



# Marlette Lake Dam Rehabilitation Project

Presented by **Chelsea Cluff, P.E.** and **Caroline Elliott, E.I.**

# What is Marlette Dam?

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- Originally constructed in 1873 to provide water for the silver mining boom in Virginia City, Nevada
- Listed on the National Register of Historic Places
- Part of the Marlette Lake Water System, located 1 mile east of Lake Tahoe within Lake Tahoe Nevada State Park and within the Lake Tahoe Basin



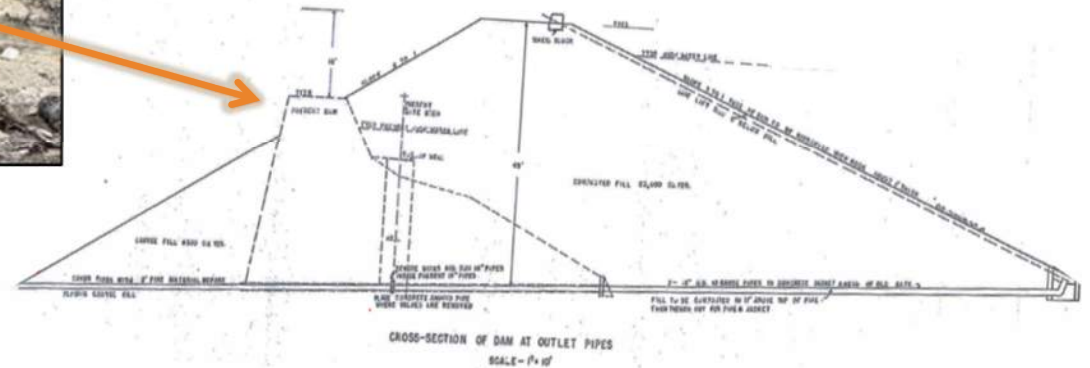
Source: Paul Hamill Photography, 2018

## What is Marlette Dam Continued...



Existing Historic Wall

- Marlette Dam raised 16 feet in 1959
- Operated by the state of Nevada since 1963
- Supplies water to Virginia City, Gold Hill, Silver City, and Carson City



## What is Marlette Dam Continued...

### Marlette Lake Water System:

- Marlette Lake and Dam
- Hobart Lake and Dam
- East Slope Catchment System
- Marlette Lake Pumping System
- Multiple transmission mains
- Generator building and maintenance yard



# Existing Dam Components



Emergency Spillway



Earthen Embankment



Outlet Pipes



Control Gates



# Why Rehabilitate the Dam?

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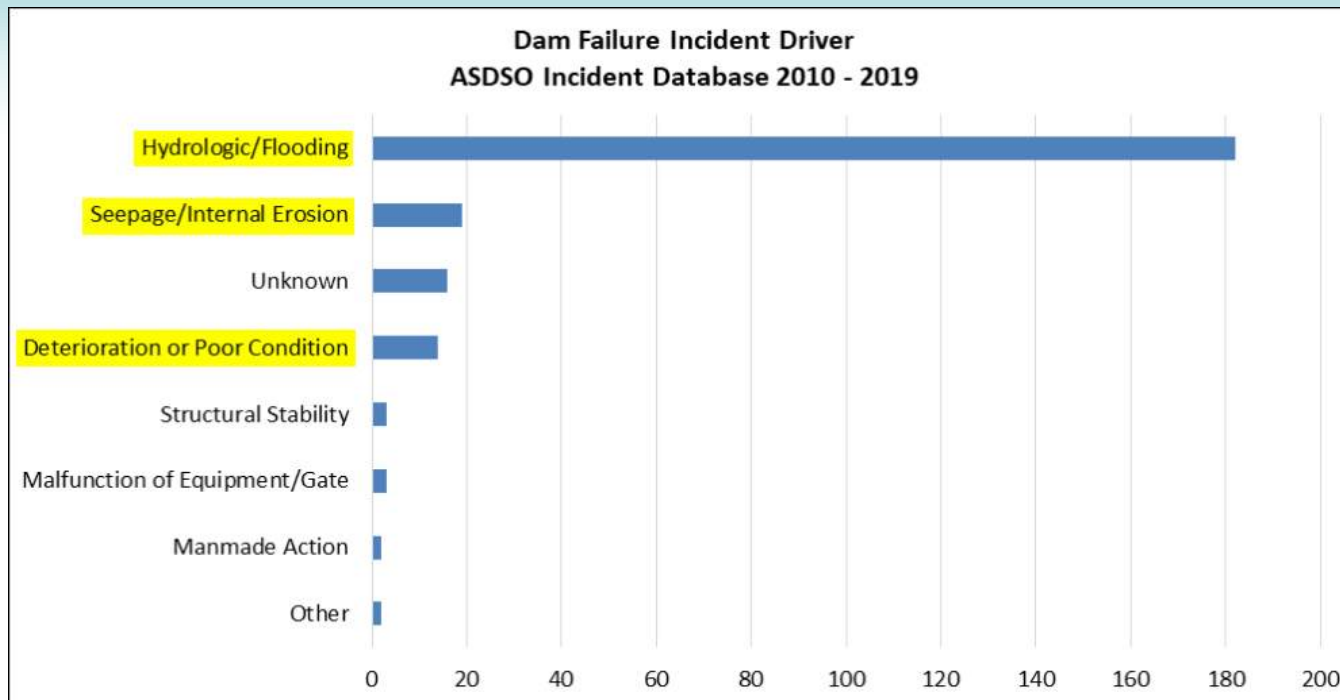
Source: [www.theconstructor.org](http://www.theconstructor.org) article "Causes of Failures of Earthfill Dams"

## Risk of Catastrophic Failure

- Significant seepage through dam along primary outlet conduits
- Structural instability under seismic scenarios
- Emergency spillway undersized

## Why Rehabilitate the Dam Continued...

Association of State Dam Safety Officials Dam Failure Statistics



## Why Rehabilitate the Dam Continued...



### Dam Failure Impacts:

#### Human Impacts

- Loss of Water Resource

#### Infrastructure Impacts

- Highway 28 and Culvert Washout

#### Environmental Impacts

- Marlette Creek and Wetland Destruction
- Chimney Beach Outlet at Lake Tahoe
- Loss of Established Ecosystem and Fishery
- Lake Tahoe Water Quality and Clarity



## Why Rehabilitate the Dam Continued...

### Operational Challenges



Emergency Spillway – March 14, 2017



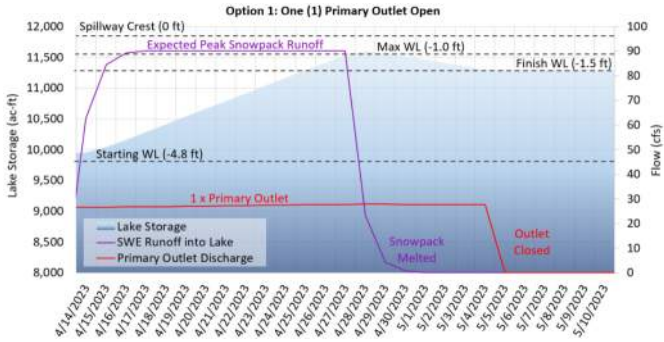
Dam only accessible by helicopter/snowcat during winter



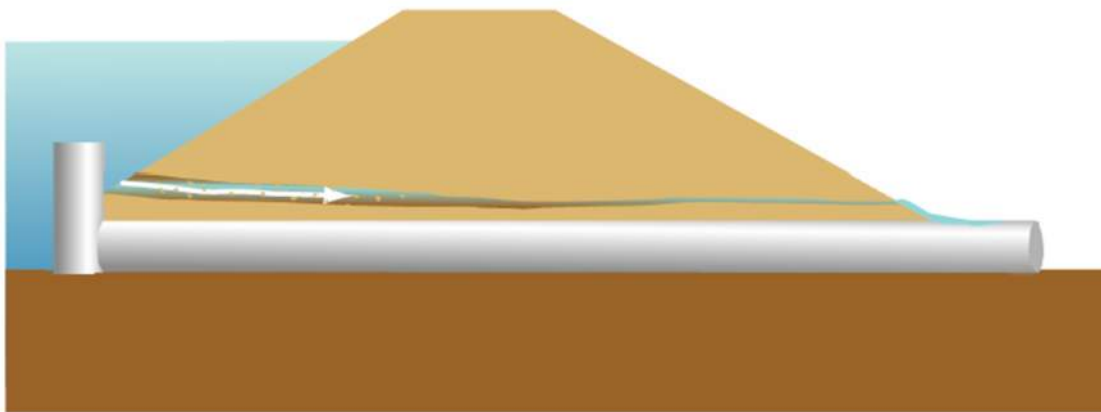
Outlet manually controlled by equipment that freezes

# Spring 2023 Snowmelt Event

- Record Breaking Snowfall in Winter 2022/2023
- The 'Big Melt' Anticipation
- Spillway Active, Undersized, and Insufficient Surge Capacity



# Design



Source: FEMA Technical Manual: Conduits through Embankment Dams

1. Mitigate Seepage Along Primary Outlets
2. Reduce Emergency Outletting Risk
3. Stabilize Dam Embankment Structure

## Design Continued...

### Key 60% Design Components

- Conduit Replacement - Excavation
- Filter-Drain for Seepage Mitigation
  - Use of water stops no longer advised by FEMA
- Replace Emergency Spillway
- Raise Dam Crest 2.5± Feet
- Buttress Fill for slope stabilization
- Remote monitoring and control

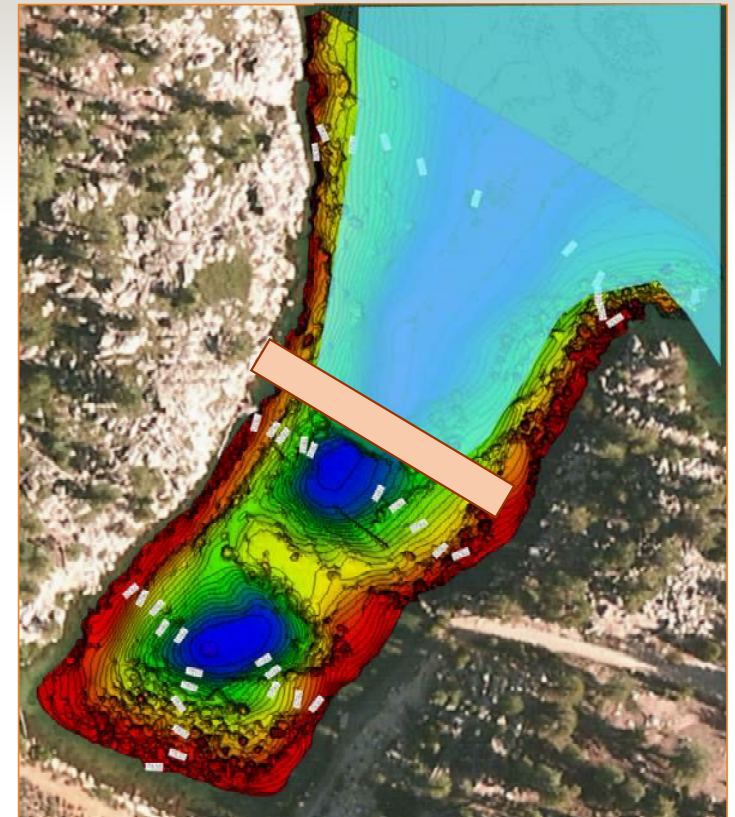
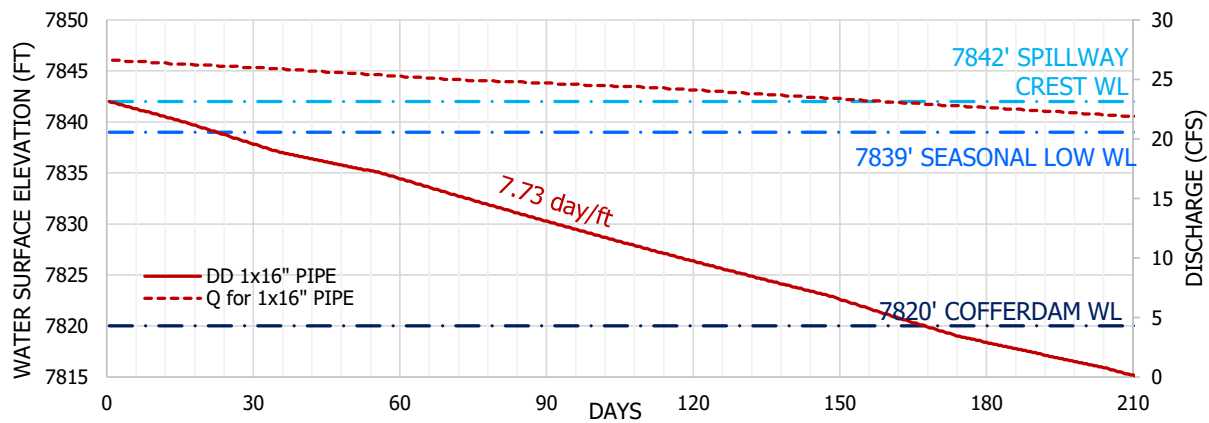


Source: FEMA's Technical Manual: Conduits through Embankment Dams

## Design Continued...

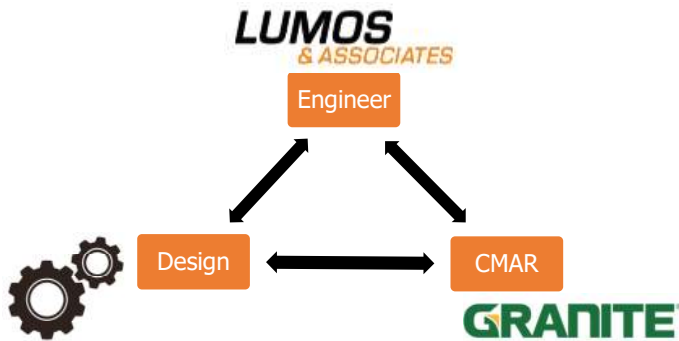
### Critical Analysis Performed

- Freeboard and wave run-up
- Hydraulic modeling of spillway and outlets
- HEC-HMS PMF Routing Model through Dam
- Multi-beam Bathymetry
- Lake Drawdown Timeline

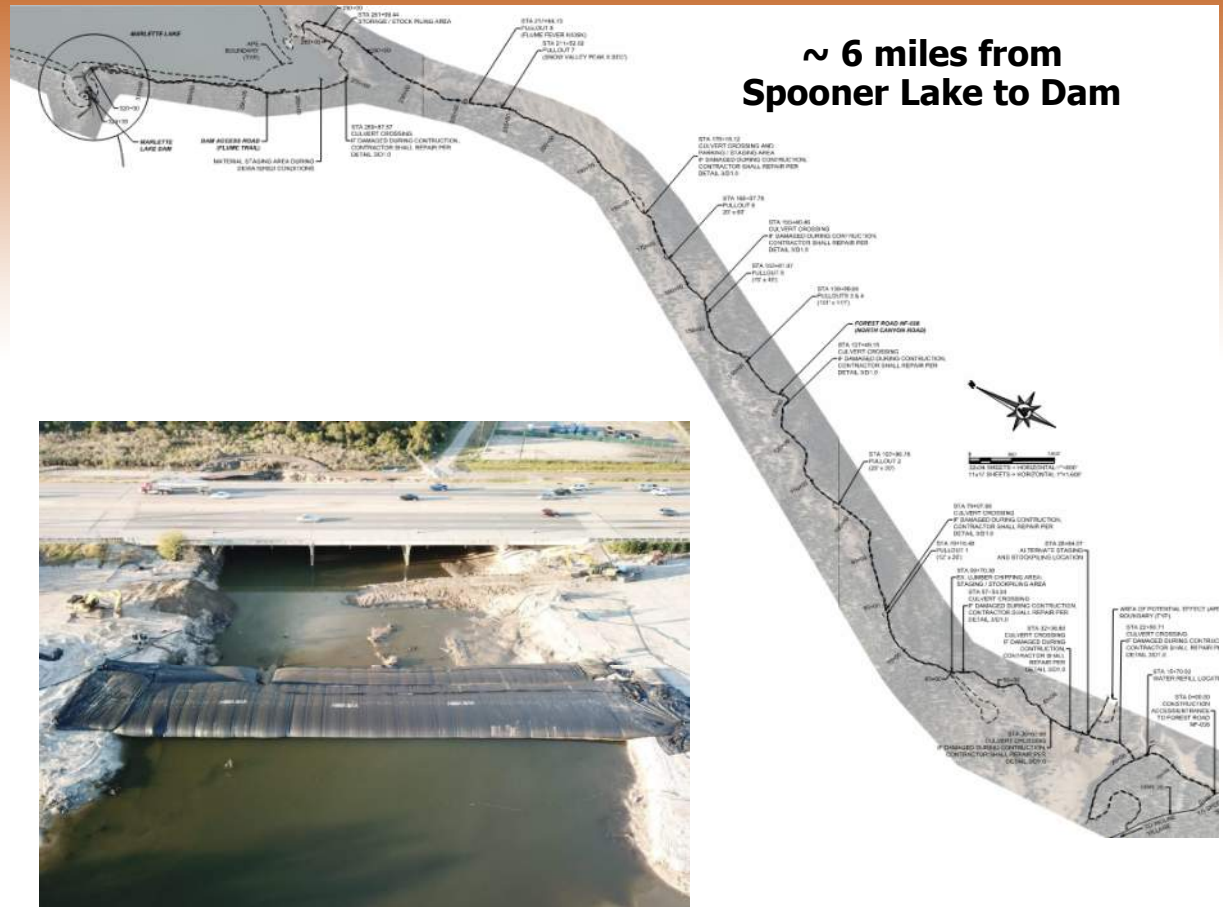


# Construction Challenges

- Location, Location, Location
  - Remote – access difficult
  - Snow-impacted schedule



- Dry construction → hydraulic cofferdam → dewater lake
- Steep slopes in tight canyons
- Stockpiling locations limited

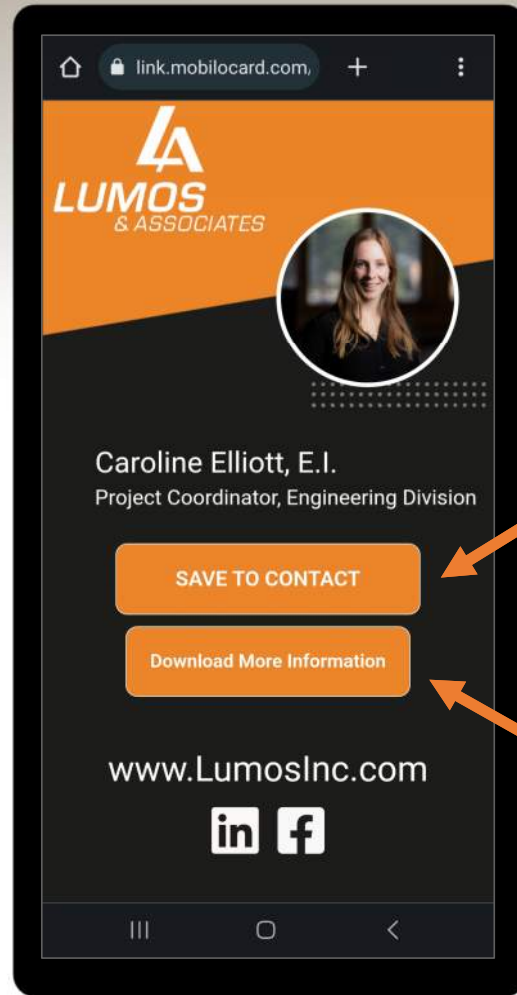
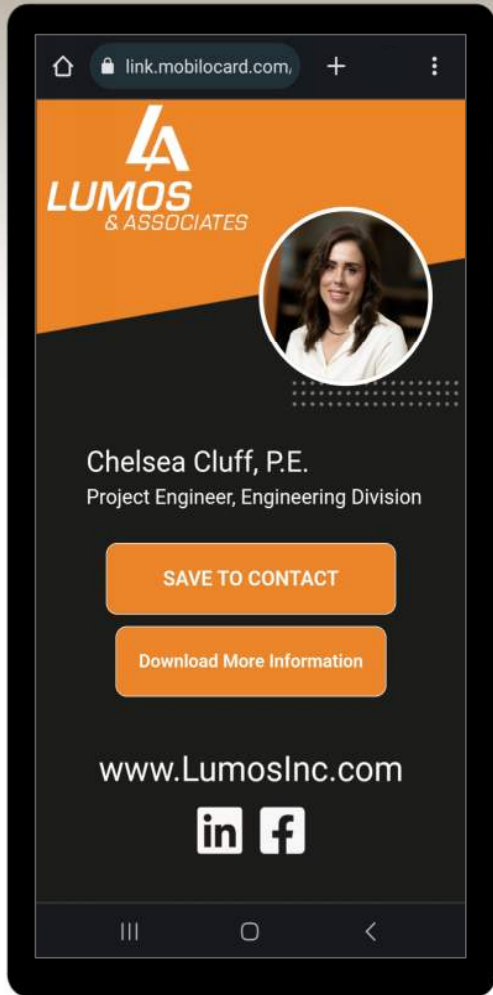


Hydraulic cofferdam, 300 ft (Ref: AquaDam, 2018)

# Takeaways



- More frequent significant hydrological events.
- Pre-emptive upgrades for peace of mind.
- Engineer and Contractor collaboration to achieve success.
- Protect the legacy of a significant, historic, water resource.



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# Thank You!

Questions?

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