Baldwin Hills Dam Disaster

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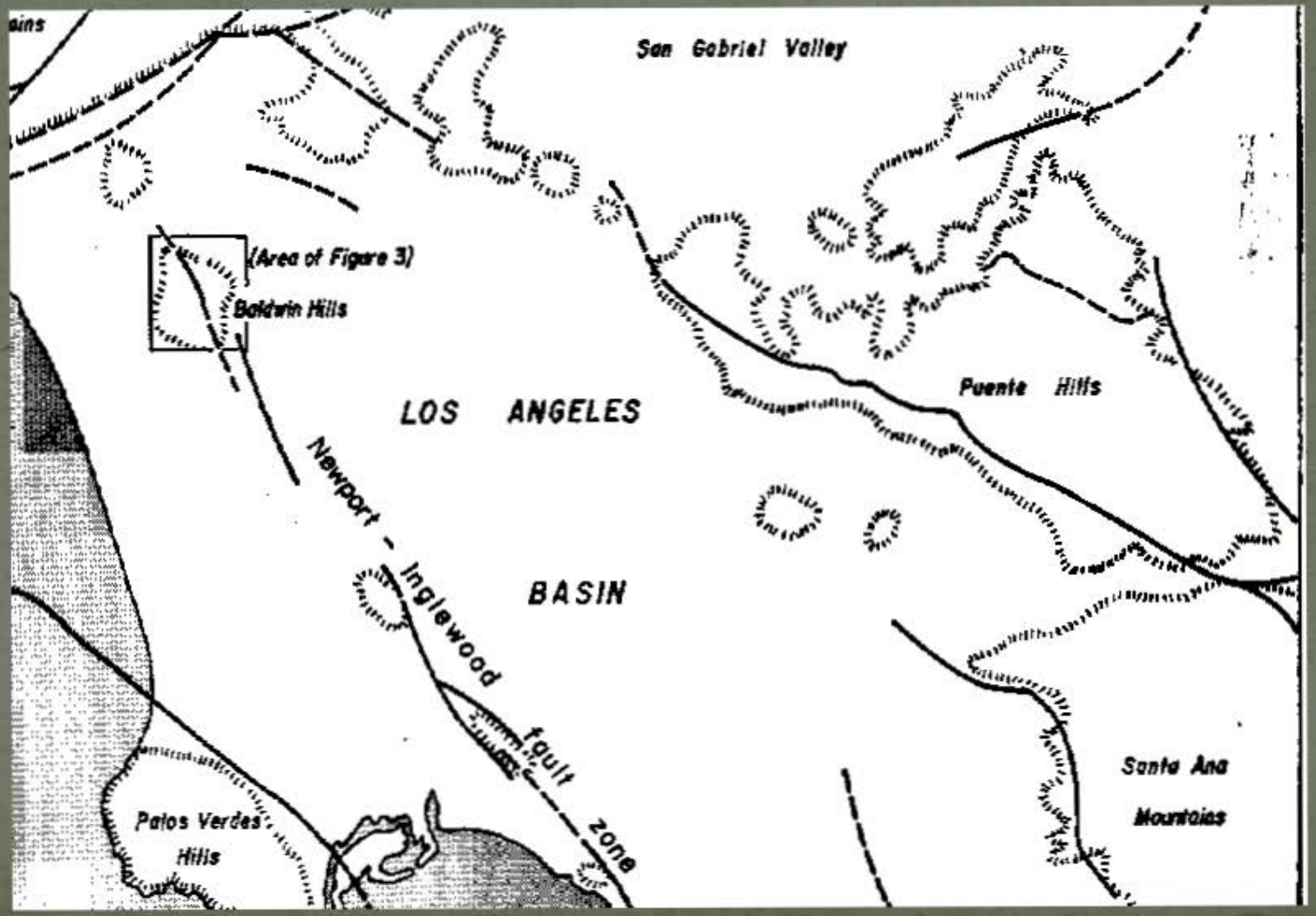
Overview of Presentation

- Site selection
- Baldwin Hills Dam and Reservoir Construction
- Scheduled Maintenance and Repairs Made
- Failure Analysis
- Conclusion

Problems from the Start

- Initial surveys found that the selected site was near the Inglewood-Newport Fault Line
- Also, a few hundred yards away were the Inglewood Oil Fields
- Soil strata were found to be very unstable underneath the site due to constant changes because of tectonic movement and waste excretion from the oil fields

Geologic Site Map



Initial Takeaway

- Engineers were skeptical at first about the future site of the reservoir

- After surveys and lab testing finished, engineers believed that the fault line would not hinder the foundation of the reservoir and gave the go-ahead to start construction

Site Plans

GrassrootsCoalition
http://www.saveballona.org
Community Health & Safety
Full Disclosure

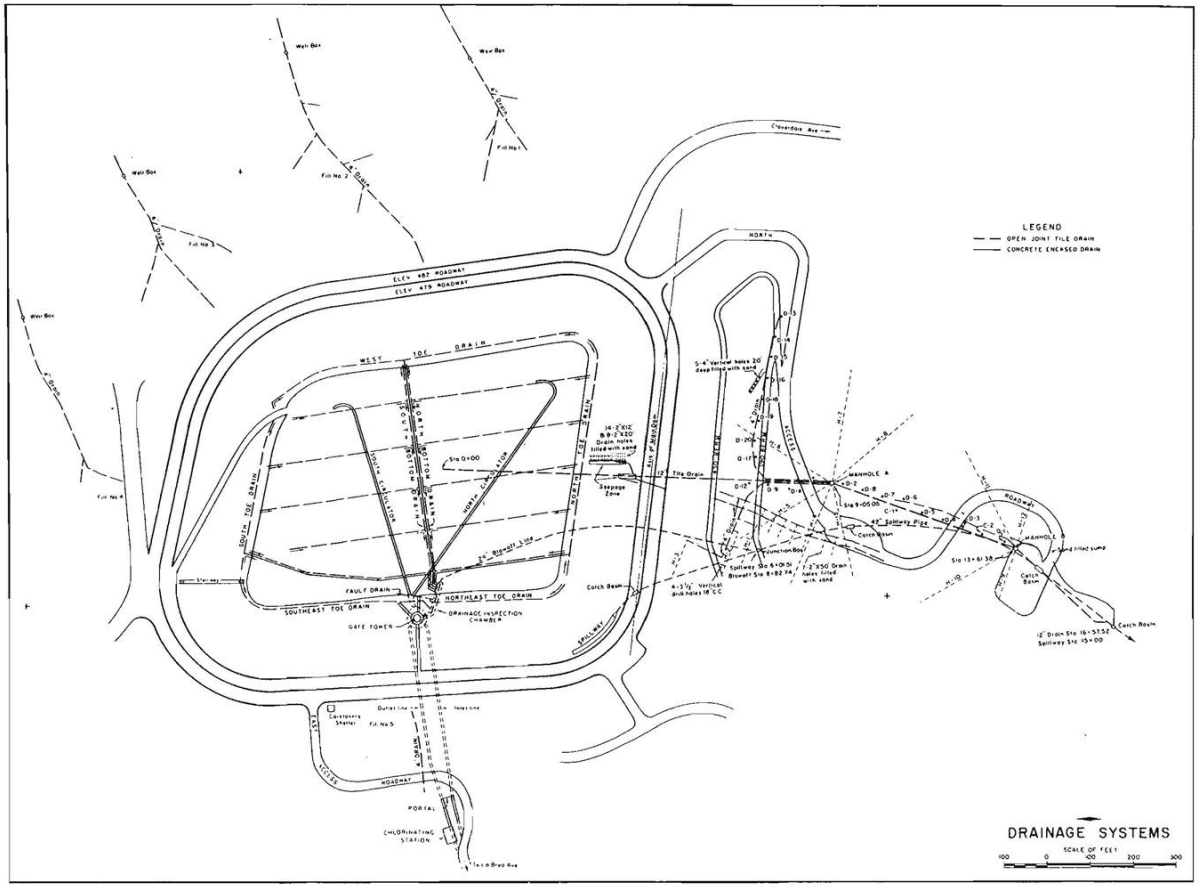


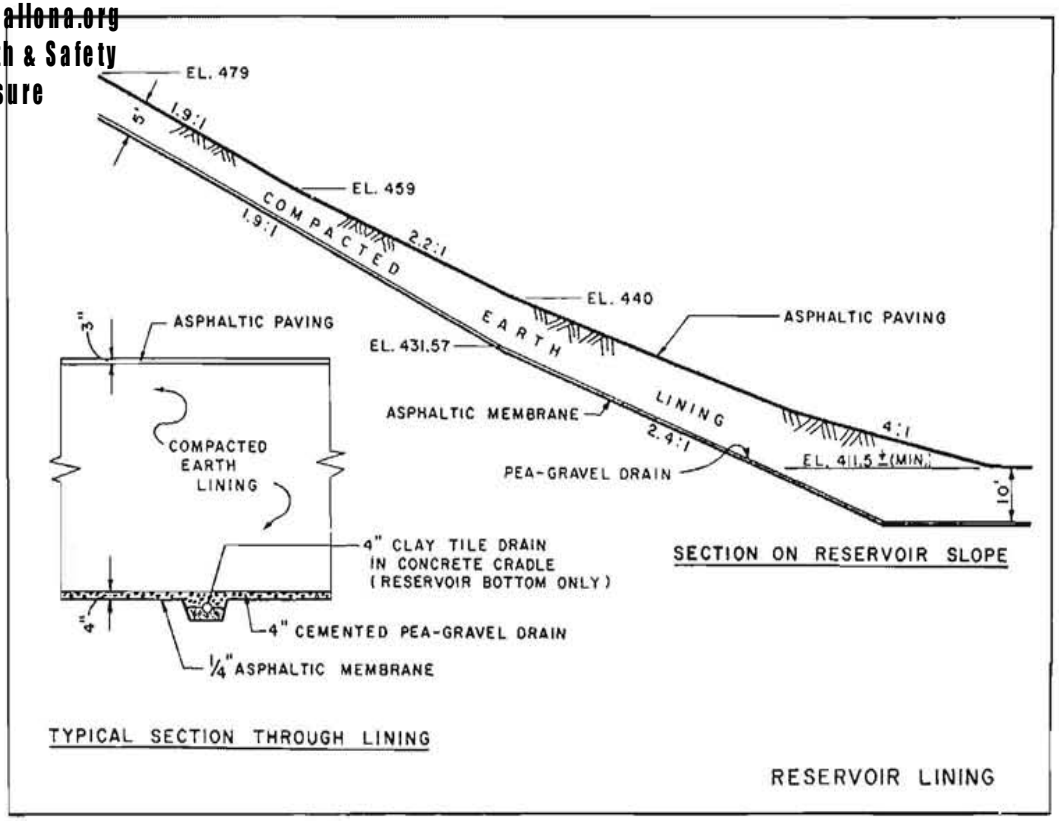
Fig. 2-2. Drainage systems, Baldwin Hills Reservoir.

Soil Compaction and Layering

- The bottom of the reservoir consisted of many layers of soils that were meant to prevent leakage of water from reservoir

- The layers from top to bottom were:
  - Compacted Earth graded with a steep slope
  - Drainage Piping surrounded by lightly cemented gravel
  - ¼" layer of pea-sized gravel that was lightly cemented
  - ¼" layer of asphalt with cotton reinforcement weaving were needed

Soil Compaction and Layering (cont.)



Building on a Knife's Edge

- The Baldwin Hills Dam rested entirely on the success of a new type of plastic layering method using asphalt with cotton reinforcement.

- This layer was to be ¼" sprayed asphalt membrane that would be reinforced with cotton weaving support where needed to ensure that no seepage would penetrate the bottom lining of the reservoir.

Overall Measurements

- The reservoir after construction was finished held 1.1 million meters cubed of water
- The dam after construction sat 71 meters (232 ft.) high and 198 meters (650 ft.) long

Operation and Maintenance

- During the lifetime of the reservoir, engineers were at Baldwin Hills daily to check drainage levels and soil layer settlement readouts
- On March 13-16, 1957 the reservoir was emptied to check for problems in the soil lining underneath the compacted earth.
- During this inspection a 2" overthrust was found in the lining running perpendicular to the dam face. Repairs were made and the reservoir was filled back up.

Critical Failure

- On the morning of December 14, 1963 at 11:15 AM a noticeable amount of water was gushing into the spillway from the reservoir.
- 3 hours later, the dam burst forth a raging torrent of water that devastated the lower surrounding residential areas.
- If it were not for the early warning provided by the engineers to the police that day, a lot more than 5 people would have lost their lives.

Critical Failure (cont.)

First Ever Disaster Broadcasted on Live US TV

- Since this unfortunate event occurred during the 60's, news channels flocked to the scene to broadcast this destruction to the entire nation

- https://www.youtube.com/watch?v=kIeNM8cm6J8

The Aftermath

- The flood that resulted from the dam failure ended up with millions of dollars worth of damage to the surrounding lowland as well as 5 people killed.

- One of the five people who died could have been saved if not for the fact that she was swept away into a sinkhole while still sitting in her car.

Post Failure Analysis

- Four days after the disaster took place, a 7” overthrust was found spanning the length of the reservoir along with many holes in the asphalt layer.
- Sinkholes were also very prevalent in the compacted earth cover lining, some being several feet in diameter.
- It was later tested that if an extra lining of a silty-clay like layer was placed under the asphalt layer, it would have allowed for a more “plastic” support to the bottom of the reservoir, and might have prevented the critical failure.

Post Failure Analysis (cont.)

- Many prevalent engineers gathered for conference after conference to find out who or what was to blame for the disaster.

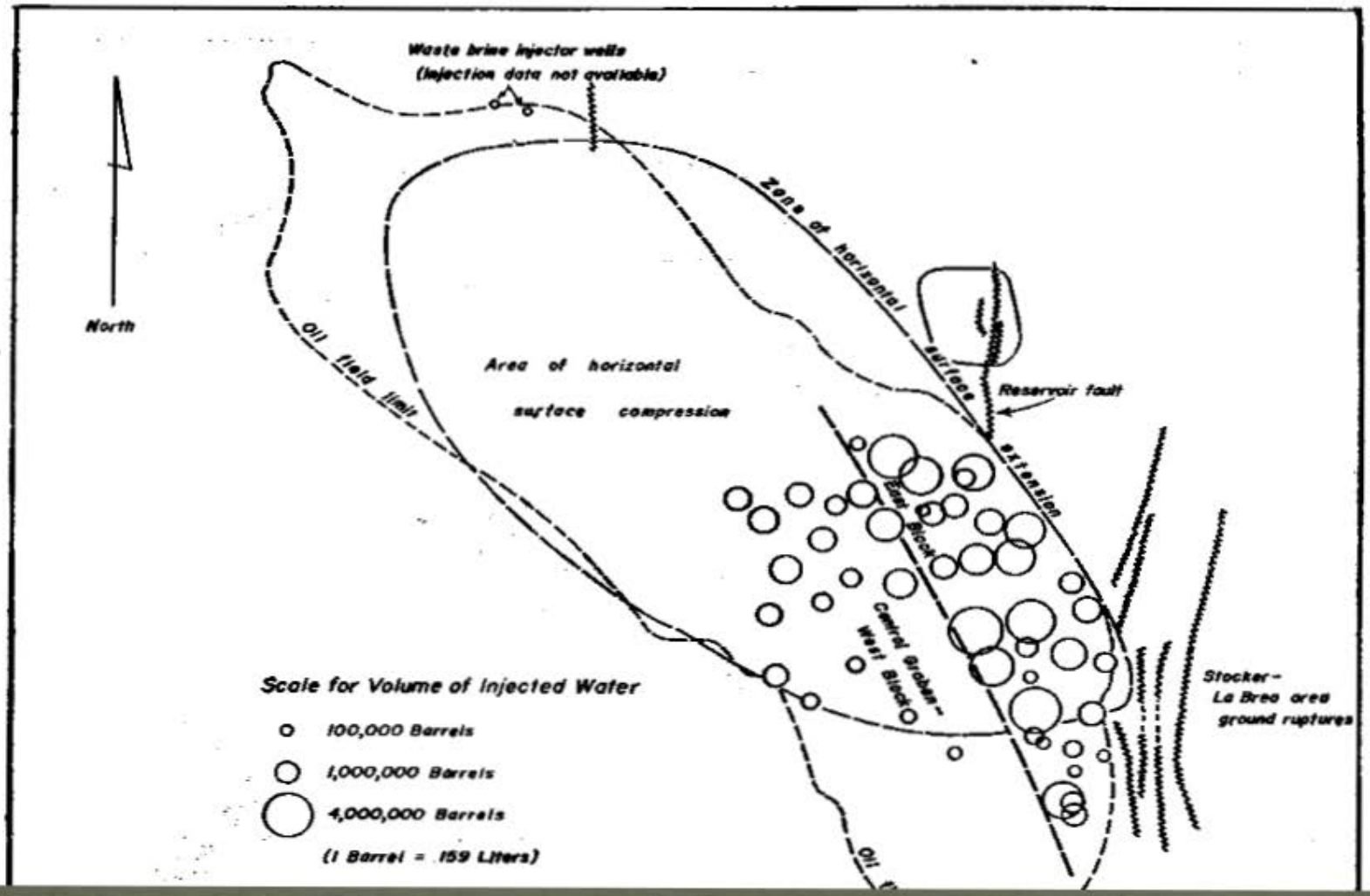
- One of the conferences involved Casegrande himself, who stated that the failure was due to previous settlement of soil due to early movements in Faults I & V causing an unstable formation that continuously deformed during the lifetime of the reservoir. Especially during the compaction phase of the lining.

Post Failure Analysis (cont. 2)

- While many of the engineers believed fault line movement was the cause, others argued that the settling of underlying soil strata due to oil field depletion from the Inglewood Oil Fields was to blame

- These oil fields had been subjected to a process known as hydraulic fracturing for many years, and some engineers believed that the build up of excess gases from the fracturing caused the soil strata to settle leading to the failure and Baldwin Hills.

Post Failure Analysis (cont. 3)



50 Years Later

- The Baldwin Hills Reservoir basin now acts as the Kenneth Hahn Park for the city of Los Angeles, CA.

- To this day there are people who well remember what happened and are able to explain the horrific sight in great detail.

50 Years Later - Reclamation

Conclusion

- What the engineering community took away from this was that one should never build something of great size on an active fault line and next to an active oil field without properly checking underlying soil conditions and tectonic activity first.

- Nowadays, this disaster stands as one of the worst failures in modern day engineering, but the lessons learned at Baldwin Hills have allowed engineers to build some of the most fantastic structures in the world on some of the most treacherous ground possible.

The End

Thank you for your time and attention, if you have any questions please ask them at this time.