Kerbs Lake at 2.6 ft over OHW (12/15/2016), Devils Lake at 2.5 ft over OHW (11/30/2016), and Paul Lake at 2.9 ft over OHW (12/05/2016). As of April 25, 2017 Little McDonald Lake had risen to 3 feet above its OHW.

The four lakes listed above and other small surrounding lakes are all located in close proximity to each other and hydraulically interact with both the groundwater underneath the lake bed and some connect with each other on the surface. This system of lakes does not have any natural or manmade surface water outlet to any lower elevation water body at or below the OHW levels for each lake. Without a natural outlet or any practical facilities or tools to manage the lake water levels the Districts sought to develop and implement an artificial outlet that would transfer water out of their hydrologic system to a suitable outlet that could accept the water without experiencing adverse impacts. Multiple alternatives were studied over the years, and the Project was determined to be the most feasible alternative.

### **III. Project Components**

The Project will consist of the following main components:

**Little McDonald Lake:** Water will be removed from the LMKP lakes through a collection, filtration and pumping system located on the east side of Little McDonald Lake. Water from Little McDonald Lake will be collected through an intake pipe that will extend into the lake a few feet below the OHW and the intake structure will include a screen on the inlet of the pipe that will prevent larger debris from entering the pumps. The intake pipe is gravity fed and outlets into the wet well of the pumping station. The pumping station is proposed to be located on the east side of Little McDonald Lake on property owned by the LMKP LID. The pumping station will include a below-grade wet well structure and 2 high capacity pumps which would transfer the water from the wet well and through mechanical filtration screens that have been designed to filter zebra mussels and zebra mussel larvae (veligers). The mechanical filtration system will be approved by the MNDNR and no water can bypass the filtration system. After passing through the filters, the filtered water will be conveyed under pressure through the non-perforated transfer pipeline to the shared leg of the forcemain. The maximum capacity of the pumping system is 15 cfs. The pumping station would have a building to function as a protective enclosure for the pumps, filters and electrical and control systems. Refer to the maps included herein for an overview of the project component locations.

**Paul Lake:** Currently, water from Paul Lake reaches Little McDonald Lake through a culvert that conveys water from Paul Lake into Rusch Lake and another culvert under CSAH 34 that moves water from Rusch Lake into Little McDonald Lake. These culverts are in disrepair and not have control structures that would allow the flows between the lakes to be controlled. A new set of 24" diameter culverts are proposed to better manage and control water transfer between the lakes and to provide the required capacity. These lake water transfer pipe would allow Paul Lake water to gravity flow into Little McDonald Lake when it exceeds its ordinary high water (OHW) elevation (1356.7 ft.) and Little McDonald Lake (OHW 1355.6 ft.) has a lower level. In addition, a permanent control gate would be installed on the pipes to allow the flows from Paul Lake into Little McDonald Lake to be controlled.

**Devils Lake:** While zebra mussels have not been identified in Devils Lake, the water pumped from Devils Lake would be filtered in a manner consistent with Little McDonald Lake. This will ensure a safeguard for future AIS needs. Considering the consistent spread of zebra mussels in the neighboring lakes, and the existence of a public boat access on Devils Lake, it is practical to provide filtering capabilities. The proposed Devils Lake outlet consists of a buried 14-inch diameter non-perforated forcemain and pumping station. The maximum pumping capacity of this system is 5 cfs. The 14-inch pipe would be approximately 1,300 feet in length. In general, the alignment of the Devils Lake Outlet forcemain would follow along 460<sup>th</sup> Street to the east of Devils Lake before joining into the shared forcemain near the intersection of 410<sup>th</sup> Avenue and 460<sup>th</sup> Street.

**Forcemain:** The shared leg of the forcemain would begin near the intersection of 410<sup>th</sup> Avenue and 460<sup>th</sup> Street. The alignment would then run northeasterly through agricultural lands and outlet into the Otter Tail River in the SE ¼ of Section 28 in Gorman Township (see map). The shared leg of the forcemain is a buried 30 inch diameter non-perforated pipe extending approximately 12,000 feet and includes multiple air release manholes installed at high points along the route. An outlet structure at the end of the forcemain will serve to dissipate energy in the water leaving the pipe while also serving to aerate the water and prevent upstream passage of fish.

## **IV. Operation**

The Project will be operated by Otter Tail County Public Works.

The Project will be utilized to lower the water surface elevations in the LMKP and DLD lakes to elevations at or above their respective OHW elevations, as defined by the DNR, without negatively affecting shoreline use, accessibility to the lakes, and downstream conditions. The pumps will not be used to artificially lower water levels in any lake to an elevation below its OHW.

The maximum discharge from the outlet of the shared forcemain cannot exceed 20 cfs. While this maximum discharge may be split between the two pumping systems, preference will not be given to either system if downstream conditions do not allow the desired discharge, i.e. either both systems operate or neither one operates. If one LID does not need to operate their system while the other one does not Otter Tail County Public Works officials can adjust the operation with written consent of each LID.

Operation of the Project will be dependent upon water quantity and water quality conditions on streams, rivers, lakes and other water bodies downstream. Discharges from the Project shall not cause water levels in any downstream water body to exceed its OHW. The trigger points provided herein provide guidance as to when the Project can be operated and when pumping shall be halted in order to prevent adverse downstream impacts.

Pumping may be performed only on days that meet the following requirements listed below. A detailed explanation of each criterion follows.

    Otter Tail River: Pumping shall not contribute to flooding on the Otter Tail River. The benchmark for flooding shall be the OHW for the river, which is defined as the bankfull elevation (i.e. the elevation at which the capacity of the main channel is exceeded and the river spills into its floodplain). Pumping shall be discontinued if the river is above its OHW within the reach extending from the outlet of the common leg of the forcemain downstream to the inlet at Otter Tail Lake.

    Little Pine: The OHW elevation on Little Pine Lake is 1334.2 (MSL 1912 datum). The estimated travel time for water to flow from the outlet of the Project to Little Pine Lake is approximately 5 hours. Pumping shall not contribute to flooding

conditions on Little Pine Lake. Pumping shall be discontinued when water levels on Little Pine Lake are rising and reach an elevation of 1334.08 (MSL 1912). Hydrologic and hydraulic modeling have shown that 20 cfs added from the Project will not cause the water level in Little Pine Lake to increase by more than 0.12 feet when the lake elevation is at elevation 1334.08 and the OHW will not be exceeded due to the water from the Project. This trigger elevation also allows adequate freeboard to allow for the pump(s) to be shutoff after a significant rainfall event and not have the discharge from the Project increase the peak water surface elevation caused by the storm. Pumping may be resumed when water levels on Little Pine Lake are falling and reach elevation 1334.1.

Big Pine: The OHW elevation on Big Pine Lake is 1332.6 (MSL 1912 datum). Pumping shall not contribute to flooding conditions on Big Pine Lake. Pumping shall be discontinued when water levels on Big Pine Lake are rising and reach an elevation of 1332.5 (MSL 1912). Hydrologic and hydraulic modeling have shown that 20 cfs added from the Project will not cause the water level in Big Pine Lake to increase by more than 0.1 feet when the lake elevation is at elevation 1332.5 and the OHW will not be exceeded due to the water from the Project. This trigger elevation also allows adequate freeboard to allow for the pump(s) to be shutoff after a significant rainfall event and not have the discharge from the Project increase the peak water surface elevation caused by the storm. Pumping may be resumed when water levels on Big Pine Lake are falling and reach elevation 1332.5.

Rush: The OHW elevation on Rush Lake is 1322.8 (MSL 1912 datum). Pumping shall not contribute to flooding conditions on Rush Lake. Pumping shall be discontinued when water levels on Rush Lake are rising and reach an elevation of 1322.7 (MSL 1912). Hydrologic and hydraulic modeling have shown that 20 cfs added from the Project will not cause the water level in Rush Lake to increase by more than 0.1 feet when the lake elevation is at elevation 1322.7 and the OHW will not be exceeded due to the water from the Project. This trigger elevation also allows adequate freeboard to allow for the pump(s) to be shutoff after a significant rainfall event and not have the discharge from the Project increase the peak water surface elevation caused by the storm. Pumping may be resumed when water levels on Rush Lake are falling and reach elevation 1322.7.

Pumping operations may continue through the winter months assuming climate conditions do not create problems including freeze up of the system.

Pumping operations will be discontinued in the spring of each year, depending on spring flooding forecasts on the Otter Tail River.

The Project must cease operation immediately if monitoring activities identify the presence of AIS such as zebra mussel veligers are detected in the collection or water transfer systems. Both pumping systems should be shut off until the source of the veligers can be positively identified and it is determined that pumping can resume.

Paul Lake: The gates on the control structures on Paul Lake and Rusch Lake may be opened when the water levels on Paul Lake exceed its ordinary high water (OHW) elevation (1356.7 ft.) and Little McDonald Lake (OHW 1355.6 ft.) has a lower level (such that gravity flow between the lakes will be permitted). The LKMP pumpstation must be operating for the control gates on Paul Lake and Rusch Lake to be opened and they must be closed when the LMKP pumpstation is shut off.

## **V. Monitoring**

Water levels: Monitoring of downstream water surface elevations potentially impacted by the pumping operations will be conducted to ensure that the impacts are limited to the predetermined elevations documented above. Water level readings shall be made by Otter Tail County staff or DNR personnel and shall be read from gages installed and maintained by a regulatory government agency. Gages must be referenced to the appropriate vertical datum for each water body, as noted herein.

Readings should be taken on a daily basis when the water levels on Little Pine, Big Pine and Rush Lakes are within 0.25 feet below their respective OHW elevations and rising. Readings may be taken on a weekly basis if the elevations of these lakes are more than 0.25 feet below the OHWs. Weather conditions may warrant changes to the monitoring, as determined by Otter County Public Works personnel.

Water quality: Dissolved oxygen levels should be monitored on a monthly basis during periods when the Project is operating. Measurements should be taken in Little McDonald Lake and Devils Lake near the collection systems, in the pumpstations for both systems, at the outlet of the shared forcemain and in the Otter Tail River upstream and downstream of the outlet. These readings shall be taken until it can be shown that the dissolved oxygen levels in the water discharged from the Project continually exceed the threshold by which they will not contribute to oxygen deficiencies downstream.

- AIS: The filtration system will be monitored in accordance with the guidelines specified by the DNR.
- Biweekly samples should be taken from mid-June through mid-September annually. These samples would be a standardized volume of water (minimum 50 liters) that would be examined via standard procedures for zebra mussel veligers and/or other AIS. Samples should be analyzed as quickly as possible to provide real-time data on AIS presence/absence. At this time, analysis should be done by cross-polarized light microscopy. Future advancements in detecting veligers may provide other more suitable means of testing.
  - Visual inspection of the outlet structures and other nearby downstream submerged hard surfaces such as wood and rocks for attached mussels should occur whenever the pump is off for maintenance or due to downstream conditions or on an annual basis of those opportunities are not presented.

## **VI. Maintenance**

Note: This section will be developed during the design phase of the project when maintenance requirements for specific features can be determined.

## **VII. Agency Personnel**

Otter Tail County- Rick West, Public Works Division Director/County Engineer

Otter Tail County- Charles Grotte, Assistant County Engineer

LMKP LID- Roger Neitzke, President

DLD LID- Jeana Nelson, President

## **VIII. Modification of Plan**

This operation and maintenance plan may not be modified without the mutual consent of the responsible agency personnel and the Otter Tail County Board of Commissioners.

## **Attachments:**

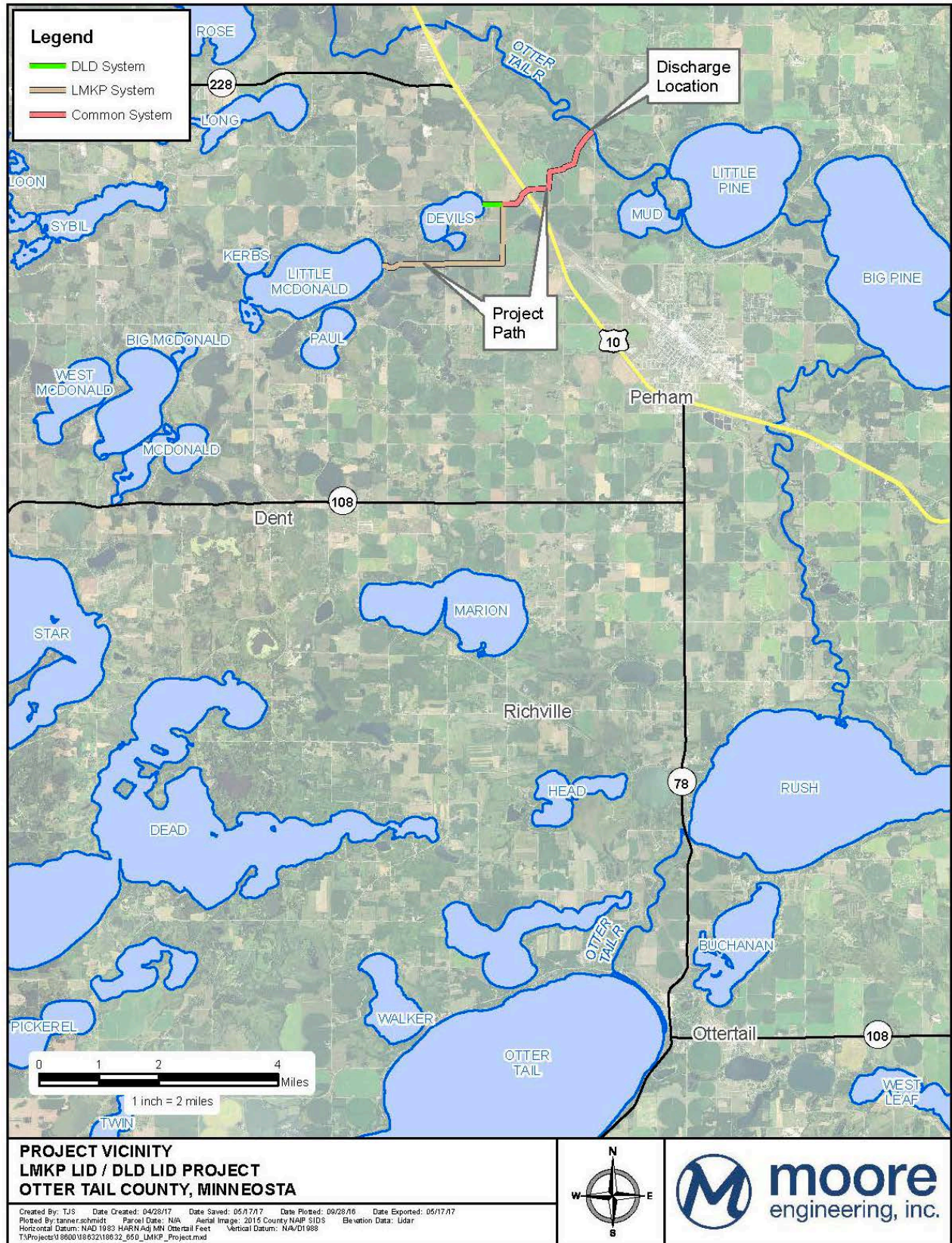
Maps

Rating Curves

Recording Logs



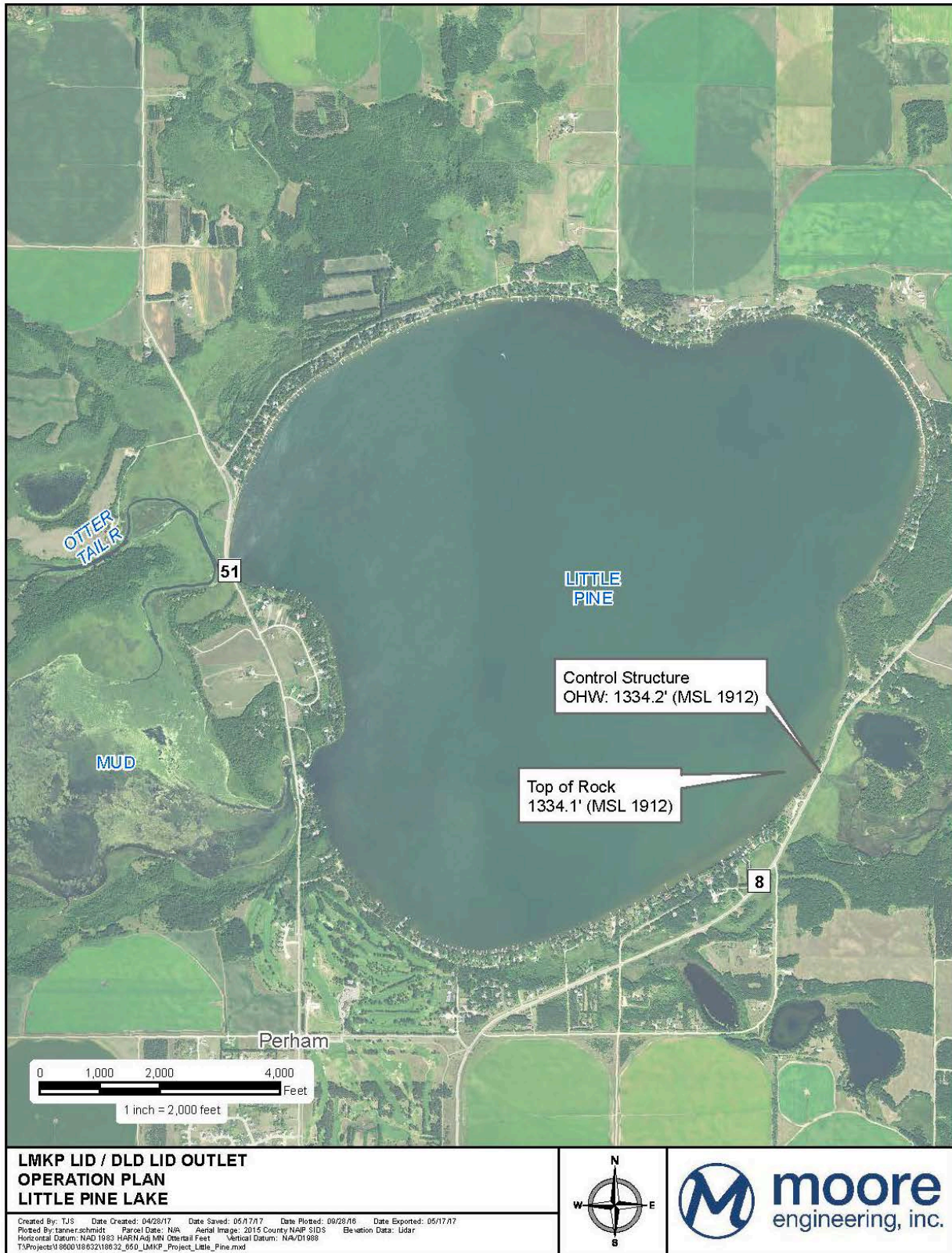




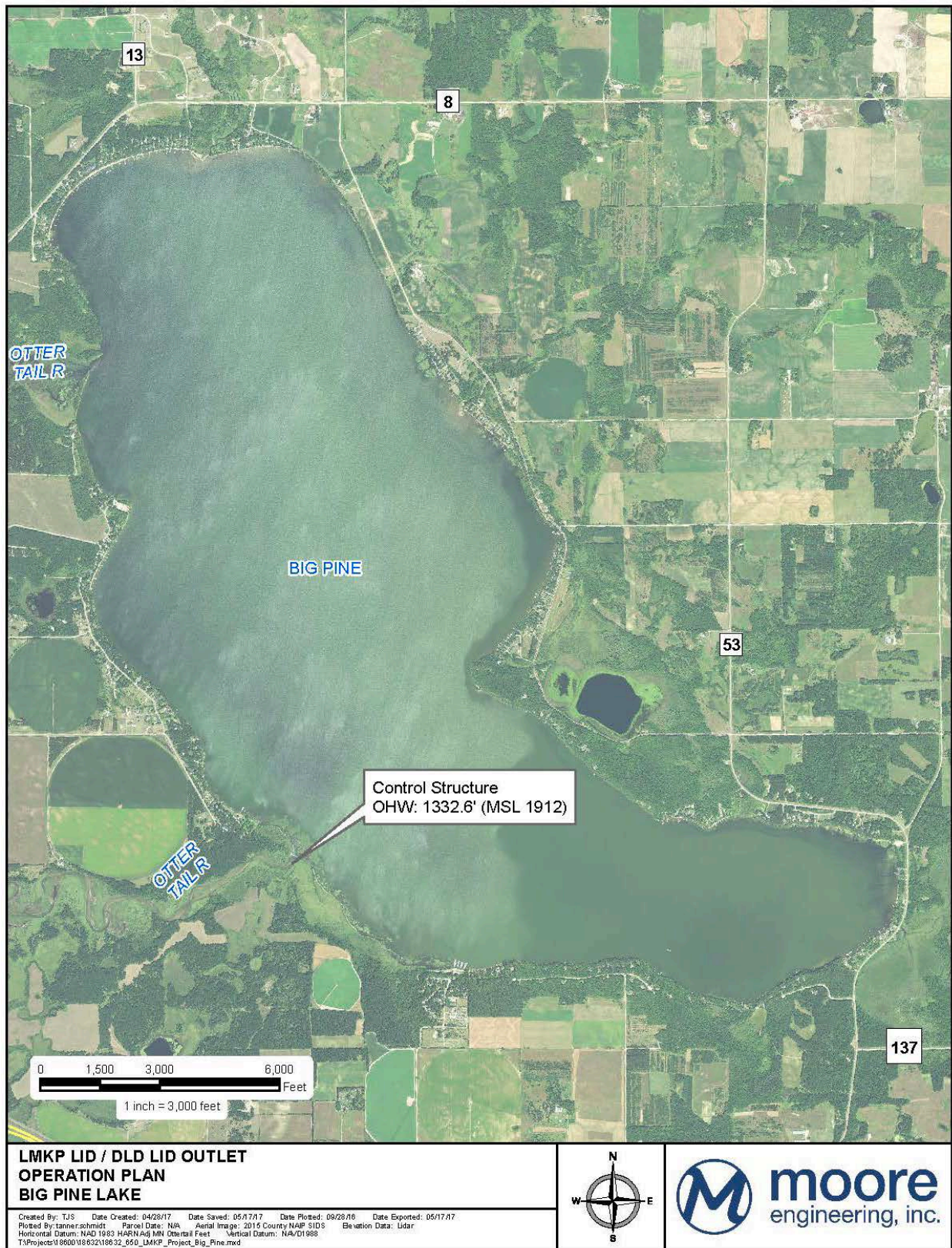




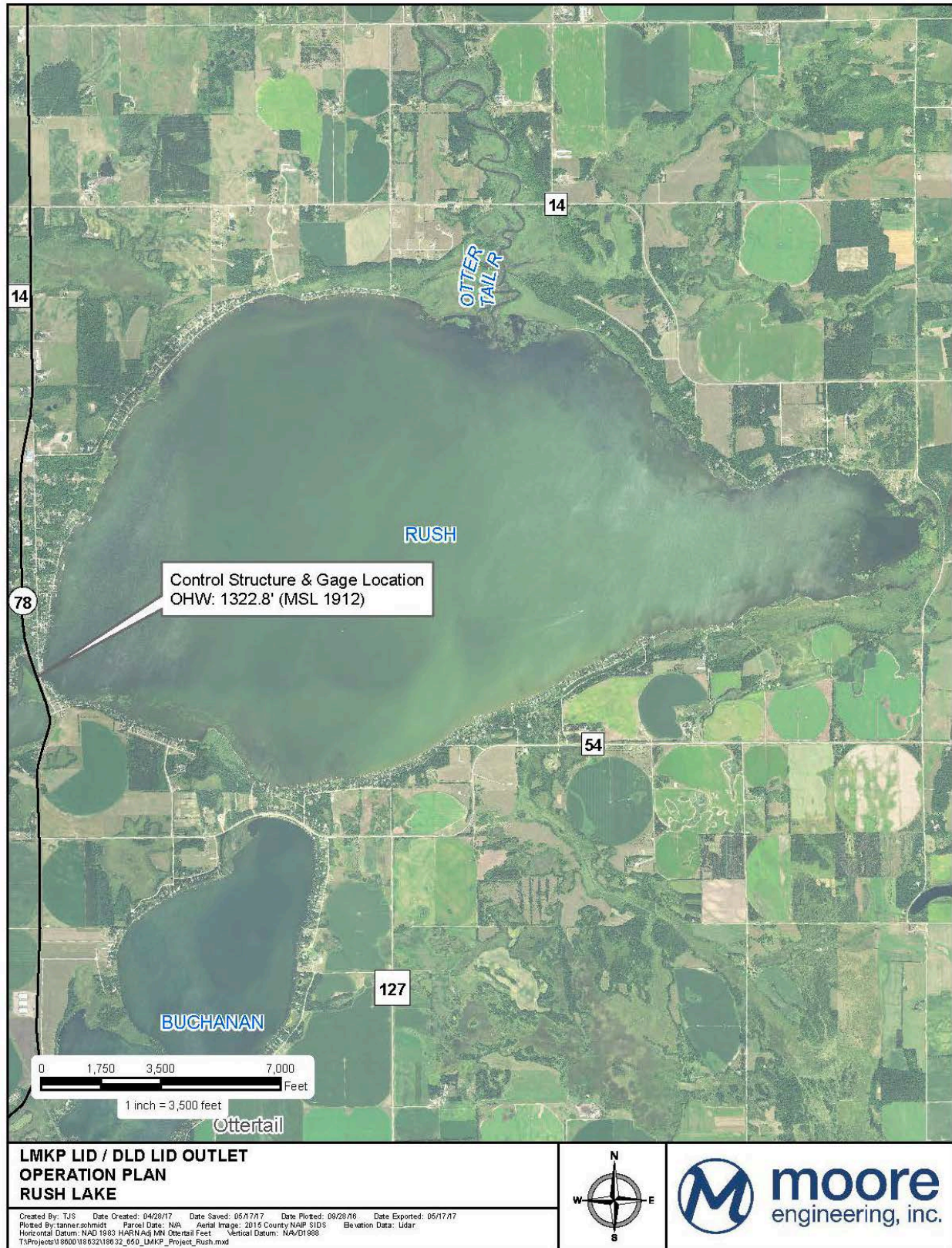




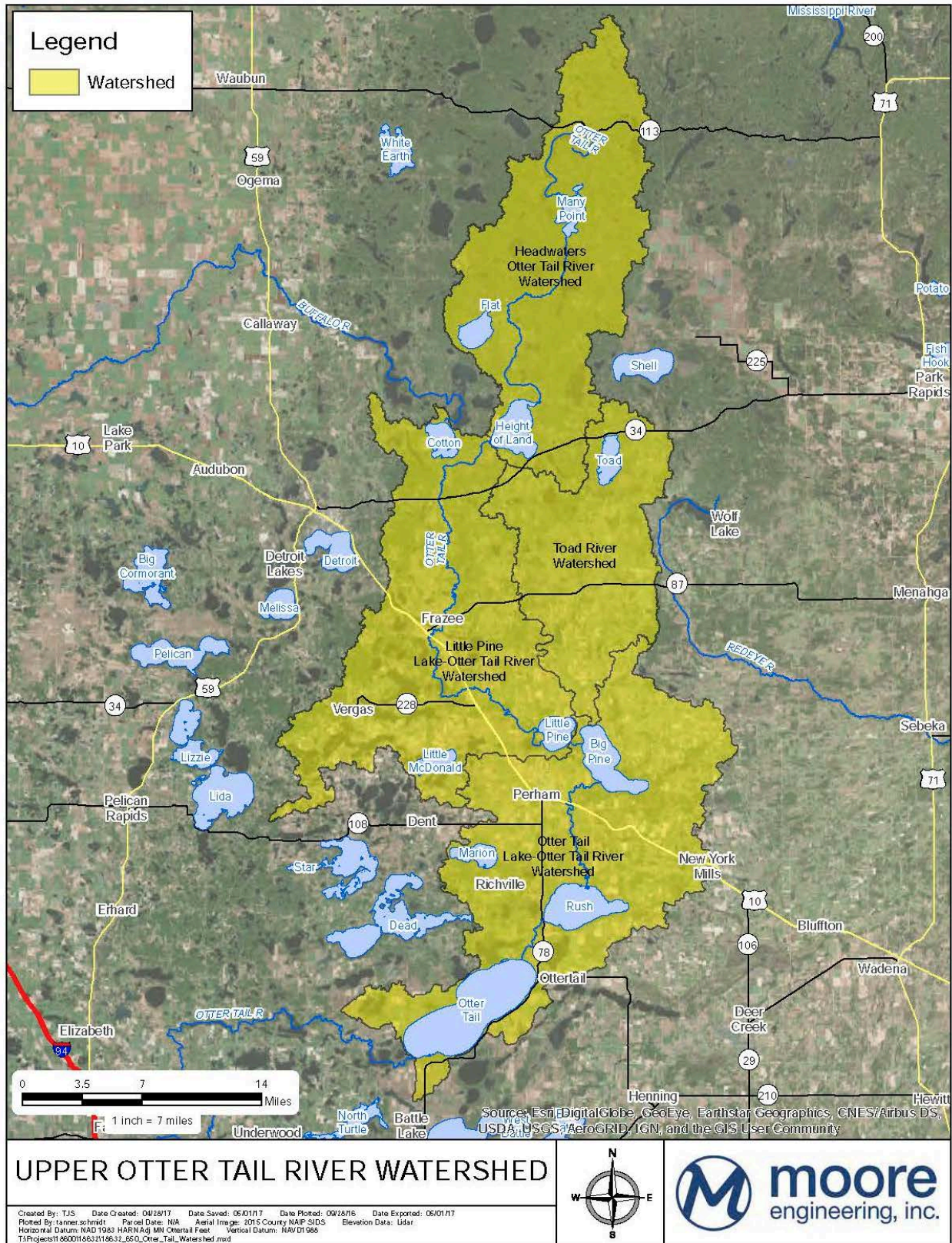




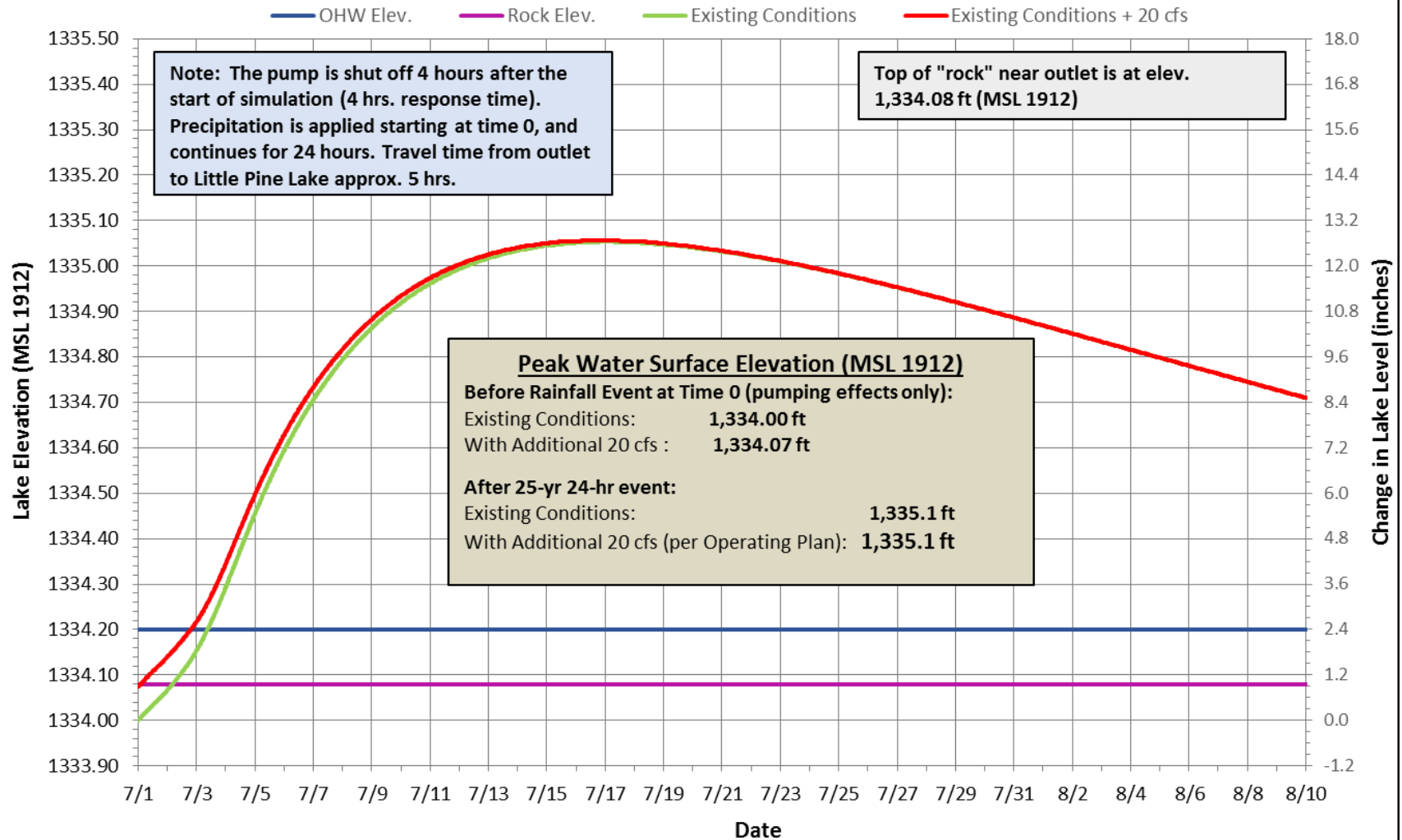




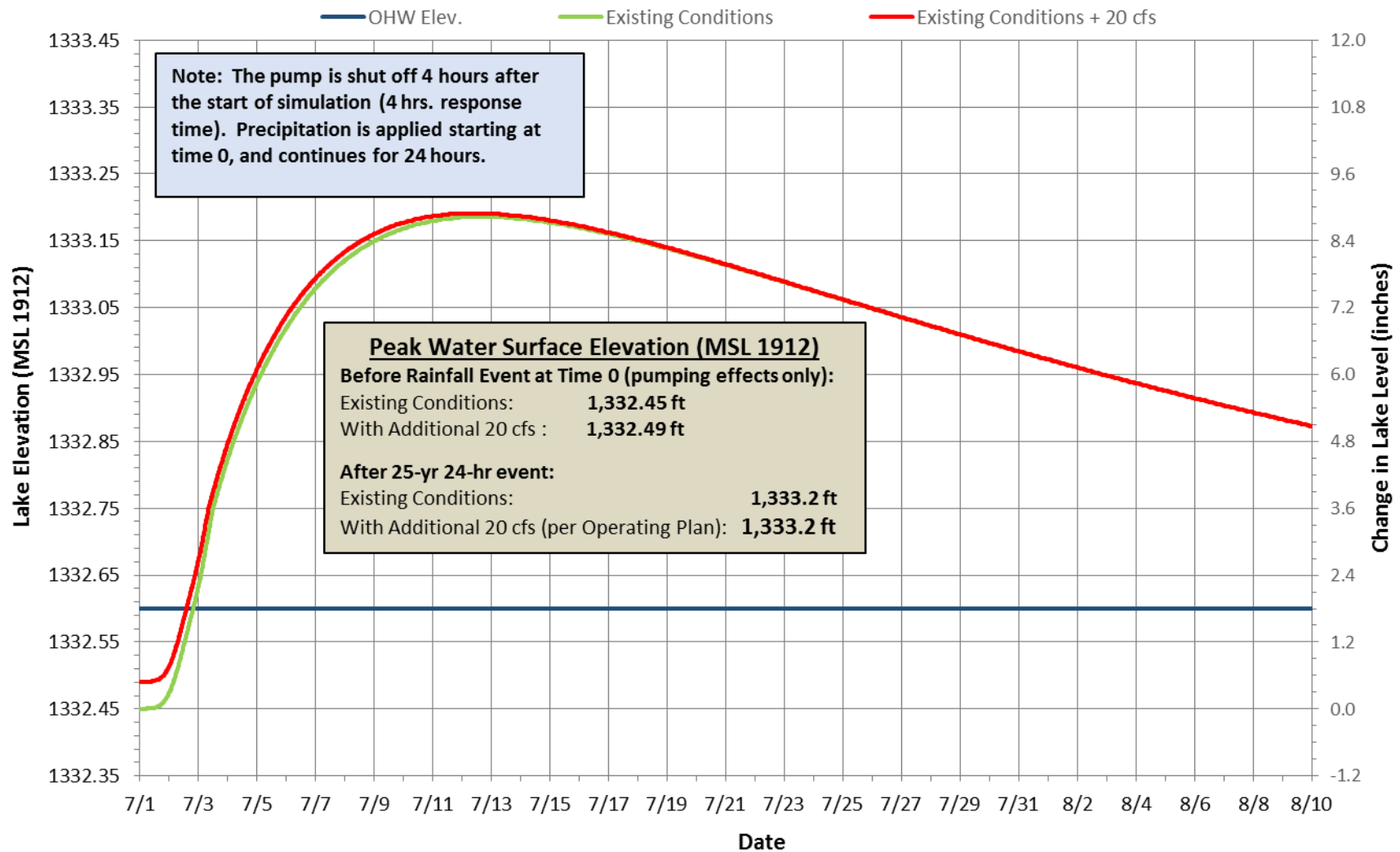




# **Little Pine Lake Impacts** **25-yr 24-hr Event (4.3" of rainfall)**

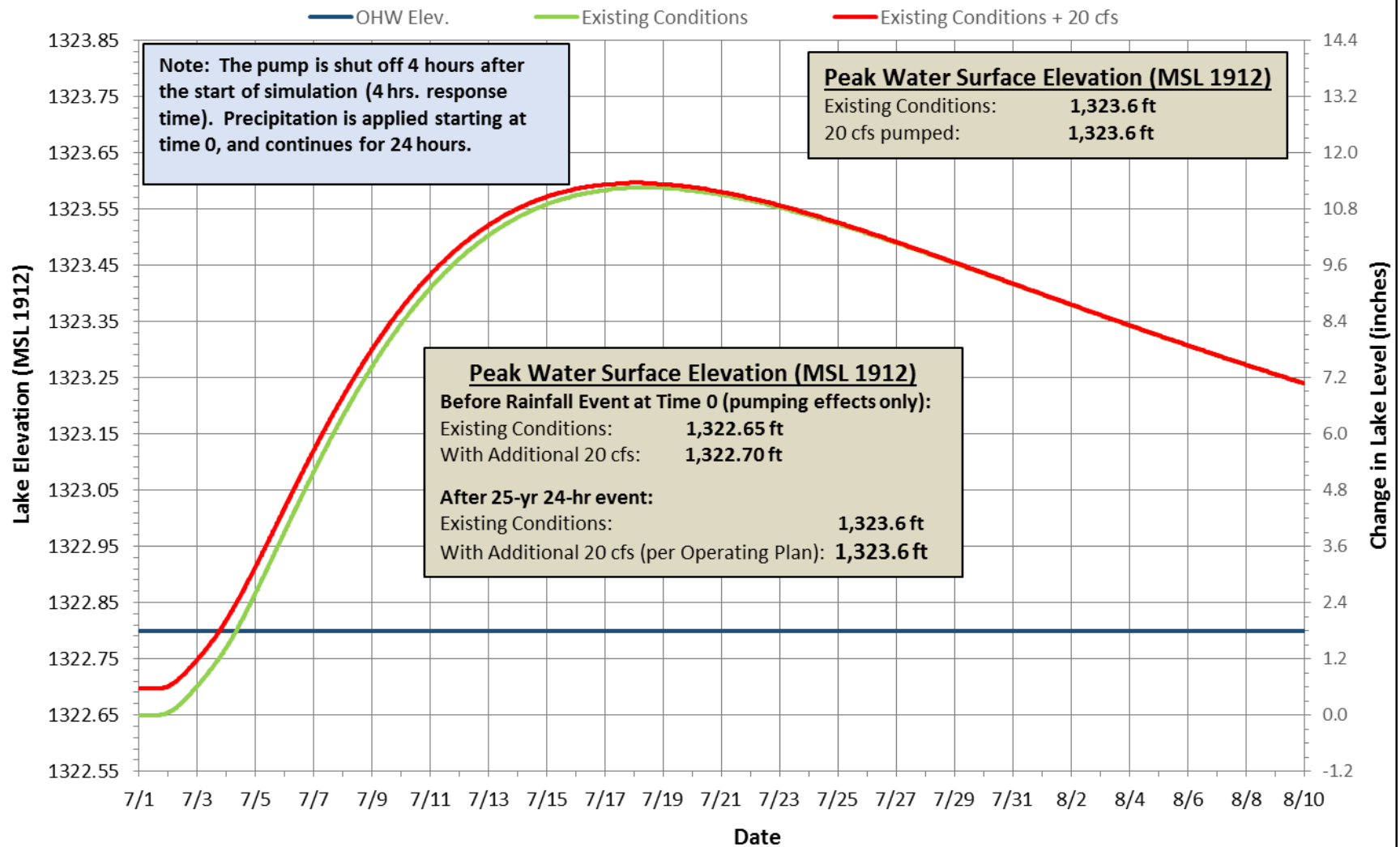


## Big Pine Lake Impacts 25-yr 24-hr Event (4.3" of rainfall)





# **Rush Lake Impacts** **25-yr 24-hr Event (4.3" of rainfall)**



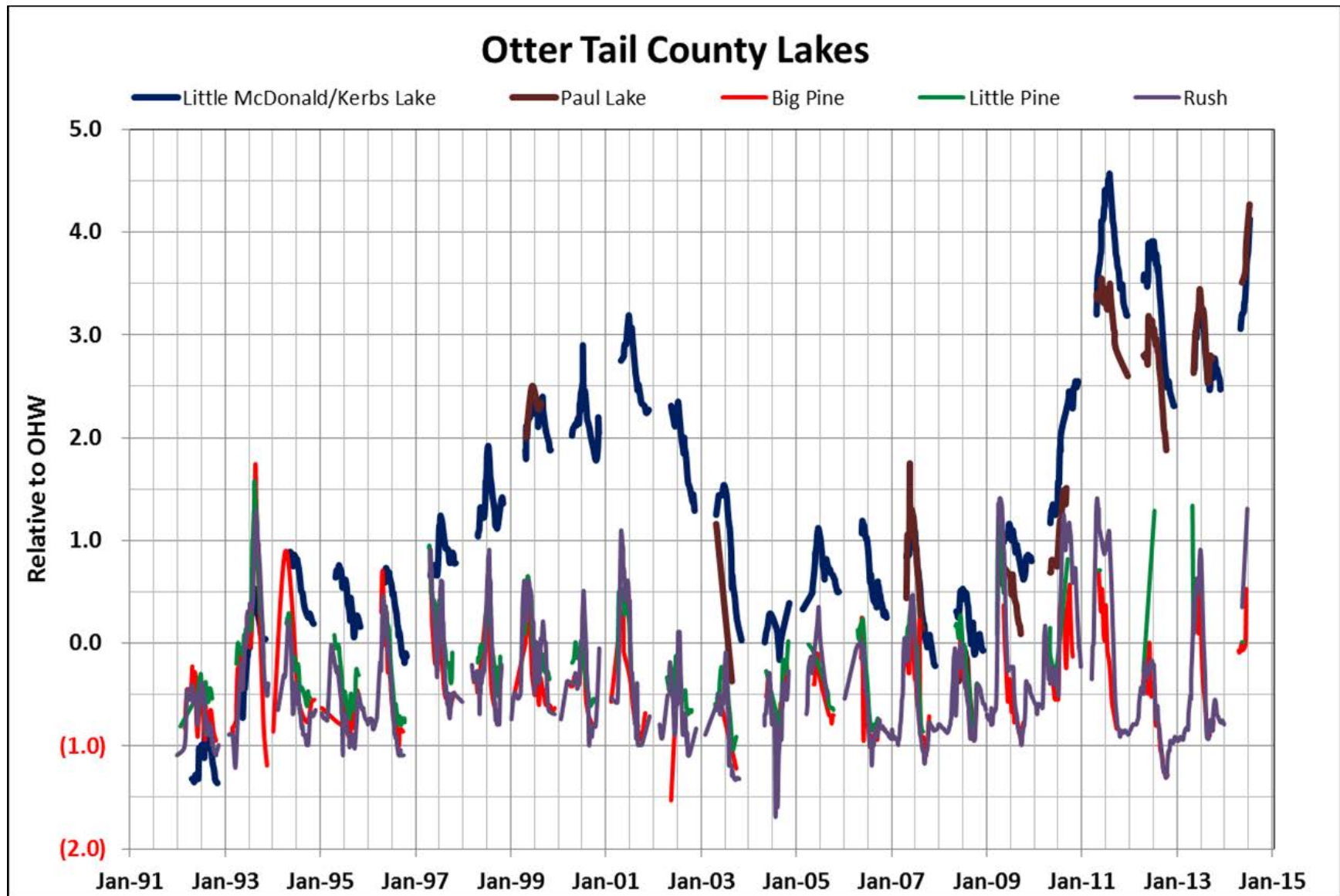
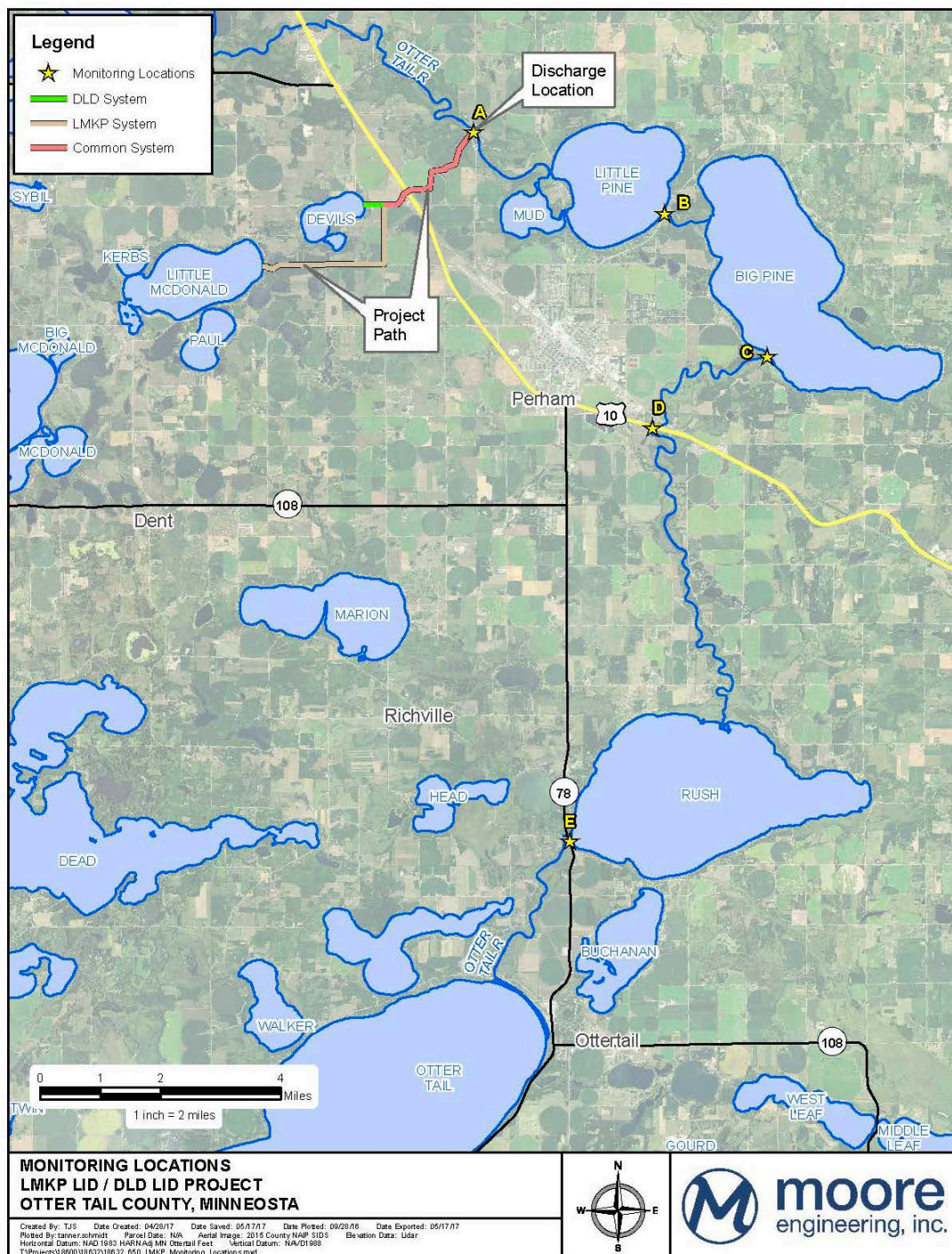


Table of Critical Monitoring Locations & Elevations					
Locations				Elevations (ft)	
Map Ref.	Description	Easting	Northing	Critical Elev. (ft)	Datum
A	Pipe outlet at Otter Tail River			Bankfull	
B	Little Pine Lake outlet			1334.08	1912
C	Big Pine Lake Outlet			1332.5	1912
D	Otter Tail River at Hwy 10			Bankfull	
E	Rush Lake Outlet			1322.7	1912



## LMKP LID/ LID Outlet to Otter Tail River Downstream Water Surface Elevation Recording Log

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