DRAFT

Hydrologic and Hydraulic Re-analysis of the
Pelican Lake (69-841) Outlet Dam

St. Louis County

DRAFT - October 24, 2007 - DRAFT

Minnesota Department of Natural Resources

Waters Division

www.dnr.state.mn.us

The attached draft report will not be finalized until risk analysis, i.e., potential for damage due to changes in height of the dam, is completed and input from St. Louis County Public Works, owner of the dam, is obtained. Following finalization of this draft report, DNR Waters will be requesting input from landowners.

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Pelican Lake (69-841) Outlet Dam
St. Louis County

October 4, 2007 - DRAFT

Problem Statement

The Pelican Lake outlet dam was reconstructed in 2002. This fixed crest dam was constructed with essentially the same length and height as the old dam. Local citizens and resort owners are concerned with recent low lake levels due to the severe drought in northeast Minnesota and seek modifications to the dam to help minimize the low lake levels. The purpose of this study is to analyze the potential lake level impacts of various alternatives to raise a portion of the outlet dam.

Analysis

This study made use of the hydrologic (HEC-1 converted to HEC-HMS) and hydraulic (HEC-RAS) computer models developed for the 1999 report completed by DNR Waters for the dam reconstruction.

The only notable adjustment made to the original 1999 models was in regard to the assumptions regarding water levels downstream of the dam. The available lake level data and historic photographs of the dam suggest that high tailwater conditions do not have as significant effect on outflow from Pelican Lake as recent studies found on two other St. Louis County Lakes – Side Lake and Esquagama Lake. High tailwater will occasionally submerge the Pelican Lake dam during higher flow conditions. But the extent to which this occurs is in large part due to backwater conditions created by the Elbow River. A minor change was made to the hydraulic model to reduce the influence high tailwater conditions have on outflow from Pelican Lake. This resulted in slightly lower computed peak lake levels that appear more consistent with the recorded lake level data since 1987.
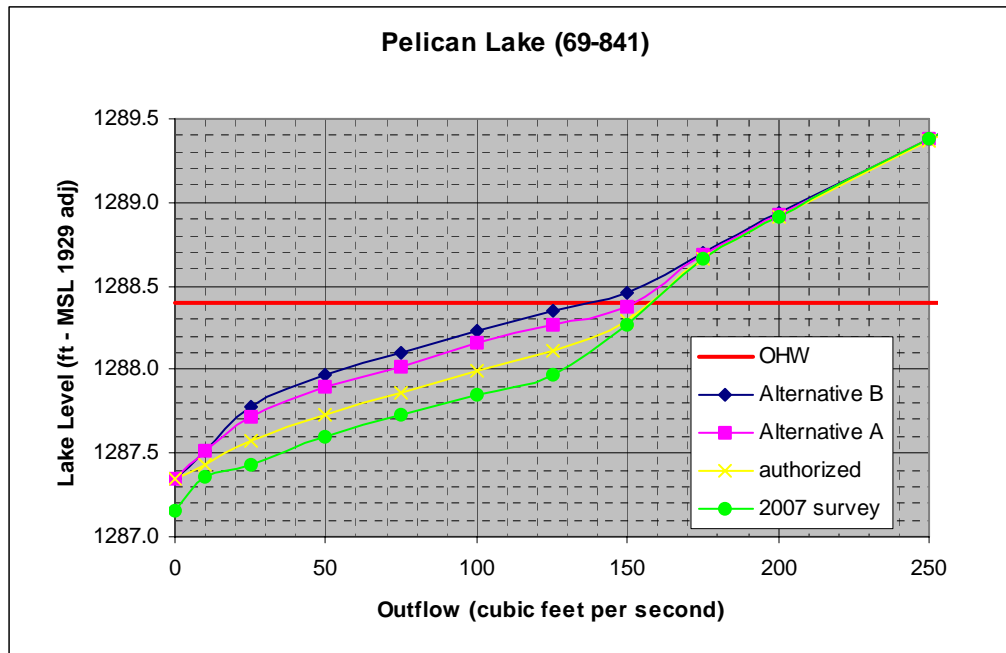
The existing Pelican Lake outlet consists of triple 12'x8' concrete box culverts with a 17.7 foot long labyrinth weir constructed inside the upstream apron of each culvert. St. Louis County surveyed the dam this past July and found that the weir has settled since construction and is now approximately 0.15 feet below the design elevations. For this analysis, the originally authorized stop log settings, the existing dam, and two alternative dam configurations were analyzed, as follows:

	Left	Center	Right
Authorized stop logs (s.l.'s) in old dam	1287.35	1287.35	1287.35
Existing dam (2007 survey)	1287.25	1287.16	1287.25
Alternative A	1287.60	1287.35	1287.60
Alternative B	1287.75	1287.35	1287.75

As with the original 1999 study, two storm durations were analyzed: 24-hour and 10-day storms. For both storm durations, the 10-year, and 100-year recurrence interval floods were computed.

Note: all elevations in this report are feet above mean sea level NGVD-1929 adjustment; Add 1.01 feet to convert to NAVD-1988.

Computed Outflow Rating Curve

Pelican Lake (69-841)

X-axis: Outflow (cubic feet per second)
Y-axis: Lake Level (ft - MSL 1929 adj)

Legend:
- OHW
- Alternative B
- Alternative A
- authorized
- 2007 survey

Computed Peak Lake Levels

	10-year flood		100-year flood	
	24-hr storm	10-day storm	24-hr storm	10-day storm
Authorized s.l.'s	1288.3	1288.4	1288.6	1289.4
Existing Dam	1288.1	1288.3	1288.5	1289.3
Alternative A	1288.4	1288.5	1288.8	1289.4
Alternative B	1288.5	1288.5	1288.9	1289.4

Discussion

- Climate conditions will remain the predominant factor affecting lake levels regardless of any change made to the dam. As has historically occurred, lake levels will continue to occasionally fall below the runout elevation of the outlet dam during dry climatic conditions.

- Alternative A would raise lake levels approximately two inches above levels resulting from a dam constructed to the authorized stop log elevations, and approximately 3½ inches higher than lake levels would be with the existing dam. The differential comparing Alternative B to the authorized historic stop log elevations and the current dam is 3 and 4½ inches, respectively.

- Neither of the two alternatives evaluated would affect the peak 100-year flood elevation. This event would most likely occur during heavy snowmelt combined with spring rainfall, or consecutive heavy rainstorm events. The lack of impact of dam configuration is due to the large total volume of runoff for these events and the downstream channel control of outflow.

- Raising a portion of the dam would result in higher lake levels following an isolated summer event. This is primarily due to the higher lake level at the start of the event and the fact that the downstream channel control would have less of an impact during these lower runoff volume events. Potential adverse impacts include increased shoreline erosion, impacted septic systems, and increased flood damage potential to low lying structures.