



MEMORANDUM

TO: Victoria J. Li, P.E., Director
Watershed Protection Department

FROM: Fang Yu, P.E., Managing Engineer
Watershed Protection Department

DATE: July 16, 2014

SUBJECT: Longhorn Dam Review

Pursuant to your request, the VE Team has conducted an initial review of the Longhorn Dam. Our review consisted of a brief site visit by the team on July 2, 2014, along with an examination of several documents produced by Freese & Nichols Inc. (FNI) for Austin Energy (AE) Department over the last couple years, and subsequent VE team discussions. The following is a brief overview of the dam status, review findings, and initial conclusions and recommendations for your consideration.

Background

According to FNI's report dated April 19, 2012, Longhorn Dam was constructed by AE in 1960 originally for the purpose of forming a cooling pond (now known as Lady Bird Lake) for the Holly Street Power Plant. As we know, Lady Bird Lake has since become and continues to be a major amenity and recreation favorite for downtown Austin with numerous hike and bike trails, parks and recreational areas, and business functions along its shores.

The Holly Street Power Plant had been operated for about 47 years by AE and was closed in September 2007, at which time the cooling pond function of Longhorn Dam was no longer needed. However, the dam obviously still has an extremely important purpose which is to maintain a fairly constant level of Lady Bird Lake (LBL). The following FNI report excerpt describes the facility in more detail.

"The dam is approximately 1,240 feet long and consists of a 506-foot wide gated spillway with an earthen embankment on each side of the spillway. The gated spillway supports a four lane bridge for Pleasant Valley Road and the hike and bike trail. The gated spillway consists of seven 50-foot wide lift gates and two 50-foot wide bascule gates. The bascule gates automatically regulate lake level during normal flow conditions, which includes generation releases from Tom Miller Dam. The lift gates are required to pass flow caused by storms or large releases from upstream reservoirs. Three City parks surround the dam, Holly Shores at Town Lake Metropolitan Park on the north, Roy G. Guerrero Colorado River Metropolitan Park on the southeast, and Longhorn Shores at Town Lake Metropolitan Park on the southwest. These parks and the dam are part of the hike and bike trail."

AE continues to own and operate the dam. The various reports listed at the end of this memo and prepared by FNI have been funded by AE for the purposes of exploring repair options necessary to continue to operate the dam safely and efficiently.

Purpose of the VE Team's Review

The basic purpose of the VE Team's review was to:

- Assess the current status of the dam,
- Summarize the estimated cost for the essential repairs to safely operate the dam for the next 30 to 50 years with different repair alternatives, and
- Recommend potential next steps and responsibilities going forward

Following is summary of these important areas of review.

Condition Status and Potential Concerns

Based on FNI's evaluations, there are a number of problematic issues with the current operation and maintenance of the dam. Listed below are the issues of most significant concern, but FNI has listed many others that should be addressed as well.

Bascule gate problems

The two bascule gates are designed to operate automatically and maintain the lake near elevation 428.25 ft, but no longer function well. The outdated mechanical and hydraulic system requires frequent adjustments using trial and error, periodically requiring personnel to visit the dam several times a day to adjust the gates.

Lift gate operational issues

Over the years, some lift gates have failed to open or close properly. This is reportedly an inherent problem with the type of hoists at Longhorn Dam. The gate hoists themselves tend not to open the gate evenly which "racks" the gate and causes the wheels to jam in the slot. Occasionally, gates have also been stuck open for a period of time. In the past 12 years (2001 to 2013), there were six times when the water surface was more than 3 feet higher or lower than the dry-weather lake level. The highest spike occurred in 2010 when it was more than six feet higher than the dry-weather lake level. When a gate is jammed and cannot be quickly fixed, the stop logs must be quickly laid out along the upstream slots of piers to facilitate repair. Unfortunately, the original design made this process rather slow. During our site visit, we observed that one of the seven lift gates is currently inoperative and stop logs are currently in place upstream.

Constrained working area and impacts

Operation and maintenance of the dam often requires personnel to occupy the sidewalk and occasionally the Pleasant Valley Road. When the dam was new, there were few pedestrians and little vehicular traffic on Pleasant Valley Road, but now there are approximately 25,000 daily vehicle crossings along with many pedestrians on the hike and bike trail. The sidewalk is too narrow for bicycles and pedestrians to pass while maintenance is being performed. Furthermore, in order to maintain the gates properly, 50-foot long, 15,000-lb stop logs must be installed upstream of the gates. This requires use of a crane and a flatbed trailer, thereby restricting traffic on Pleasant Valley Road. It is costly to both AE (for the installation effort) and the public (traffic snarls), and as a result the stop logs are rarely installed and maintenance has suffered.

In summary, with 50-plus years of dam operation, Longhorn Dam is now in need of major repairs and upgrades including:

- bascule gates with outdated and leaky mechanical systems,

- lift gates which are problematic due to uneven lifting or lowering, resulting in wheels jamming in the gate slots,
- outdated and inadequate electrical systems, and
- other needed security, controls, safety, site stabilization, and access accommodations.

The VE Team does not believe these conditions pose an imminent concern for some sort of catastrophic failure of the dam or require immediate emergency action. This belief is also based on FNI's report that indicates regardless of gate operation, flooding above the 25-yr event is driven primarily by tailwater and not dam function. However, the lake level, as a result of the noted problems, especially those associated with the gates, has the potential to be dramatically elevated or lowered if the gates are not repaired. Without significant repairs to the existing dam, the severity of lake level fluctuations can only get worse.

Repair Alternatives and Costs

FNI's evaluations to date have been very conceptual in nature and thus drawing any firm conclusions at this time on a particular alternative repair would be premature. Repair alternatives evaluated thus far can generally be classified into two major approaches.

- Existing Gate System Rehab Approach - repair and upgrade the existing system of bascule gates, lift gates, electrical systems, embankments and other miscellaneous problem areas.
- Labyrinth Weir Approach - reconfigure the dam using a labyrinth weir.

These two approaches are very different in terms of capital cost, operation and maintenance, and each has its own set of unique implications. The estimated costs (design and construction) from the conceptual designs are:

- (1) Existing Gate System Rehab Approach: In 2012, FNI recommended \$8.5M for the essential repairs and \$14.2M (total) for complete site/system rehabilitation. In 2013, after subsequent discussion with AE staff, FNI reported \$10.6M for essential and prioritized repairs.
- (2) Labyrinth Weir Approach: In 2013, FNI estimated \$16.5M for the labyrinth weir. This estimated cost does not appear to include bank slope, river bed, and sidewalk stabilization or rehabilitations (~\$2-3M).

When compared to an optimal gate system operation, the Labyrinth Weir would likely bring up a number of operation issues, including

- (1) higher lake levels (0-2ft) during smaller to intermediate storms, which is an adverse impact to the upstream area and is prohibited by City's Land Development Code),
- (2) lake levels that can be elevated for longer periods of time (another measure of the adverse impact to the upstream area),
- (3) more labor-intensive debris-removal requirements for Labyrinth weirs,
- (4) a higher degree of debris clogging potential, which can significantly reduce the hydraulic flow efficiency, and
- (5) significant sedimentation accumulation at upstream of the Labyrinth dam.

Conversely, the Labyrinth Weir provides a more passive mode of operation due to fewer moving parts, e.g., no gates needed and no gate O&M personnel needed. The labyrinth weir could also reduce lake level spikes caused by malfunctioning gates during a storm. In general, the labyrinth dam alternative needs much more in-depth analysis due to its relatively short history.

The cost estimates to date also warrant additional scrutiny, even for budgeting purposes. FNI performed a life cycle cost analysis that included a 50-year life cycle. This analysis resulted in the \$10.6M gate rehab option producing a \$20M present value. The labyrinth weir option of \$16.5M produced a present value of \$17M. While this indicates a cost preference for the labyrinth weir option, as previously stated it appears the labyrinth option did not include \$2-3M of associated repairs. Also, the annual maintenance estimates of \$480k/yr for gate rehab and \$25k/yr for labyrinth seem very far apart from each other and not much explanation is provided for these questionable estimates.

Preliminary Conclusions and Recommendations

Based on the information reviewed and observations from our brief site visit, the VE Team offers the following for further consideration.

- Potential for dam failure – The VE Team does not believe there is significant cause for concern relative to possible catastrophic failure of the dam. However, lake level fluctuation could become severe due to increasing difficulty in gate operation. The VE Team strongly recommends that AE, coordinating with other City Departments and LCRA, continue to lead its current effort to evaluate and implement a proper dam repair project to reduce failure risks and minimize the water level fluctuation in LBL. While the VE team believes risk of imminent failure is not high, an increased sense of urgency should be applied to a study process that has already spanned 4 years (2010-2014).
- Responsibility for Longhorn Dam – With the closing of the Holly Street Power Plant, the primary function of the dam has shifted from that of both cooling pond and constant lake level maintainer for LBL to mostly only lake level management. One could reasonably conclude this shift in primary function broadens responsibility for the dam beyond just AE Department. Logically, with the connecting hike and bike trails to the dam (PARD), the protection of the major water utility lines crossing just below the dam (AWU), the three nearby city parks impacted by the lake level fluctuation (PARD), the impact on traffic control of the Pleasant Valley Road (PW), the potential of flooded properties (WPD), and the overall Lower Colorado River operational interest (LCRA), many parties have a stake in the dam safety and operation. **Given these points, the VE Team recommends that a stakeholder group be formed to include the parties mentioned above. Since AE is still the owner of the dam, AE should take the lead role for the stakeholder group. This stakeholder group should have two primary goals – 1) Develop a plan for future maintenance and operations, 2) Maintain close involvement and cooperation in future dam repair planning. Consideration should also be given to including outside interest groups at some point in the process.**
- Establish proper goals and objectives for next steps – With the conceptual nature of the evaluations conducted to date, the scope has been fairly limited to a simple “fix the problems” approach. While this has apparently served AE’s desired purpose thus far, going forward, **the VE Team recommends conducting a preliminary engineering study to provide more detailed analysis of proposed alternatives, including additional alternatives and/or functions (such as hike and bike trail connectivity, LBL water quality and recreation, pedestrian safety and traffic controls). The PER should include stated goals not just of “least cost repair”, but also of reduced flooding risk and environmental enhancement, among other goals. An evaluation of future dam operation and maintenance and possible LCRA involvement should also be included. The various stakeholders should be given the opportunity to bring forward any particular goals they may want to incorporate into this process. Following a detailed PER process and identification of funding, final design and**

construction should proceed promptly. FNI's estimate of 3-5 years to complete construction is reasonable only if we proceed with a sense of urgency.

The Longhorn dam repair project is more complicated than most other city CIPs. First, flows in and out of the LBL is currently controlled both by the City of Austin and LCRA; second, the dam was constructed and owned by AE for dual purposes; third, there are multiple City department stakeholders; fourth and above all, LBL is a crown jewel of Austin and thus entails more careful planning, design and O&M consideration. There are perhaps a number of policy issues for the City Council to consider. These may include, but are not limited to: (1) long-term funding for the longhorn dam repair, maintenance and operation, and (2) LCRA's role in the dam operation and maintenance. As a stakeholder, WPD can provide the necessary technical support to review plans, models, reports, and project designs.

Should you have any questions or need additional information, please do not hesitate to let me know.

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Watershed Protection Department

cc: Mike Ihnat, P.E., Consulting Engineer
Saul Nuccitelli, P.E., Consulting Engineer

Documents Reviewed:

- 1) 1- Longhorn Dam Conceptual Design Summary Boards.pdf
- 2) 2-Labyrinth Weirs Presentation - Longhorn Dam Slides.pdf
- 3) 3- Longhorn Dam Gates Conceptual Design Report - Final.pdf
- 4) 4- Longhorn Dam Gates Conceptual Design Supplemental Memorandum.pdf
- 5) 5- Longhorn Dam Labyrinth Conceptual Evaluation - Final (1).pdf