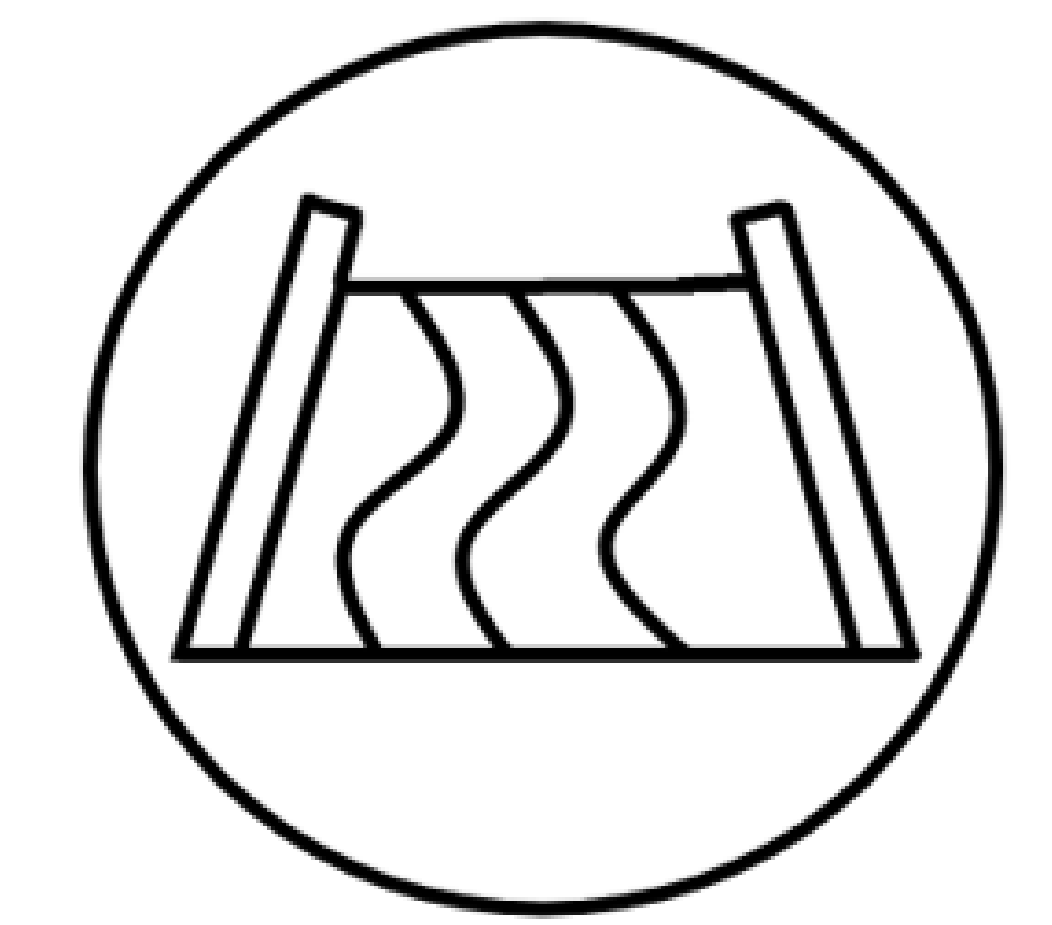


C2.05 – Rehabilitation of Lake Dunlap Dam

Sarah Brooks, Richard Kortz, Sydney McKean, and Drew Price

Faculty Advisors: Dr. Feng Hong and Dr. Felipe Gutierrez



Project Overview

The purpose of this project was to select an aging dam and propose a method of rehabilitation. After an alternative was chosen:

- A system and component design was completed with AutoCAD
- A capital and life cycle cost analysis was determined with RSMean
- Sustainability of design was evaluated with Envision framework

Background

The Lake Dunlap dam, also referred to as the TP-1 dam, is hydroelectric. It was constructed in 1928 and designed with three Bear Trap style spill gates. After roughly 90 years, on May 14th, 2019, the middle spill gate failed due to corrosion in the bottom hinges of the middle gate. Due to the failure, Lake Dunlap's water level fell about 7 feet.

Site Selection

The location of the dam rehabilitation is on Lake Dunlap in New Braunfels, Texas



Figure 1: Location of Lake Dunlap (TP-1) dam

System Design

The recommended system design is replacing previous 3 spill gates with Crest Hydraulic Actuated spill gates. A total of three steel gates and six hydraulic cylinders are needed.

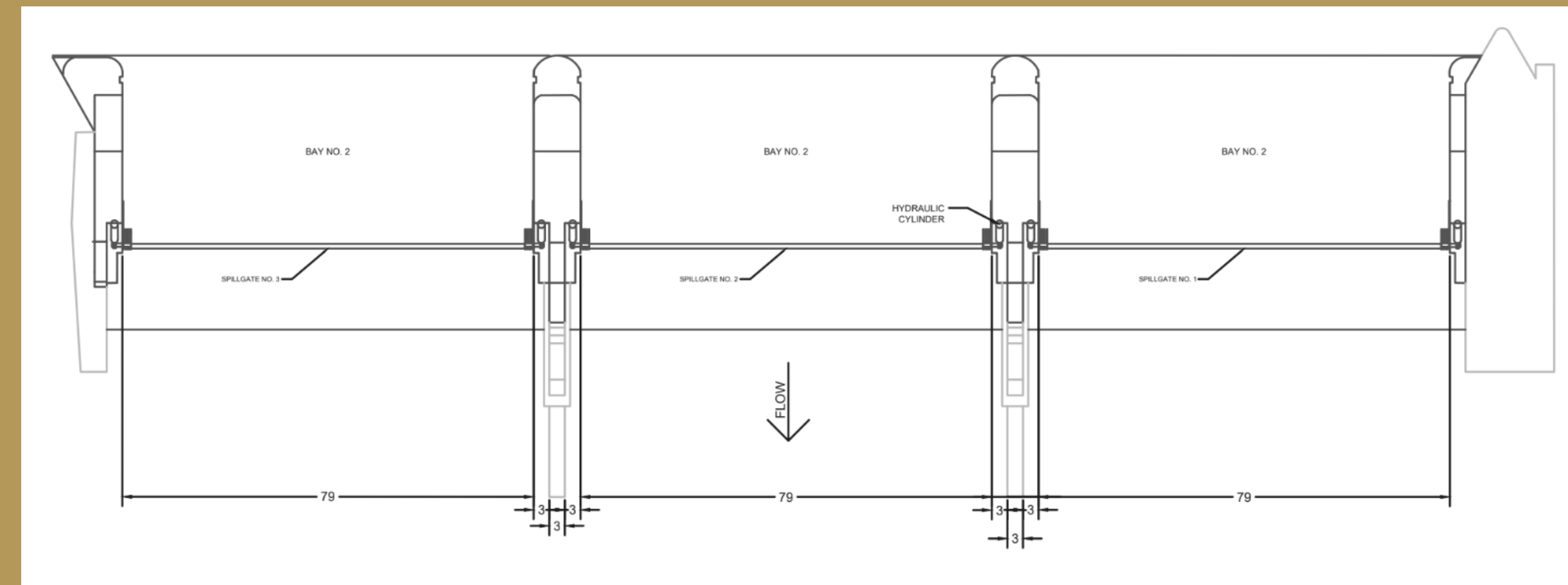


Figure 2: Top View Drawing of Lake Dunlap Dam

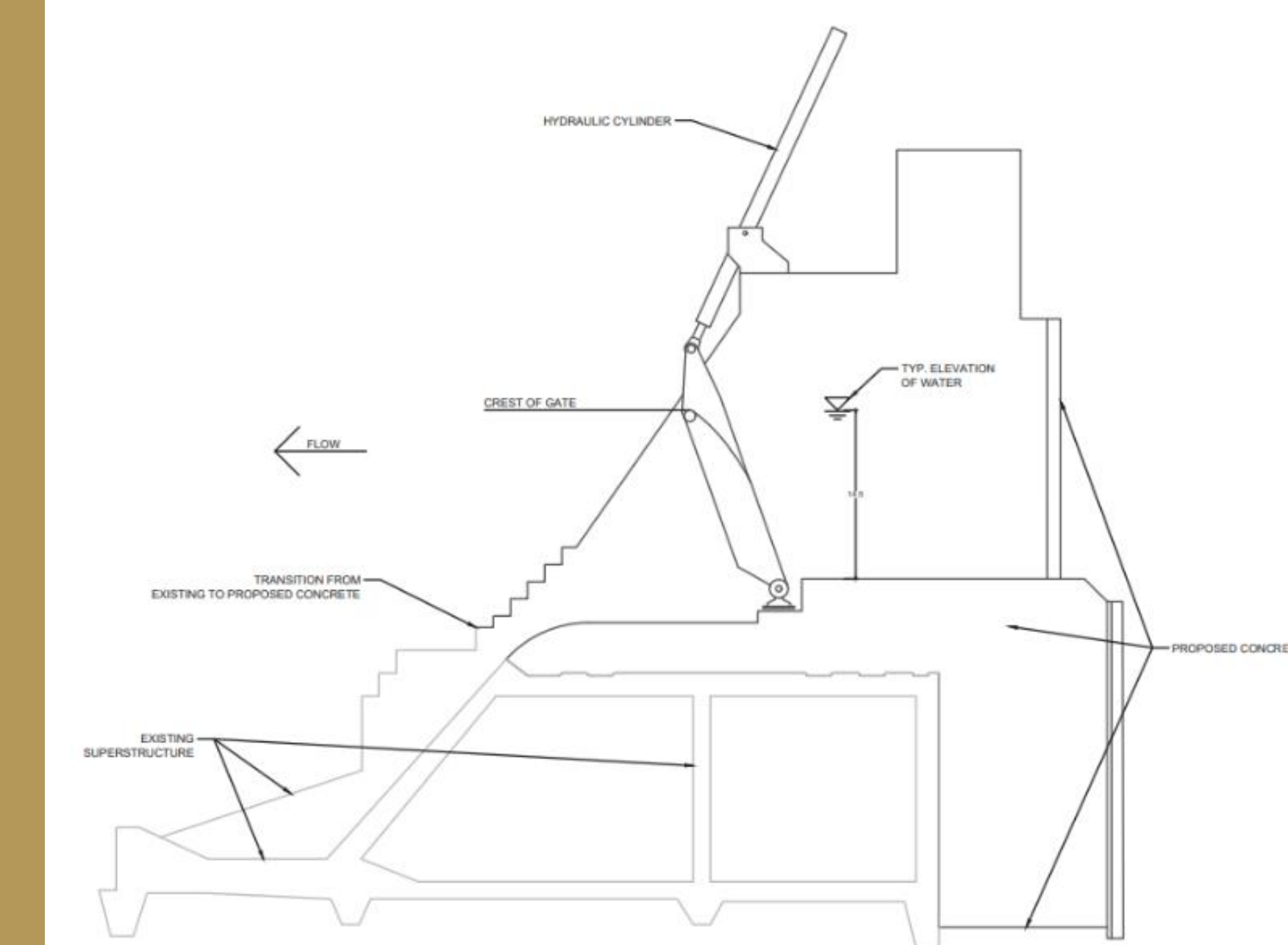


Figure 3: Side View Drawing of Crest Hydraulic Actuated Gate

Gate Dimensions:

- 79 feet long
- 14.5 feet tall

Design Specifications Considered:

- Possible loss-of-storage from spill gate malfunction
- Damage to gate from siltation and debris

Force acting of gate:

904.8 pounds per square foot at 9.67 feet

Discharge when gate is fully lowered:

3,918 acre-feet per day

Hydraulic Cylinders

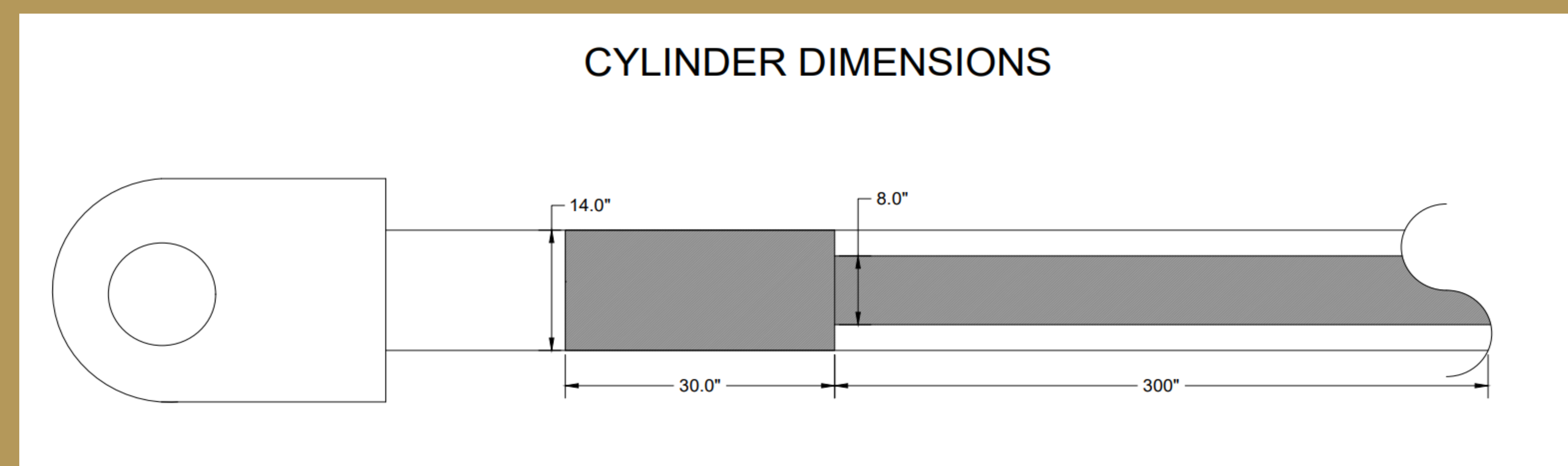


Figure 4: Side View Drawing of Hydraulic Cylinder

Design Specifications Considered:

- 3,000 psi - Designed Operating Pressure
- Each cylinder can raise/lower their respective gate by themselves
- Other Specifications required per GBRA

Cylinder Dimensions:

- 8 inches for piston rod diameter
- 14 inches for bore diameter
- 300 inches for stroke length

Force on Cylinder: 461.8 kips

Force on Rod: 311.0 kips

Capital and Life Cycle Costs

The capital and life cycle costs of the rehabilitation of the Lake Dunlap Dam were estimated with the cost software, RSMean. The capital costs were calculated along with consideration of the regular maintenance costs, with the life cycle costs being calculated into net present value (NPV).

Project Costs:

Construction Cost: \$17.5 Million

Value in 100 years: \$17.9 Million

Sustainability

Using the sustainability framework, Envision, the chosen design was evaluated and determined to be highly sustainable, receiving a "Silver" ranking per Envision's guidelines.

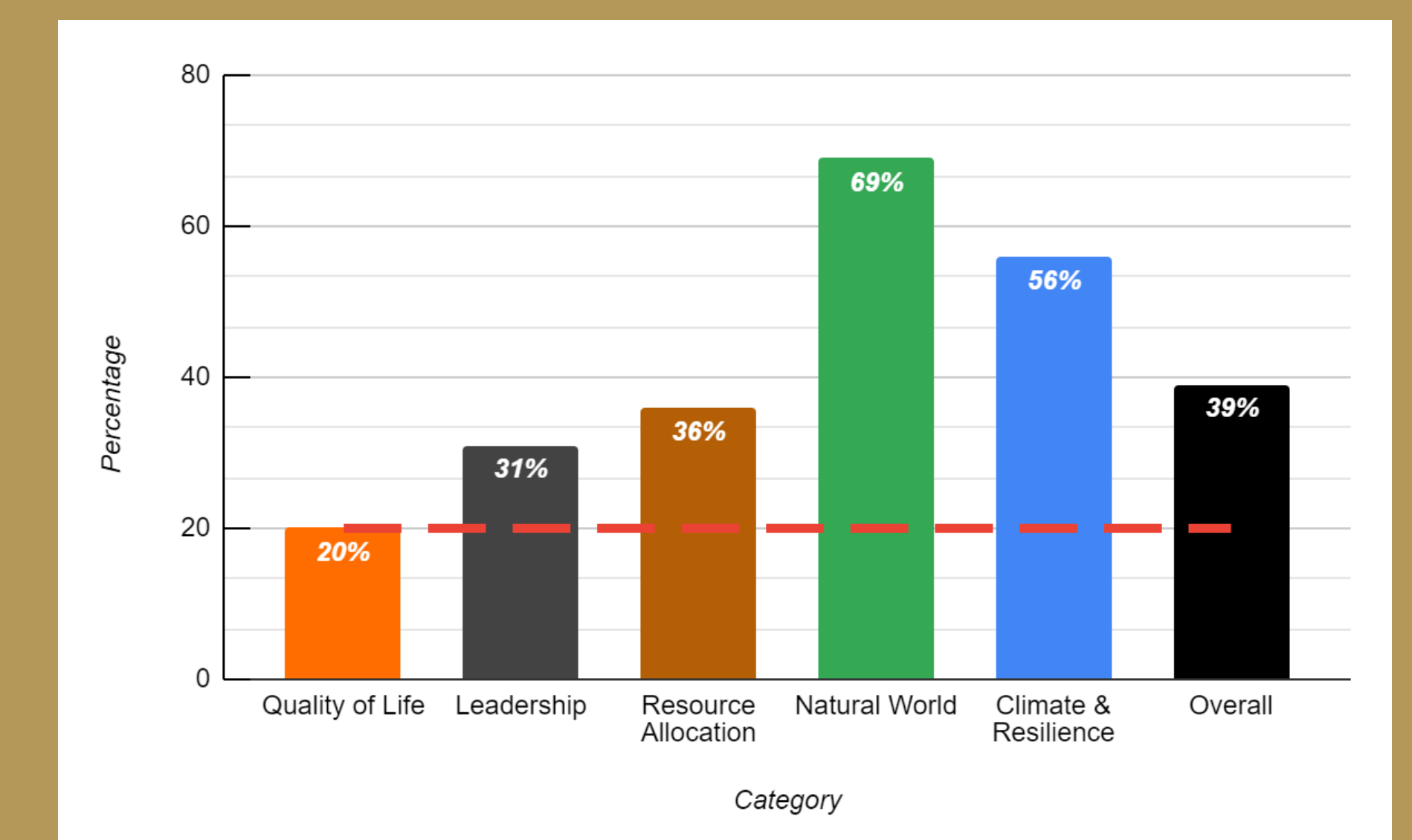


Figure 5: Envision Score of design

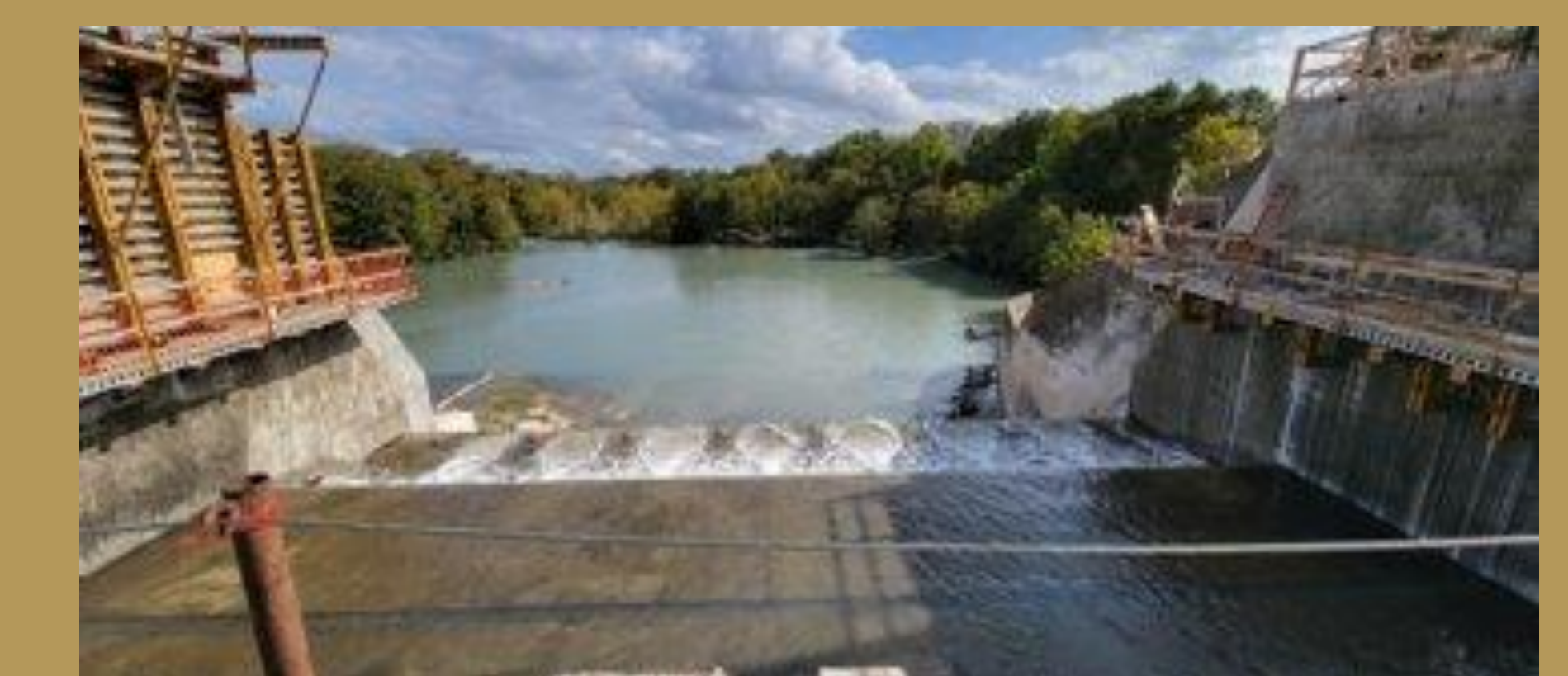


Figure 6: Demolded spillway of Lake Dunlap dam from site visit on Nov. 4, 2022