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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

January 24, 2018

Ron Holbrook, President
Glass Club Lake Inc.
574 Omaha Drive
Omaha, TX 75571

Subject: Glass Club Dam (TX04004)
Routine Inspection/Final Construction Inspection

Mr. Holbrook:

We wanted to extend our appreciation for allowing the Texas Commission on Environmental Quality (TCEQ) Dam Safety staff to visit the above-mentioned dam on October 12, 2017. We have completed our inspection report and have enclosed a copy of the inspection report for your reference.

Glass Club Dam, a small size earthen dam, was inspected by TCEQ staff as part of the TCEQ regular inspection schedule in conjunction with the final construction inspection. The owner's engineer was notified of the inspection on September 21, 2017. The dam was found in overall fair condition. The primary issue of concern was the partially filled in and damaged spillway channel/concrete stilling basins. Additional areas of concern included: bare areas along the crest; a vegetated overgrowth in the riprap along the upstream slope; seepage along the downstream toe; vegetated growth in the first concrete stilling basin; and several expansion joints in the concrete stilling basins lacked sealant. A verbal exit interview, explaining the results of the inspection, was conducted on the same day of the inspection with Mr. Green and Mr. Kirker. Additionally, the Emergency Action Plan needs to be updated and the hydraulic inadequacy needs to be addressed.

Please review the enclosed report and provide our office a written response by **May 19, 2018** with a plan of action for addressing each area of concern for the dam. It is understood that some of the requirements/recommendations will require an LTPE to be retained, and your written corrective action plan can be limited to notifying us of a time frame to secure the services of an LTPE. TCEQ appreciates your assistance in these areas. Your efforts will help minimize your liability by reducing the threat to downstream life and property. Thank you for your time and if you would like to discuss any of this in further

detail, please feel free to contact me at (512)-239-6238 or my supervisor Johnny Cosgrove at (512)-239-4307.

Sincerely,

A handwritten signature in cursive script that reads "Levi Best".

Levi Best
Dam Safety Section
Critical Infrastructure Division MC-177

Enclosed: Inspection Report

CC: Mike Green, PE
Johnson & Pace Inc.
1201W Loop 281 STE 100
Longview, TX 75604



DAM SAFETY SECTION CRITICAL INFRASTRUCTURE DIVISION

Dam Safety Inspection Report

GENERAL INFORMATION

INVENTORY No.: TX04004

DAM: Glass Club Dam

OWNER: Glass Club Lake Inc.

STREAM: Tributary of Village Creek

BASIN: Sulphur River

COUNTY: Morris

GENERAL LOCATION: 1.6 miles east of Omaha

DAM HEIGHT: 31-ft

SIZE CLASSIFICATION: Small

NORMAL CAPACITY: 500 ac-ft

MAXIMUM CAPACITY: 750 ac-ft

NORMAL WATER LEVEL: 346.6 ft-msl

CURRENT WATER LEVEL: 345.8 ft-msl

PREVIOUS INSPECTION DATE: October 25, 2011

CURRENT INSPECTION DATE: October 12, 2017

INSPECTION BY TCEQ PERSONNEL: Levi Best and Malcolm-Louis Hamilton, EIT

PERSONNEL CONTACTED: Mike Green, PE – Johnson and Pace, Owners Engineer
Ron Kirker – Glass Club Lake Inc. - Chairman of Buildings
and Grounds

SUMMARY

Glass Club Dam, a small size earthen dam, was inspected by TCEQ staff on October 12, 2017, as part of the TCEQ regular inspection schedule in conjunction with the final construction inspection. The owner's engineer was notified of the inspection on September 21, 2017. The dam was found in overall fair condition. The primary issue of concern was the partially filled in and damaged spillway channel/concrete stilling basins. Additional areas of concern included: bare areas along the crest; a vegetated overgrowth in the riprap along the upstream slope; seepage along the downstream toe; vegetated growth in the first concrete stilling basin; and several expansion joints in the concrete stilling basins lacked sealant. A verbal exit interview, explaining the results of the

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inspection, was conducted on the same day of the inspection with Mr. Green and Mr. Kirker. Additionally, the Emergency Action Plan needs to be updated and the hydraulic inadequacy needs to be addressed.

BACKGROUND

According to TCEQ records, Glass Club Dam was constructed around 1922 and was inspected several times during the 1970's by predecessor agencies of TCEQ; however, the 1977 inspection determined the dam to be a low hazard and it was not added to the Texas Dam Safety routine inspection schedule. Little is known about the history of the dam and there was a large time gap between inspections until October 25, 2011 when the dam was inspected at the request of the owner.

The 2011 inspection found the dam to be in overall poor condition due to the excessive erosion in the earthen spillway, a significant overgrowth of trees and brush along the downstream slope, and a significantly deteriorated, non-functional siphon. Additional areas of concern included:

- An overgrowth of trees and brush along the upstream and downstream shoulders of the crest.
- Displaced concrete bag wall riprap along the upstream slope.
- An overgrowth of trees and brush along the earthen portions of the upstream slope.
- Significant erosion gullies (10-ft wide by 3-ft deep) along the downstream slope.
- Animal burrows (up to 2-ft deep) along the upstream and downstream slopes.
- Seepage along the downstream toe of the dam.

As a result of the 2011 inspection, the owner acquired the services of Johnson and Pace Inc. to conduct a hydrologic and hydraulic (H&H) analysis and develop plans to rehabilitate the dam. On August 14, 2013 TCEQ received plans and specifications to address the hydraulic inadequacy and deficiencies noted from the 2011 inspection. After multiple iterations of plans and comment letters it was determined that the owner needed to purchase the small track of land downstream of the dam to accommodate the proposed improvements to the dam. On May 12, 2015, another draft version of the plans were submitted for a preliminary review. Comments were provided by TCEQ on June 26, 2015. On August 10, 2015, TCEQ received the finalized set of plans and H&H analysis. On September 9, 2015, TCEQ approved the H&H analysis; however, additional comments were provided for the plans and specifications. The final revisions to the plans were submitted on February 8, 2016 and approved on February 12, 2016. A minor revision to the approved plans (removal of additional trees) was added on June 13, 2016 and approved on June 23, 2016. The proposed improvements included:

- Remove the existing spillway and the wooden bridge along the spillway inlet.
- Construct a new 20-ft wide (bottom width) concrete spillway with 3H:1V side slopes and a bottom elevation of 346.6 ft-msl. The spillway discharged through two concrete stilling basins that were separated by a 100-ft wide earthen channel.
- Install riprap erosion protection with TRM underlayment between the two concrete stilling basins.
- Remove the overgrowth of tree and brush from the embankment.
- Line the upstream slope with rock riprap erosion protection.

Construction reportedly began on July 12, 2016. The Engineer's Notification of Completion and as-built plans were submitted to TCEQ on November 21, 2016, which indicated that the construction was completed on October 26, 2016.

PRE-INSPECTION MEETING

A pre-inspection meeting was not conducted; however, Mr. Kirker and Mr. Green met with TCEQ staff during the inspection where a brief background of the modifications was discussed. In addition, concerns with the partially failed spillway were discussed, which according to Mr. Green are planned to be repaired in the near future.

INSPECTION FINDINGS

Figure 1 is a location map of Glass Club Dam with respect to the City of Omaha. Figure 2 is an aerial view with 10-ft contours and stream flow-lines. Figure 3 is a sketch of the dam indicating the approximate photo locations. Note that right and left indications are from the perspective of an observer looking downstream. Field measurements taken during the inspection were done using a hand-level and survey rod. The water level was at approximately 345.8 ft-msl, or 0.8-ft below the spillway inlet.

CREST

- The 12-ft wide crest of the dam was generally flat and straight for the length of the dam; however, it lacked a suitable vegetated cover (Photos 1-2).
- The previously noted tree and brush growth appeared to have been removed and voids repaired as per the approved plans and specifications.
- The crest was found to be in fair condition.

UPSTREAM SLOPE

- The 2.5 horizontal to 1 vertical [2.5H:1V] upstream slope was lined with rock riprap. A minor overgrowth of vegetation was observed within the riprap; however, the slope overall appeared to be stable. It should be noted that the overgrowth increased along the right half of the slope (Photos 3-4).
- The design report provided by Johnson and Pace Inc. indicated that the owner planned to armor the slope once funds were available. However, the approved plans did not provide any specifications/details for the riprap along the slope and it could not be determined how far below the normal water level the riprap was installed. It was speculated that the riprap was installed in conjunction with the spillway repairs.
- The upstream slope was found to be in fair condition.

DOWNSTREAM SLOPE

- The 3H:1V downstream slope was a vegetated slope that was recently cleared of all trees and brush. There were no obvious areas of erosion or depressions and the vegetation appear to be re-establishing very well. The tree removal and void filling appeared to have been conducted as per approved plans (Photos 5-6).
- Seepage was observed along the majority of the toe with the largest concentration of seepage near the midpoint of the dam. It should be noted that the seepage was observed about 2-ft above the toe; however, the seepage was clear with no obvious boils or suspended sediment (Photos 7-8).
- An area of surface erosion (about 6-inches deep by 8-ft wide) was observed right above the seepage area; however, it could not be determined if the erosion and seepage were correlated.
- The downstream slope was found to be in good condition.

SPILLWAY

- The spillway is located at the right end of the dam and was composed of a 20-ft wide staged spillway. The spillway inlet is a concrete lined channel that discharges

into a 20-ft wide by 24-ft long concrete stilling basin, which transitions into 20-ft wide riprap lined earthen channel. The earthen channel diverts the flows into a second concrete stilling basin about 100-ft downstream of the first stilling basin. The spillway appears to have been installed as per approved plans and specifications. However, according to Mr. Green, shortly after the completion of the spillway the area received a significant amount of rain, which caused the soil under and around the concrete stilling basins to settle, resulting in a substantial slide on the hill adjacent to the spillway channel (Photos 9-14).

- The first stilling basin exhibited some settling, which caused the under drain system along the right slope wall to be displaced and likely broken. According to Mr. Green, the contractor plans to cut and remove the right slope wall, repair the under drain system, stabilize the subgrade, and reconstruct the right slope wall. In addition, the stilling basin exhibited a minor silt build-up with vegetation growing within the silt. The undrain system was not discharging any flows during the inspection, which was expected due to the damages it had sustained.
- The riprap lined channel between the two concrete stilling basins was filled in by the slide, which narrowed the channel to about 4-ft wide. The channel in its current condition will not adequately discharge flows from the stilling basin. In addition, as TCEQ indicated during the review process, the riprap within the channel appears to very small for a spillway and will likely be displaced downstream during significant rain events.
- The second stilling basin was filled with about a 4-ft thick layer of soil and the majority of the basin could not be inspected. It was not determined if the slide damaged any portions of the second stilling basin; however, it is likely that the right slope wall had settled and cracked.
- Seepage was discharging from the concrete chute slab above the first stilling basin as well as from the floor of the first stilling basin. A 6-inch PVC pipe was installed to drain stilling basin with the drain outlet located about 70-ft to the left of the basin. The drain was discharging an estimated 2 gallons per minute of seepage from the spillway's first stilling basin. In addition, there was no form of erosion protection for the drain outlet and the seepage flow had caused some minor erosion.
- Several expansion joints in both concrete structures were lacking sealant.
- The spillway was found to be in poor condition.

LOW FLOW

- The previously noted siphon appeared to have been removed in conjunction with the approved modifications and was not observed during the current inspection.

DOWNSTREAM CHANNEL

The channel downstream of the spillway was a heavily wooded and fairly well defined channel that traveled in a northern direction.

CONFIDENTIAL: DOWNSTREAM HAZARDS

This dam is currently classified as a significant hazard dam, which was supported by a simplified breach analysis that indicated two residents and State Highway 77 (previously a major collector road) are potentially impacted by a failure of Glass Club Dam. However, after an updated evaluation of the downstream inundation map, State Highway 77's classification has increased to a minor arterial road, which is enough to warrant a high hazard classification for the dam. Therefore, the hazard classification of the dam will be raised to high. It should be noted that the hazard classification is not a description of the condition of the structure, but rather, a description of the potential for loss of downstream

Glass Club Dam, TX04004

life or property in the event of a failure of the dam. The high hazard classification indicates that some potential for loss of life exists.

HYDROLOGIC/HYDRAULIC (H&H) ANALYSES

This dam is required to safely pass 75% of the Probable Maximum Flood (PMF), given that the following provisions are satisfied:

1. Emergency Action Plan (EAP) completed/finalized
2. Operation & Maintenance (O&M) Plan generated
3. Implementation of Owner's Routine Inspection Program
4. Submits an Annual Report to TCEQ documenting compliance with provisions 2 & 3 above.

A hydrologic and hydraulic study was performed by Johnson and Pace Inc. on August 8, 2015, which determined the dam could safely pass 50% of the PMF. The analysis was accepted by TCEQ on September 9, 2015. However, the dam is now required to pass 75% of the PMF and is currently hydraulically inadequate.

OPERATION AND MAINTENANCE (O&M) PLAN

No written O&M was available; however, Mr. Kirker explained that they do conduct routine maintenance on the dam.

EMERGENCY ACTION PLAN (EAP)

A finalized EAP was submitted on July 31, 2013 and was approved on September 13, 2013.

REQUIREMENTS/RECOMMENDATIONS

The following requirements and/or recommendations are provided:

- A.** It is a requirement that EAP be updated annually and a Tabletop exercise be performed every 5 years. Provide TCEQ Dam Safety with any portions of the EAP that need to be updated. If there are no updates to the EAP then provide TCEQ with a letter indicating that no updates are required.
- B.** The spillway needs to be reconstructed to the approved design and the hill side adjacent to the spillway needs to be stabilized. Due to the nature of the repairs, they should be conducted under the supervision of your LTPE.
- C.** The vegetation noted within the riprap along the upstream slope should be removed and efforts should be made to keep all the riprap clear of vegetated growth.
- D.** The expansion joints should be cleaned and sealed with a suitable sealant. Efforts should be made to keep the joints sealed.
- E.** Establish a vegetated cover along the crest and make an effort to keep a good vegetated cover along the crest and downstream slope.
- F.** In the 30 Texas Administrative Code (TAC) Chapter 299, §299.43(a), a written O&M plan is required to be developed. The plan shall include items addressed in the requirements/recommendations portions of this report. The method and the time frame for addressing these items are left up to the owner, and it is recognized that finances may govern when the work can be undertaken. In addition, the following deficiencies need to be monitored:

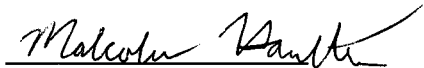
- a. The seepage flow along the downstream toe and from the first spillway stilling basin for a sudden increases and/or presence of suspended sediment.
 - b. Minor erosion along the downstream slope above the seepage.
- If conditions worsen with any of the deficiencies, then a LTPE should be consulted in order to determine the level of damage and provide improvements if needed.

CONCLUSIONS

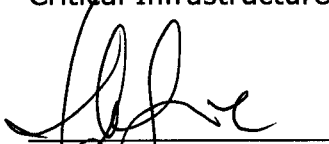
The recent modifications conducted on the dam appear to be as per approved plans; however, as indicated in the inspection report, the hill side adjacent to the spillway exhibited a significant slide causing the spillway channel/concrete stilling basins to be partially filled in and damaged. It is the owner's responsibility to maintain the dam in a safe condition in order to prevent loss of life and limit the potential for property loss. The owner of this dam may be liable for downstream damages in the event of a spill or breach. In addition, regular maintenance may reduce future rehabilitation and repair costs. This structure will be scheduled for re-inspection in 5 years, or in conjunction with any modifications.



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