A map of Lauderdale Lakes, Wisconsin, showing several interconnected lakes: Green Lake, Middle Lake, and Mini Lake. The map includes street names, road numbers (13, 67, 18), and landmarks like the Lauderdale Lakes Country Club. The text is overlaid on the map.

# Lessons Learned in the Design Analysis & Modification of an Early 1900's Dam Lauderdale Lakes, Elkhorn, WI

Photo provided by CenterPoint Properties

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# Problem: Lake Water Level

- Increasing periods of “No Wake”
- Localized flooding more frequent
- Unknown effectiveness of lake outfall

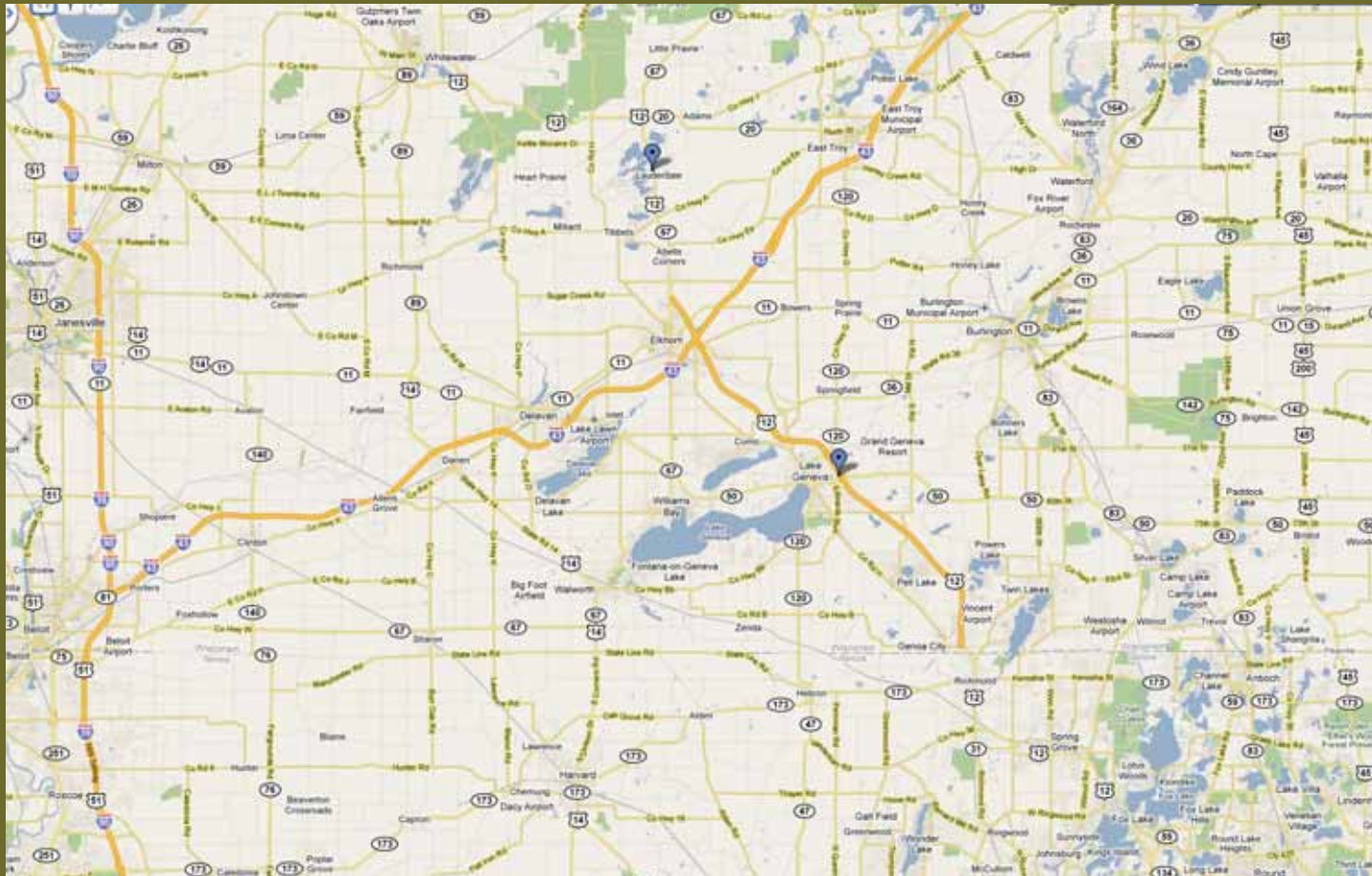


## Answer: Assess & Propose Solution

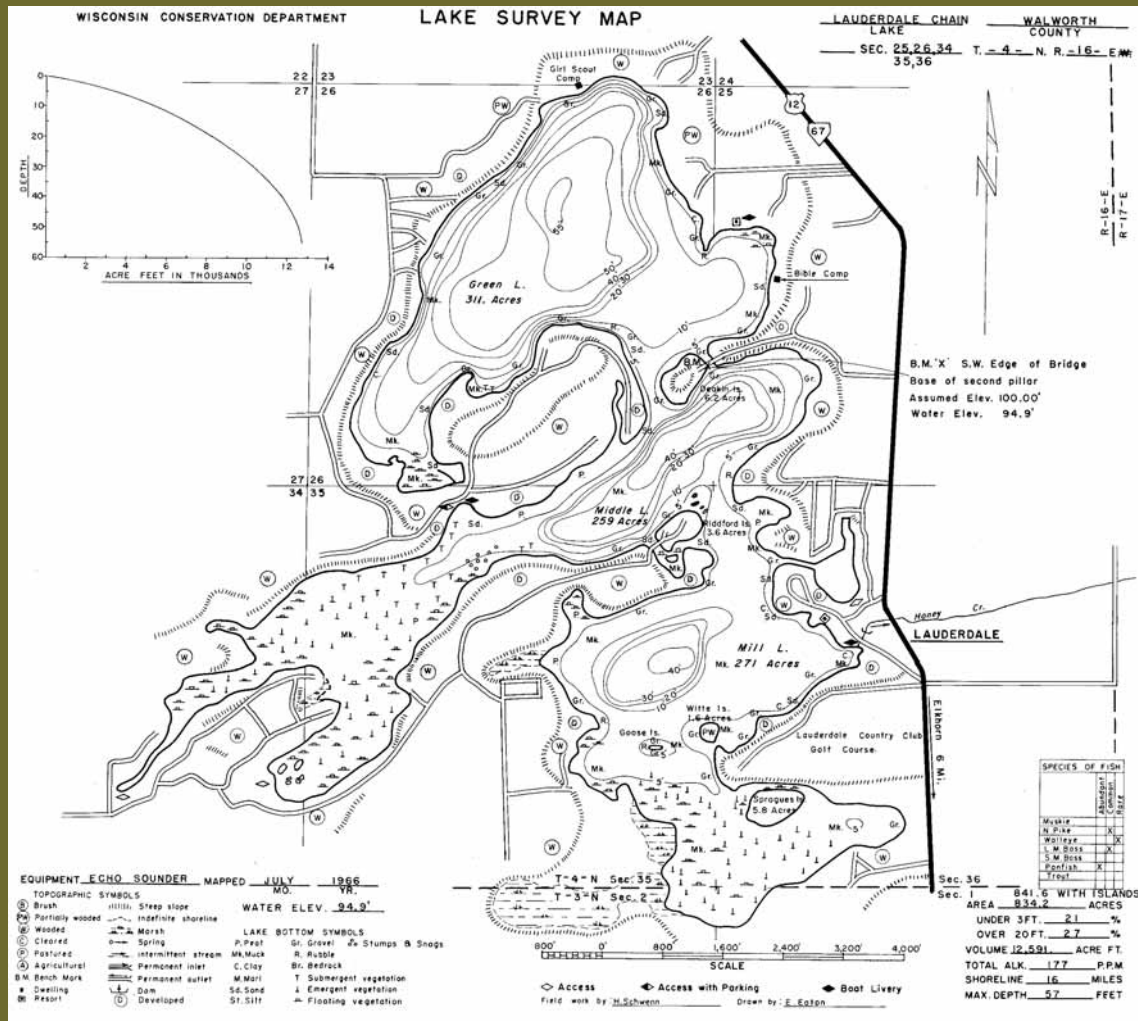
- Analyze Existing Outfall Structure
  - Find Suitable Model
  - Calibrate to observed HWL's
- Propose Retrofit



# Lake Background: Location Map



# Lake Background: Bathymetric Map



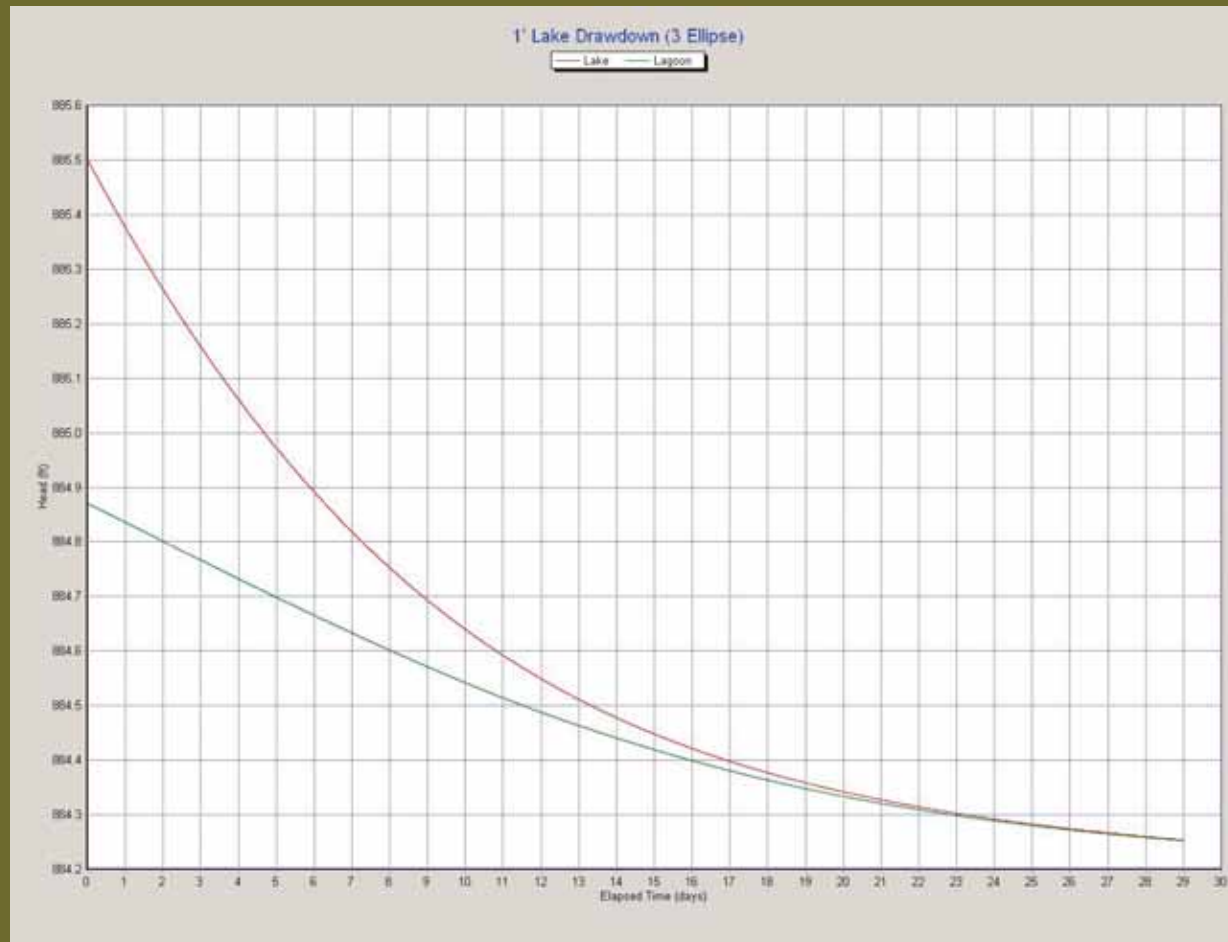
# Lake Background: Lake Schematic



# Model: Analysis & Calibration

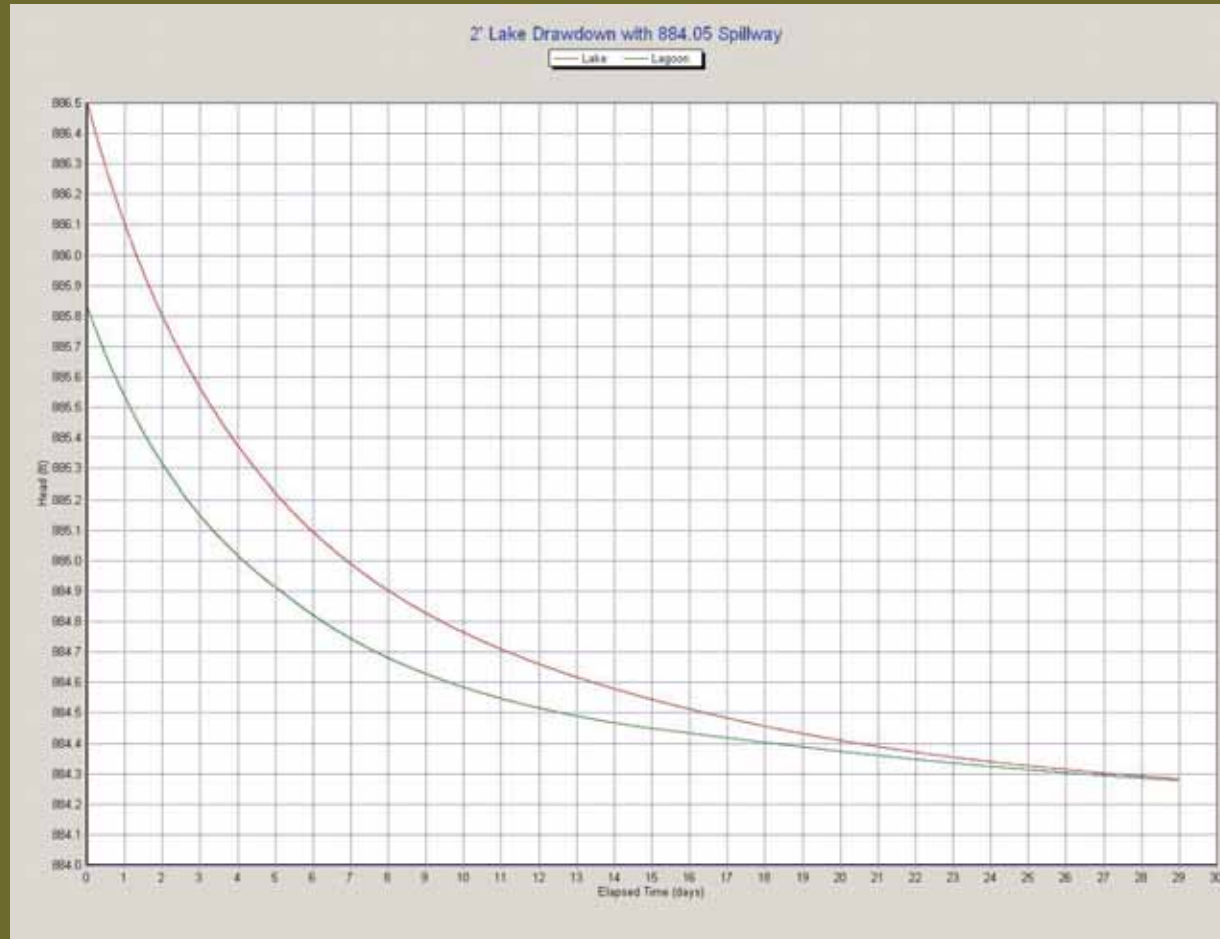
- EPA SWMM was the chosen model
  - Allowed for analysis of culverts with impact of downstream dam
  - Collected field surveyed data for input
  - Calibrated to observed HWL to maximum extent possible
  - Used calibrated model to propose a retrofit for better outfall functionality
- Reviewed results with LLMD staff
- Incorporated any information from previous WDNR reports

# Model: Drawdown Curves





# Model: Drawdown Curves



## Model: Result

- Settled on (2) 5' X 3' box culvert
- Began permitting process through Wisconsin DNR, Walworth Co, and USACE
- WDNR – “Minor Replacement” as described under Trans 207.04.
- Walworth Co – Land disturbance permit
- USACE – Statewide permit for restorative work within a navigable waterway

## Problem: Lake Delton

Lake Delton collapse in June 2008 caused WDNR to reassess all existing dam safety related issues



## Problem: Lake Delton

- WDNR performed a dam safety inspection which further resulted in:
  - Dam Breach Analysis
  - Emergency Action Plan (EAP)
  - Operation and Maintenance (O&M) Schedule
  - Analysis of 1,000 year flow on proposed structure
- Additional requirements delayed acceptance of the construction plans by up to 8 months

# Construction: Demolition & Replacement

- Staging
- Demolition
- Dewatering



# Construction: Stuff Happens

- Contractor Locates Gas Main
- Emergency Coordination
- Emergency Removal



## Construction: Cooler Heads Prevail

- *We Energies* handles everything within days
- Dewatering completed
- Culvert installation completed



# Construction: Box Culvert

- Staged box culvert installation
- Dewatering reversal
- Restoration





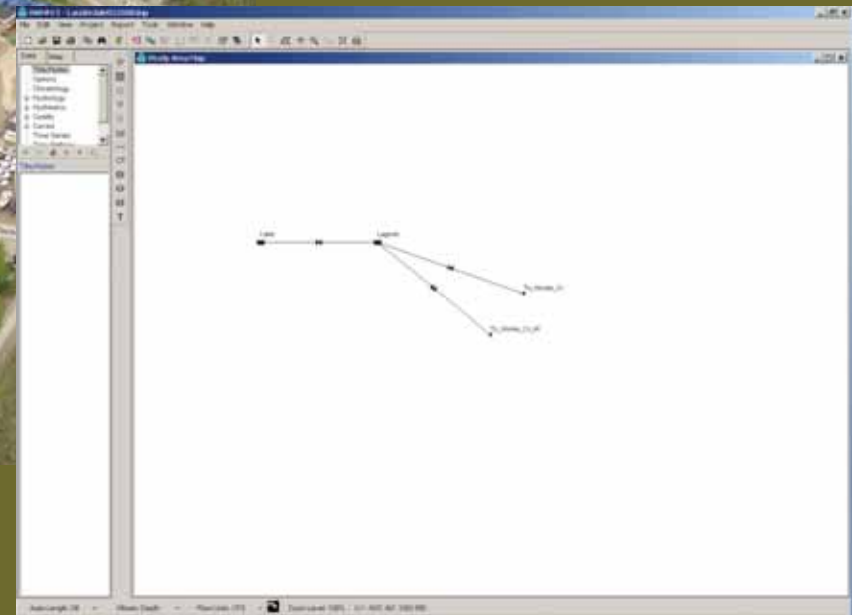
# Lesson Learned #1

When something goes awry...blame the engineer



## Lesson Learned #2

Models are not real. They are a representation of false reality under ideal conditions.



## Lesson Learned #3

Communication is key to solving problems and moving forward to adversity



## Lesson Learned #4

Making a complete diagnosis of the problem can't always be completed until the project is over.



## Lesson Learned #5

YOU can help your lake to get better. If you think something is wrong don't wait to prove yourself right.



## Summary

- Increased volume due to increased impervious cover
- Increased restriction at outlet due to zebra mussel colonization
- Retrofit of outfall to allow for restriction at dam and maintenance at culvert crossing
- Lake Management District Staff to investigate potential watershed management action plan to help incorporate better development standards