The 11th International Symposium on Water Supply Technology

SFPUC Water System Improvements to meet Levels of Service

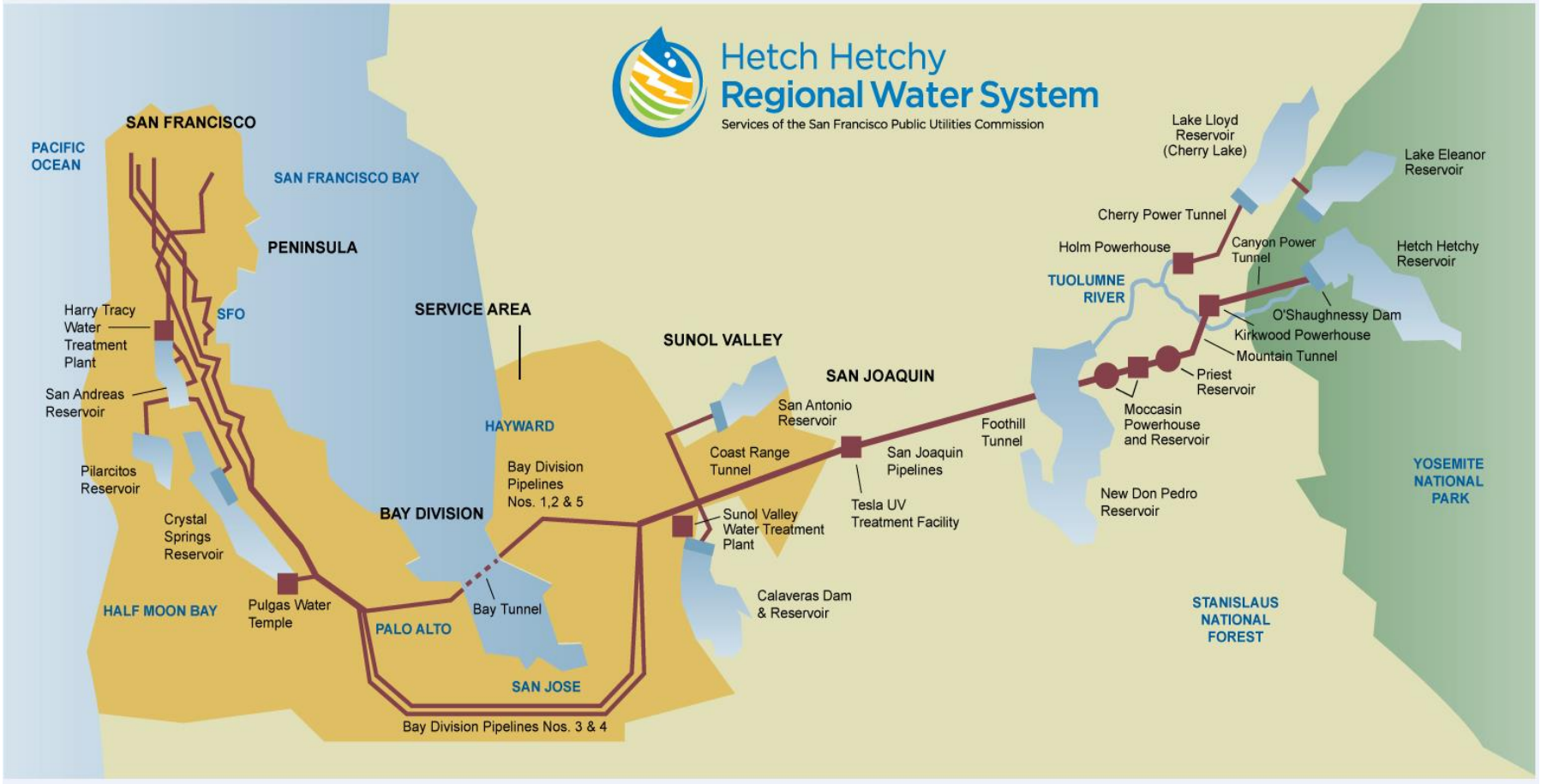
July 10, 2019

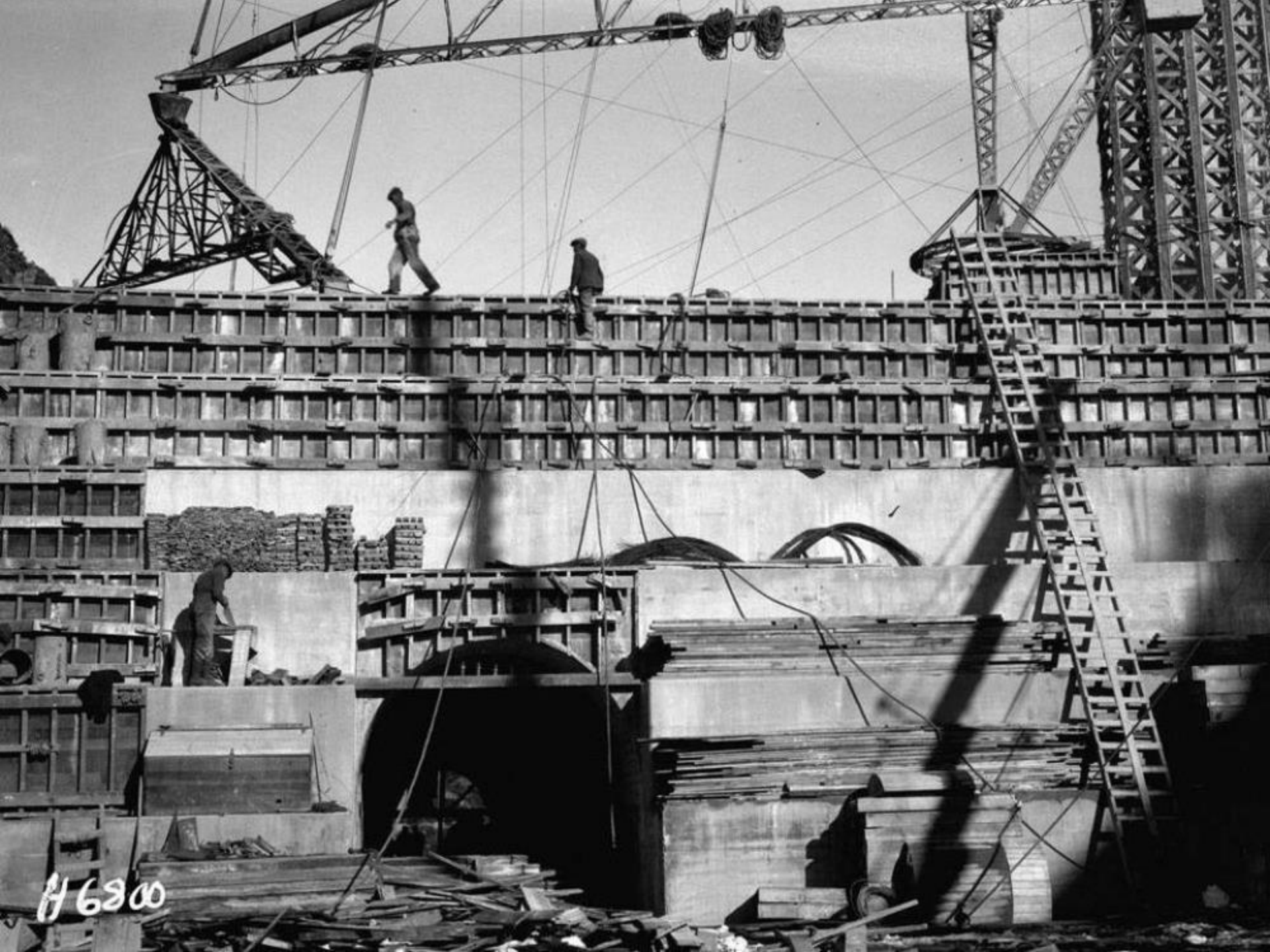
San Francisco Public Utilities Commission (SFPUC)
Sam Young, P.E.

Outline

- SFPUC Water System Overview
- Water System Improvement Program (WSIP)
  - Level of Service Goals
  - Key Projects
- SF Water System Overview
  - Level of Service Goals
  - Pipeline Replacement Program

SFPUC **Water System Overview**

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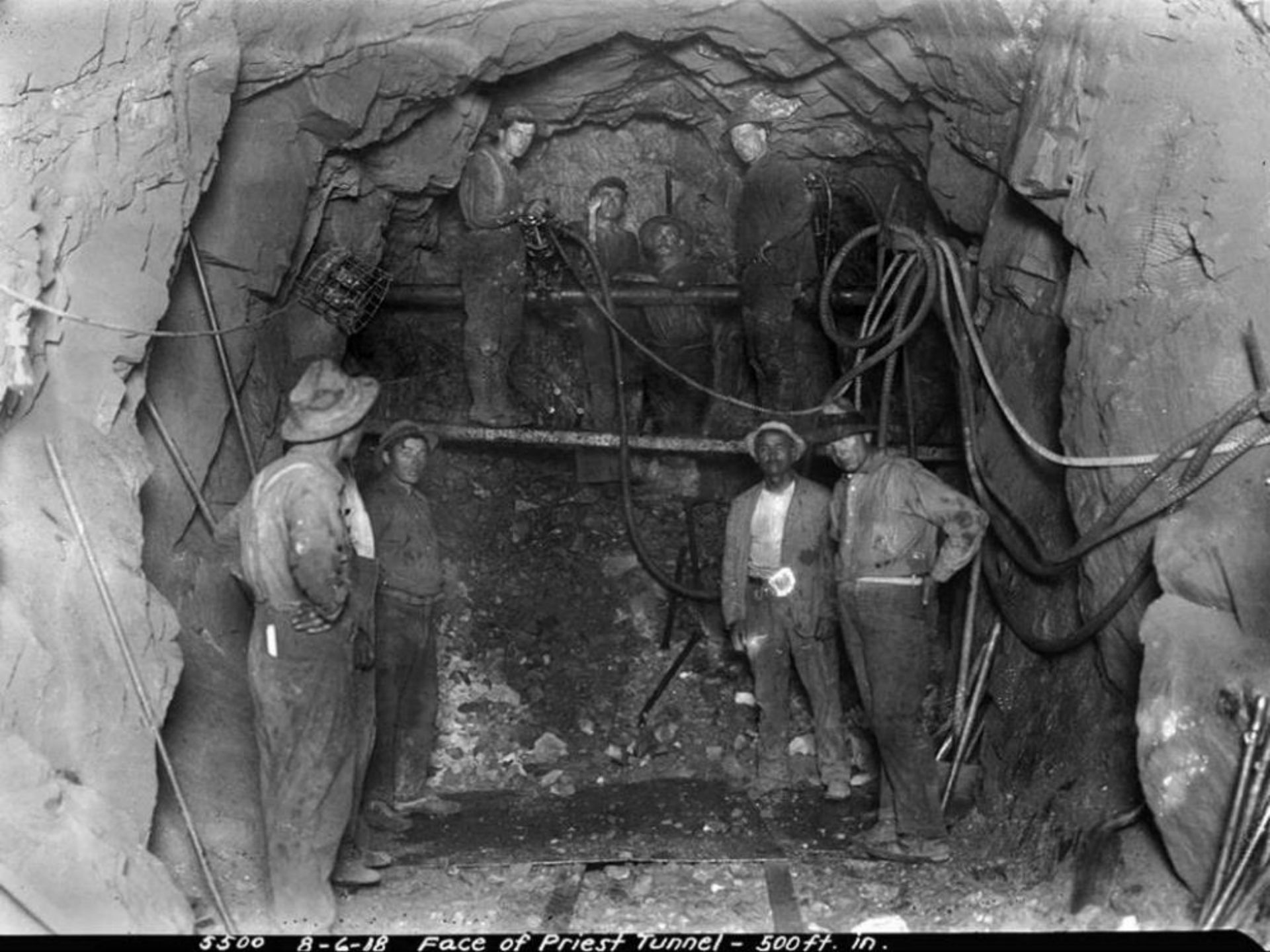
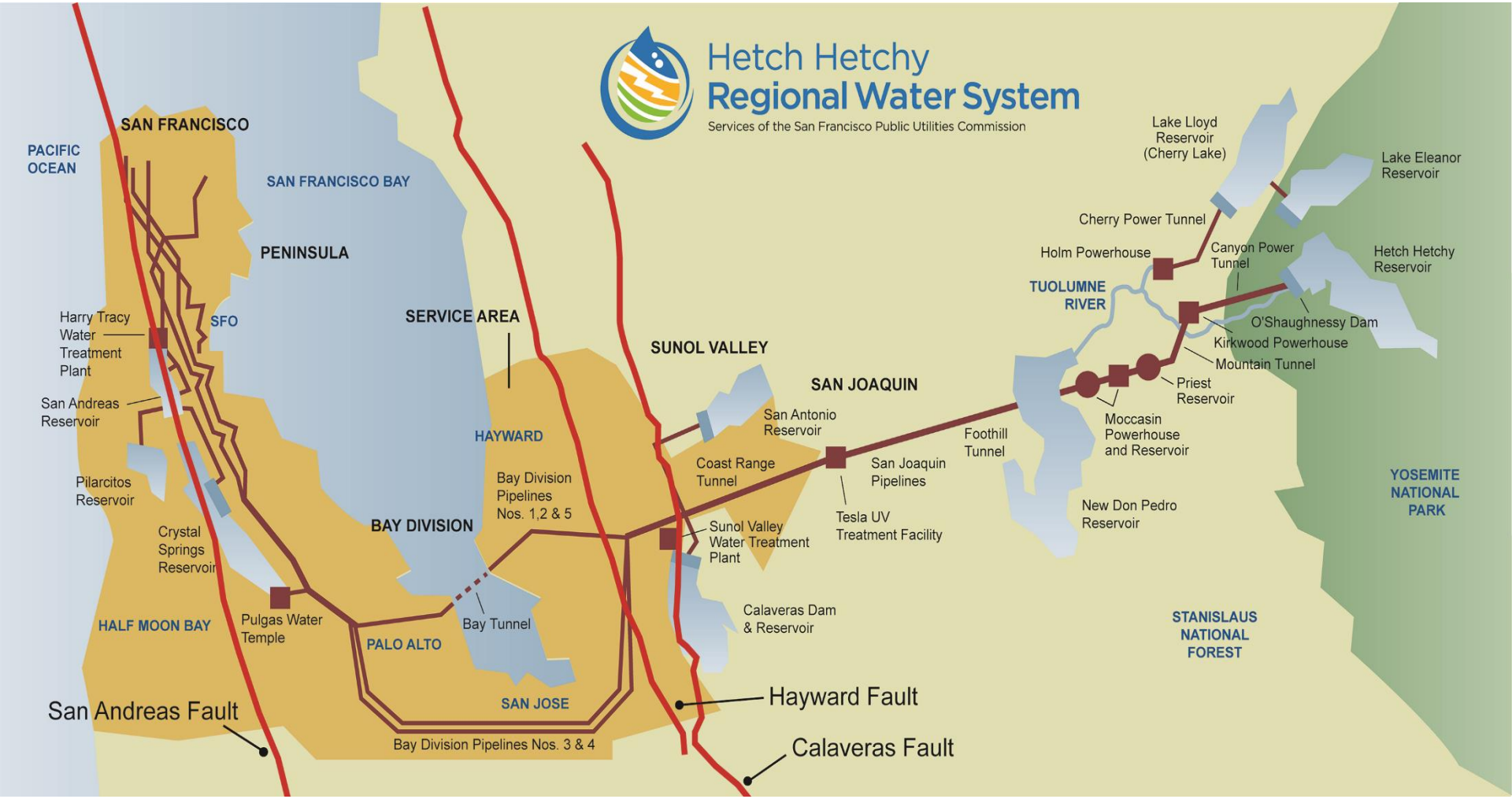


3300 B-6-18 Face of Priest Tunnel - 500ft. in.

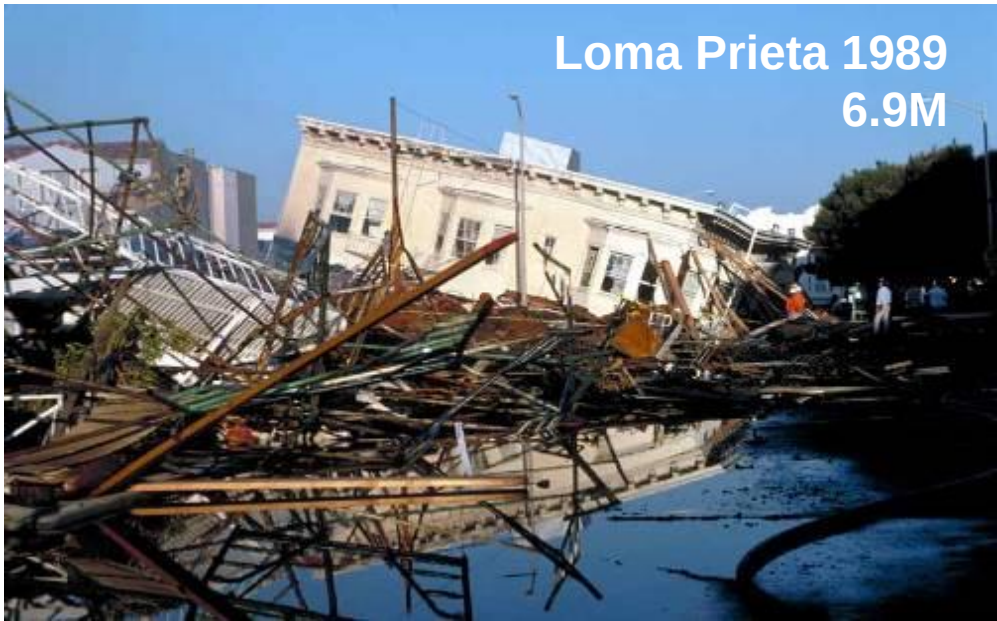
End of Useful Life

LACK OF REDUNDANCY

3 Major Earthquake Faults



It's Not "IF" But "WHEN"



Water System Improvement Program (WSIP)

- Initiated in 2002
- 87 Projects
  - 2 dams
  - 3 tunnels
  - 3 treatment facilities
  - Pipelines, pump stations, reservoirs, tanks, etc.
- 7 Counties
- $4.8 Billion, Bond-Funded
- 2021 Completion

Why Set Level of Service Goals?

- Establish performance standard
- Ensure / improve reliability of the system
- Develop capital improvement program that is tied to performance levels
- Identify deficiencies and cost-effective solutions
- Provide quantifiable basis for capital improvement projects
- Support stakeholder decision-making process

Levels of Service Development

- **Reliability Study Phase I** – Defined system & identified hazards (1995)
- **Reliability Study Phase II** – Quantified hazards and evaluated system response (2000)
- **Reliability Study Phase III** – Reliability and risk analysis (2003)
- **Performance Standards I & II** – Developed alternative performance levels and improvement needs (2004)
- **Water System Improvement Program** – Levels of Service and Program Adoption (2005)

Level of Service Goals

- Seismic Reliability
- Delivery Reliability
- Water Quality
- Water Supply

Seismic Reliability LOS

Reduce vulnerability to earthquakes

- Design improvements to meet current seismic standards.
- After a major San Andreas, Hayward, or Calaveras earthquake:
  - Deliver "basic service" to 3 region service area (SF, East/South Bay, and Peninsula);
  - Basic service is Average Winter Month Usage (229 mgd);
  - Delivery to at least 70 percent of the customer turnouts in each region

Seismic Reliability LOS

- Restore facilities to meet average-day demand (up to 300 mgd) within 30 days after a major earthquake.

Before WSIP: San Andreas 7.9M Event

After WSIP: San Andreas Event Probabilities of Failure

Key Projects

Tesla Treatment Facility

- $114 Million
- 315 mgd capacity
- UV disinfection
- Compliance with latest EPA guidelines
- Design-Build contract

San Francisco Water Power Sewer

Tesla UV Treatment Facility

Tesla UV Treatment Facility

New Irvington Tunnel

- $340 Million Water Transmission Tunnel
- 3.5-mile long, 13.5-ft dia.
- Convention mining with roadheaders and controlled detonation
- Redundancy
- Challenging ground conditions
- Gassy tunnel

Drill and Blast Excavation

Conventional Mining Method

BDPL Reliability Upgrade

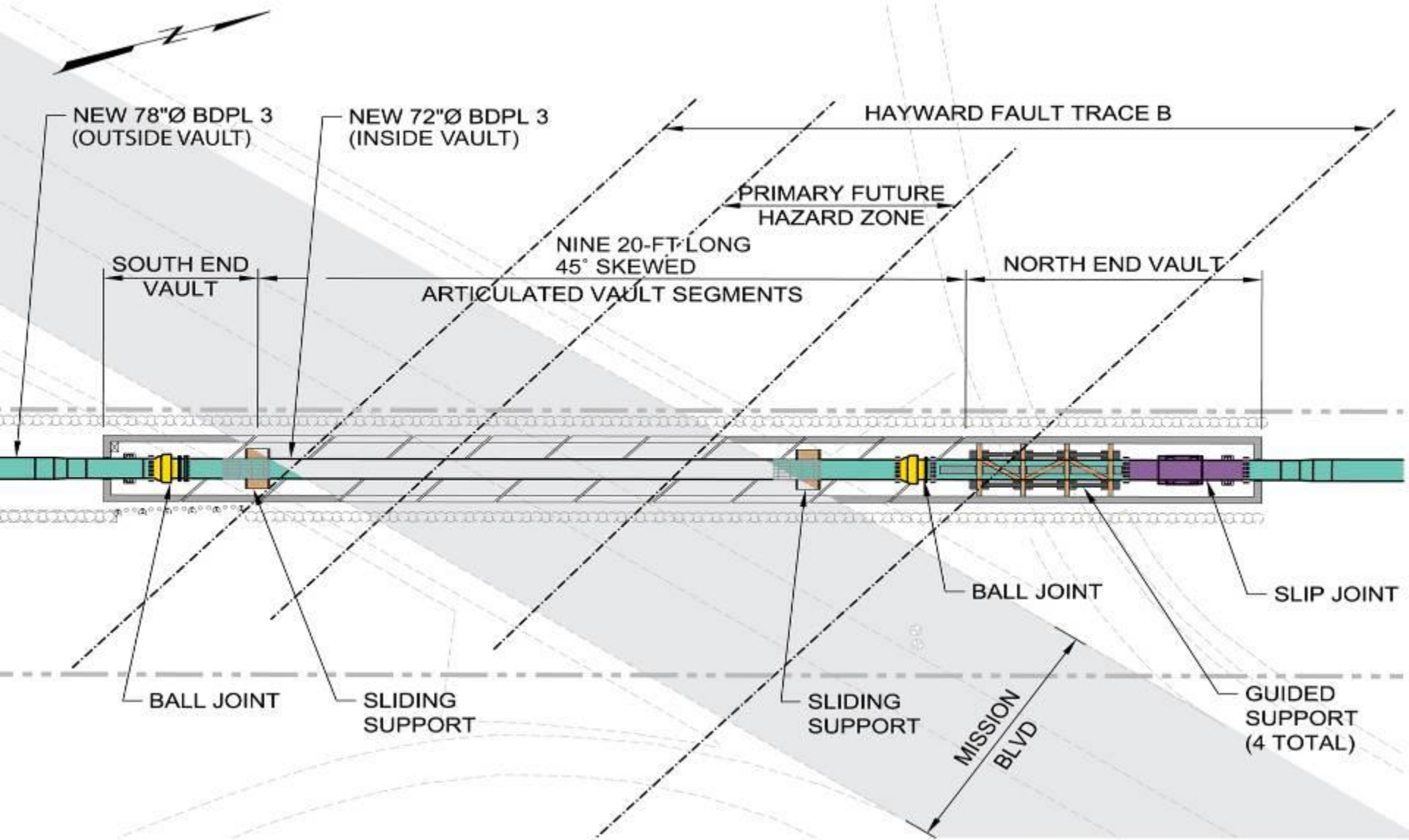
- $347 Million (tunnel)
- $251 Million (pipeline)
- 5 mile tunnel under SF Bay
- 19 mile pipeline in East Bay & Peninsula
- Hayward Fault crossing

Bay Tunnel

TBM at Launch Shaft

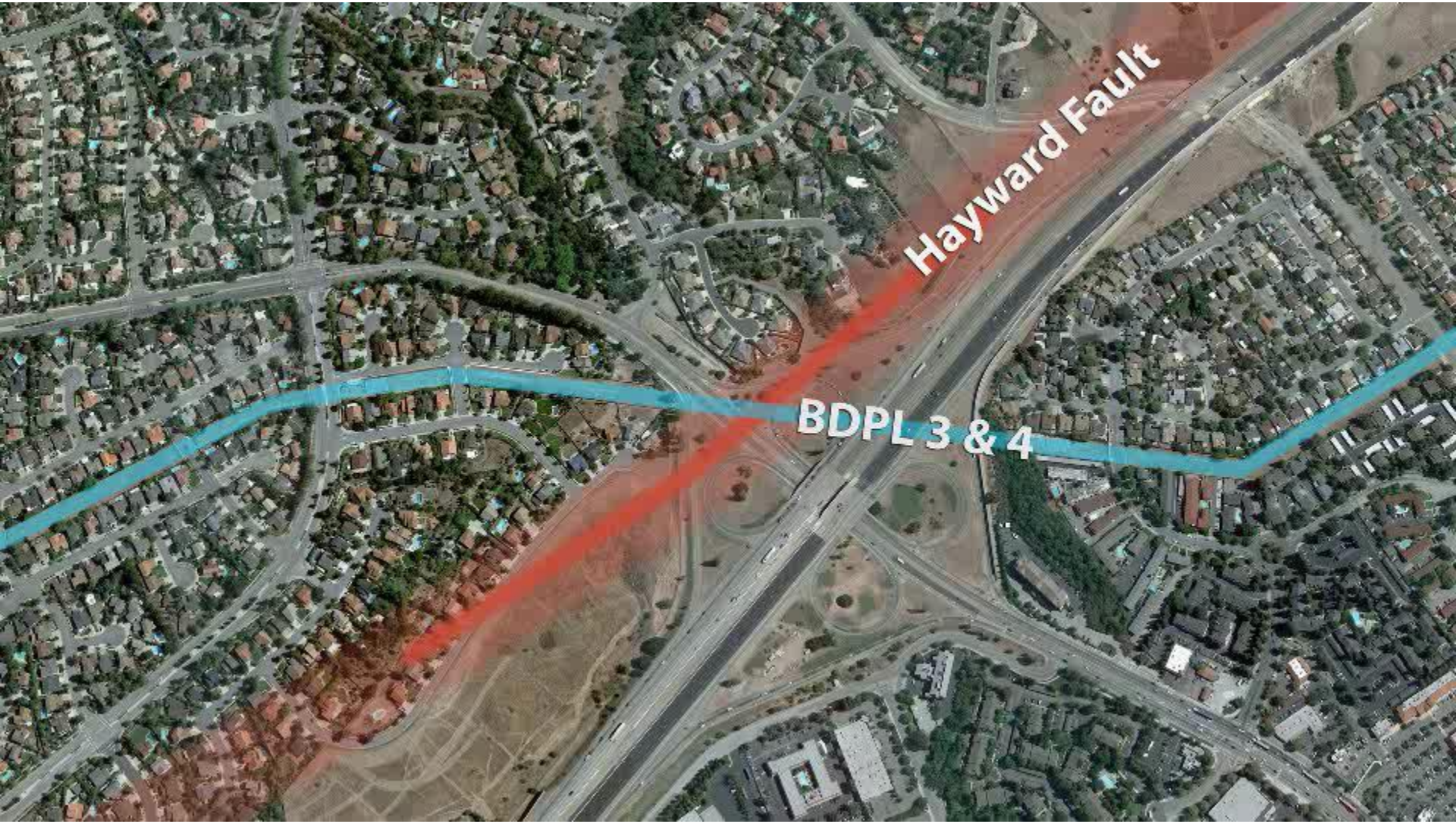
Hayward Fault Crossing

DESIGN CONCEPT AT TRACE B

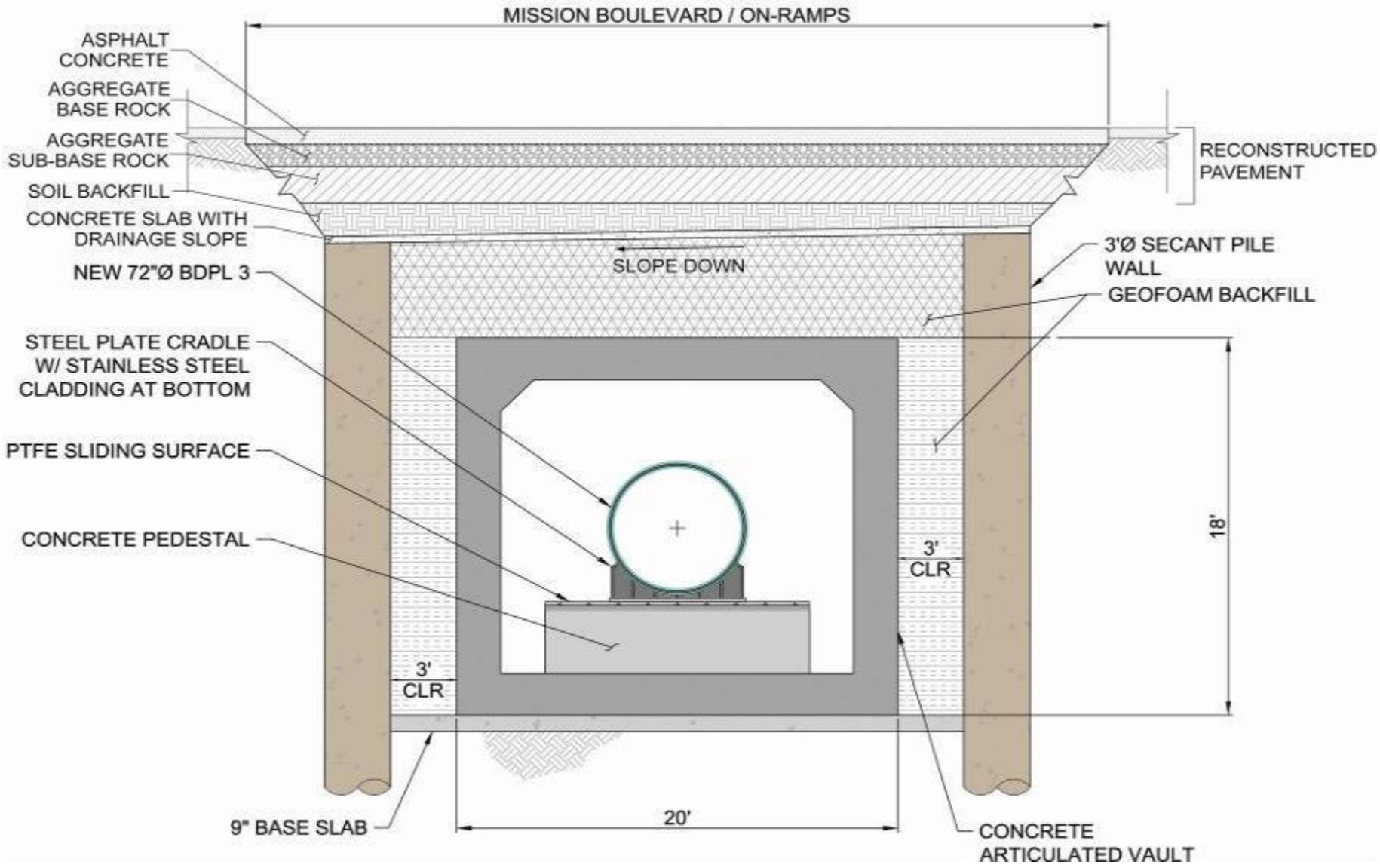


San Francisco Water Power Sewer

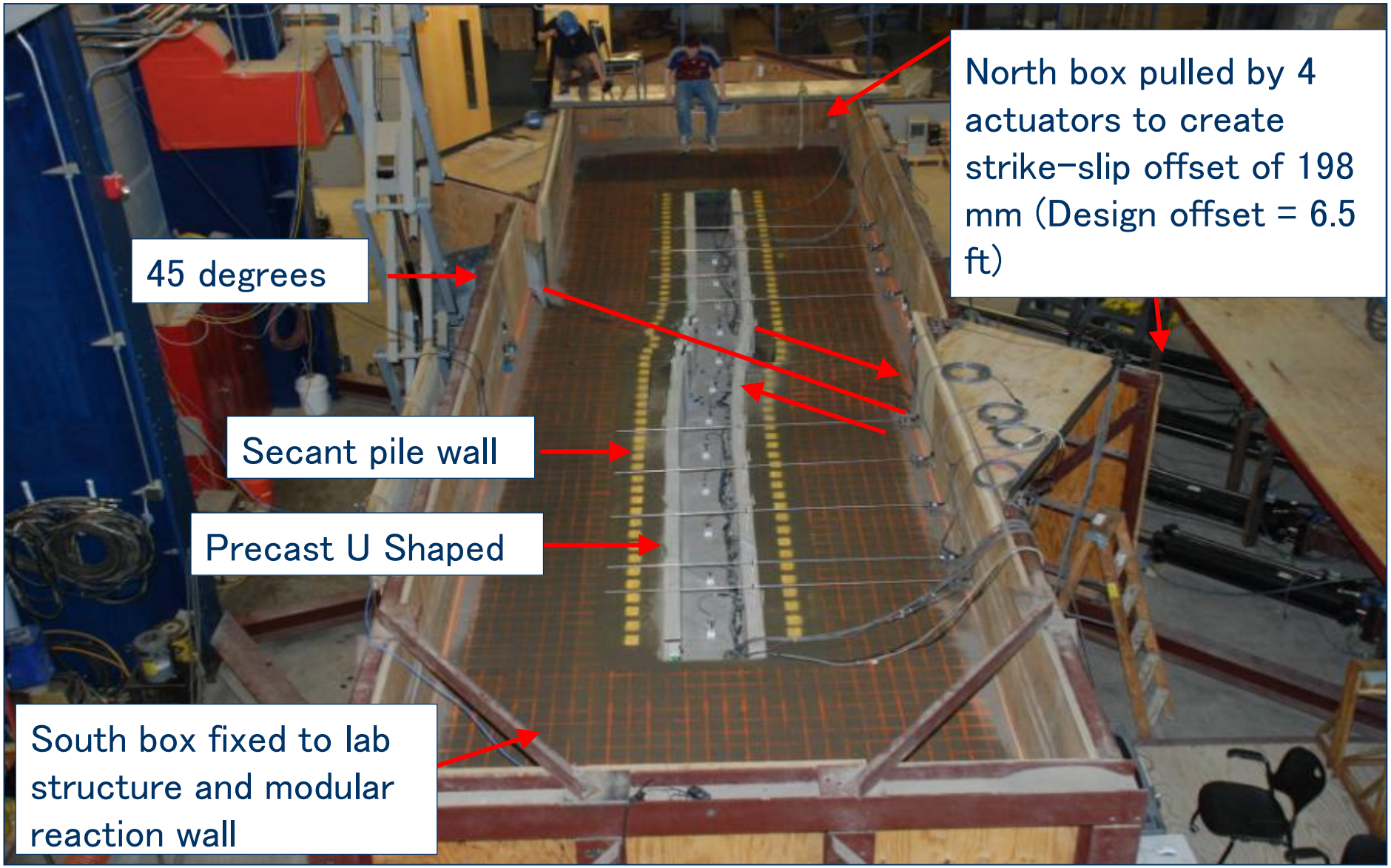
DESIGN CONCEPT ANIMATION



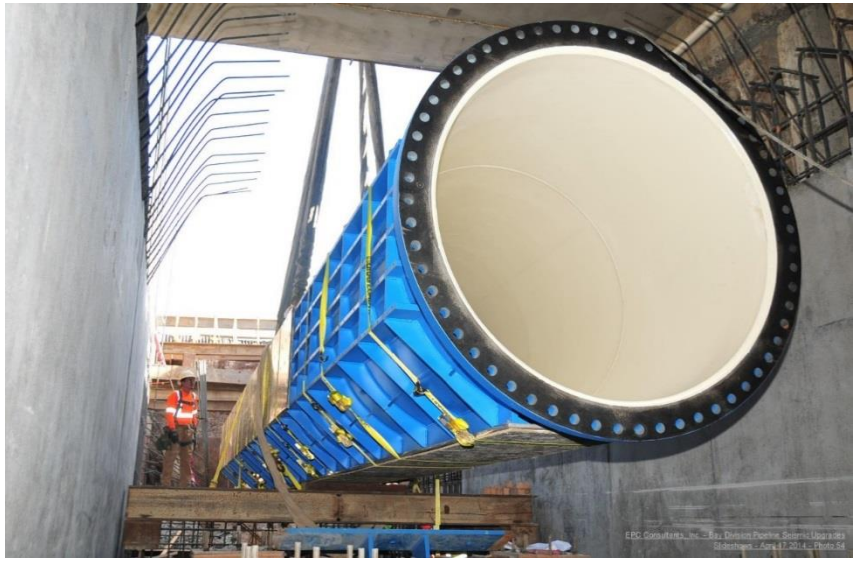
Typical Section At Fault Zone



Test Bed at Cornell University



Ball Joint and Slip Joint Construction



Calaveras Dam Replacement

- $823 Million
- New seismically safe dam
- Restore original storage level (31 Billion gallon)
- Difficult geological conditions
- Environmental challenges

1Y1A7102

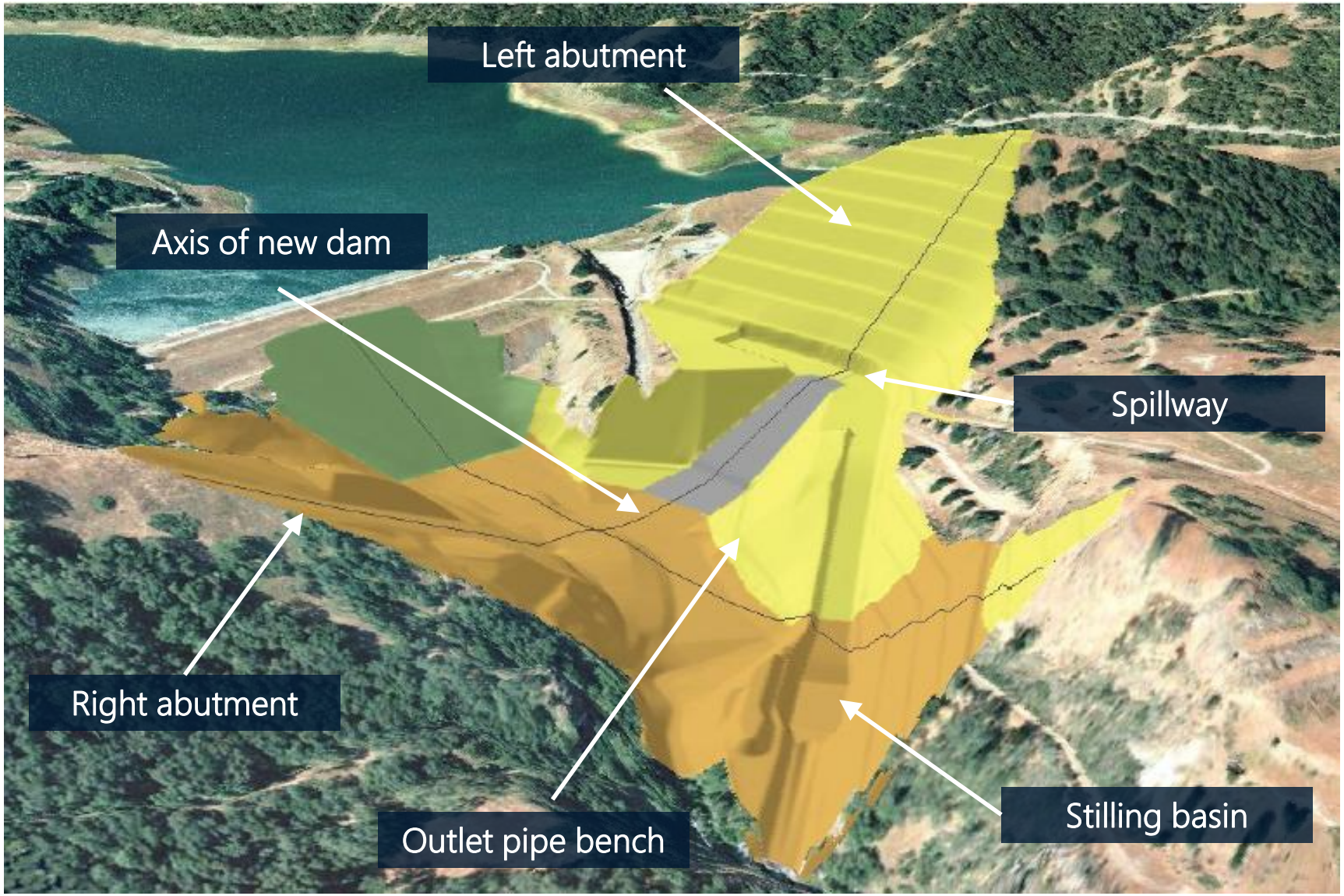
Photo Date: September 21, 2018

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

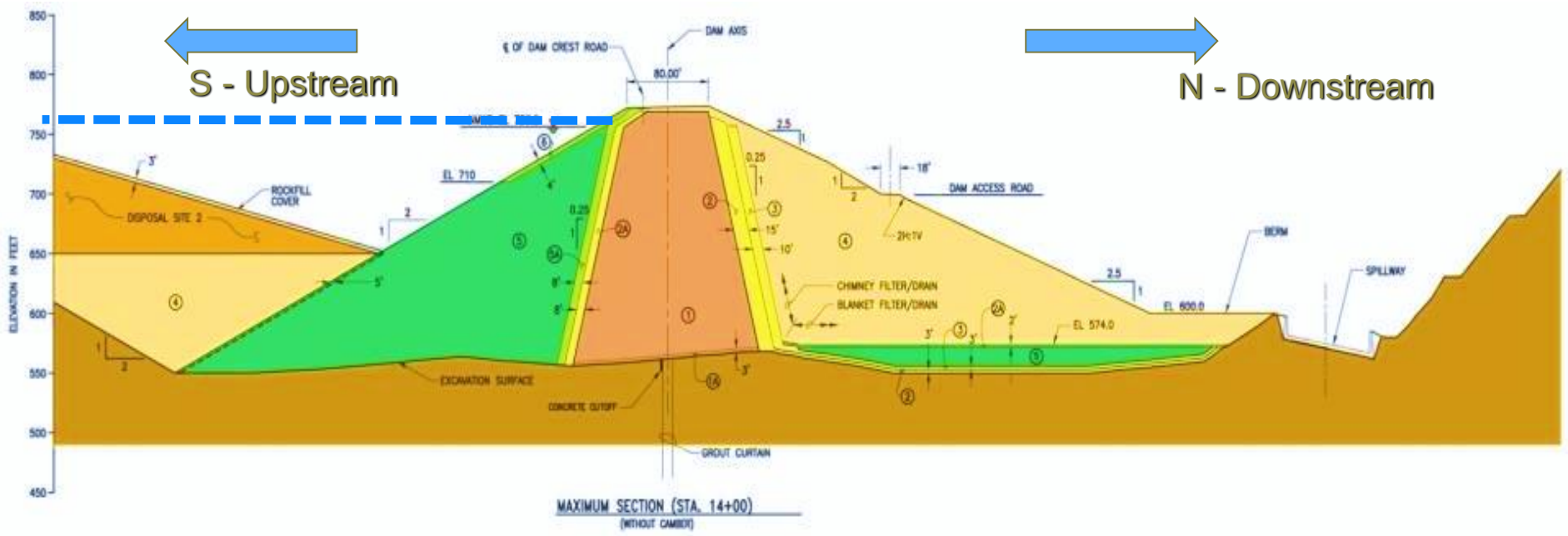
CALAVERAS DAM REPLACEMENT PROJECT
San Francisco Public Utilities Commission

skyhawk PHOTOGRAPHY

Dam and Spillway Excavation



Cross Section of Replacement Dam



- Zoned Earth and Rock-Filled Dam
- 220 feet high & 1200 feet in length
- 80’ Crest and 1,180’ Base

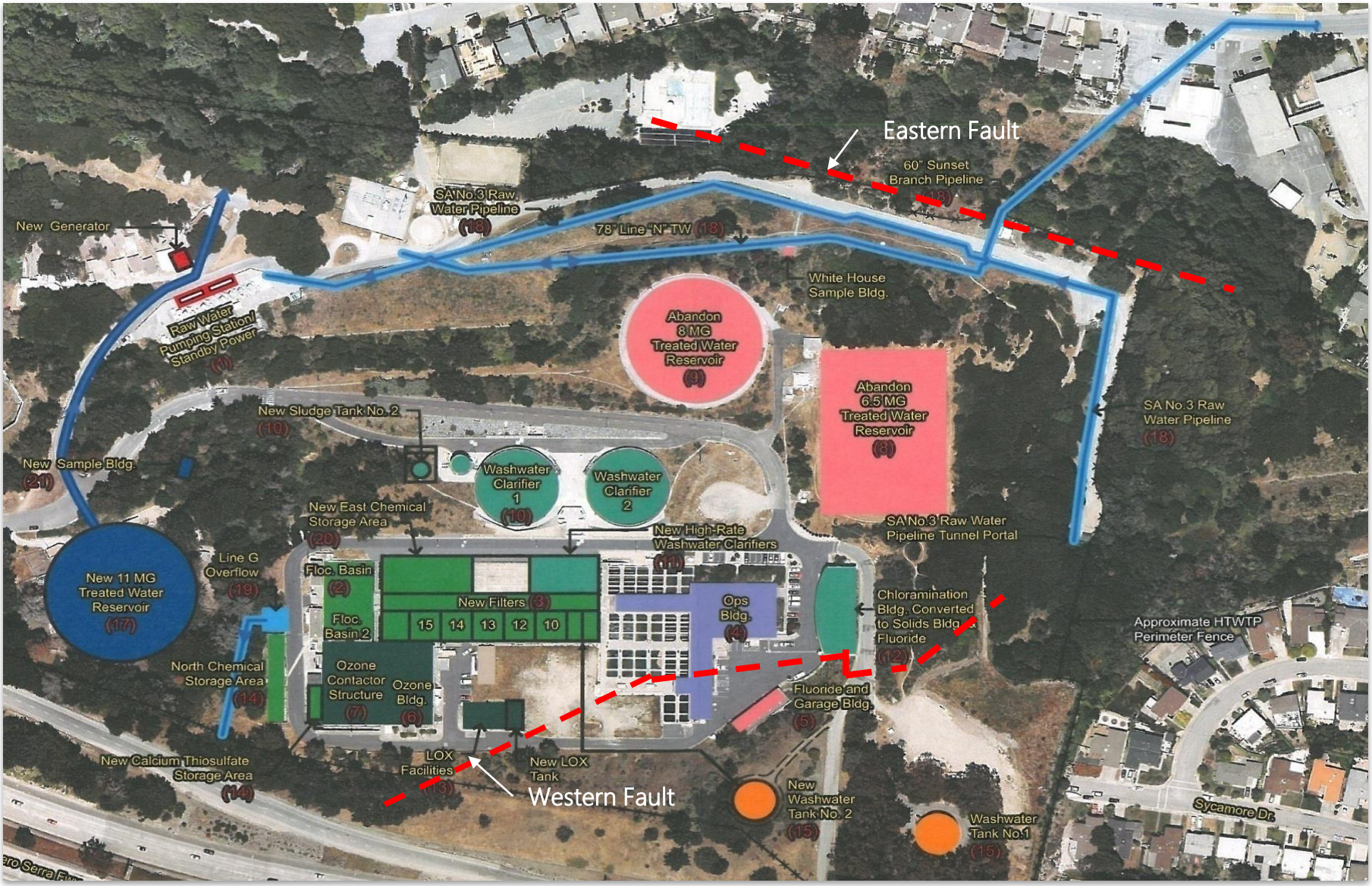
Construction Time Lapse Video

Calaveras Dam 2019

HTWTP Long-Term Improvements

- $359 Million
- 140 mgd capacity
- Seismic retrofit
- Process improvements
- New seismic risks
- Plant challenges
  - San Andreas Fault
  - Raw water quality
  - Site limitations
  - Maintain Operations

Project Components



New Filters

11 MG Treated Water Reservoir

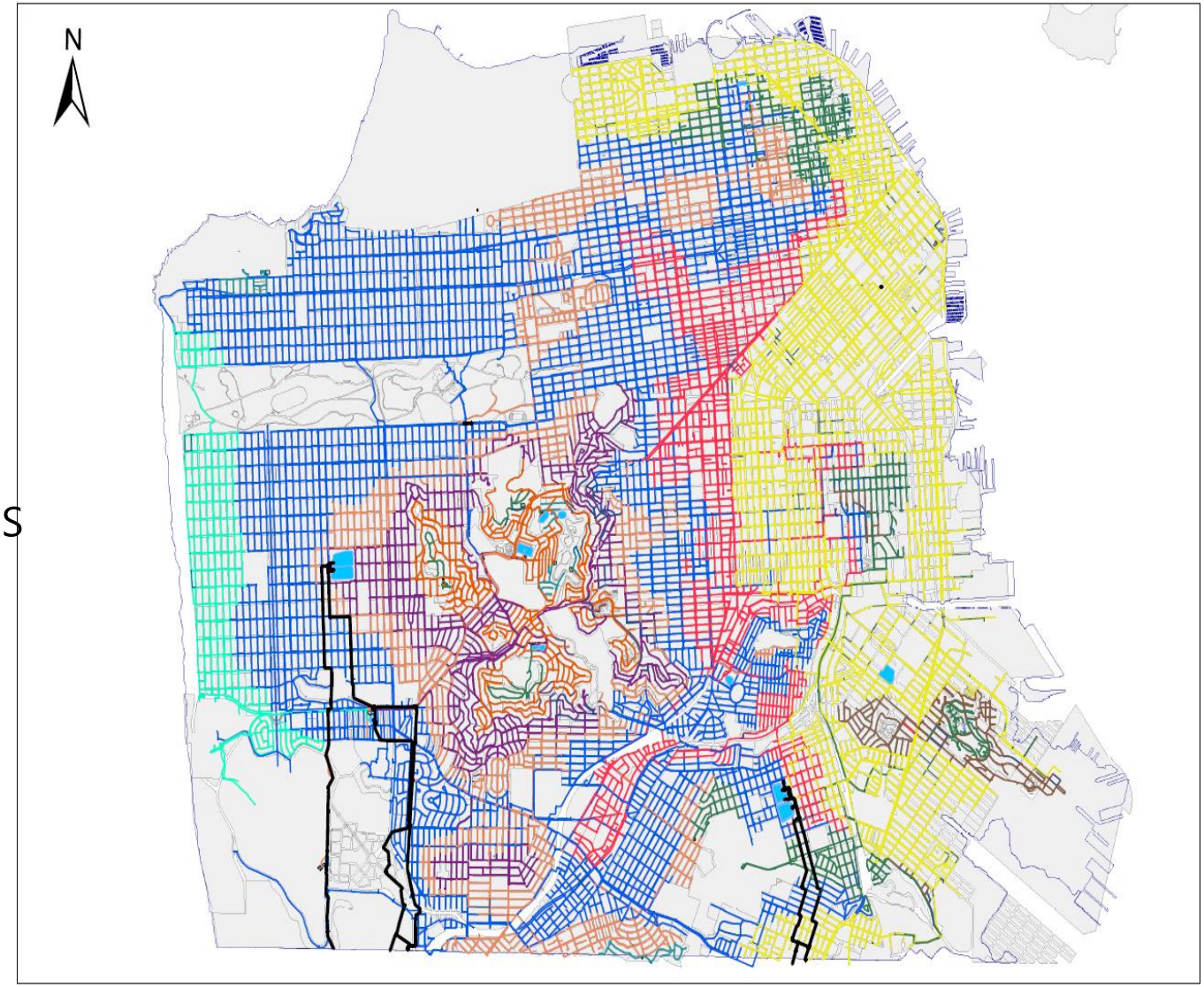
TWR Contactor and Storage Cell

TWR Roof Construction

Completed Site

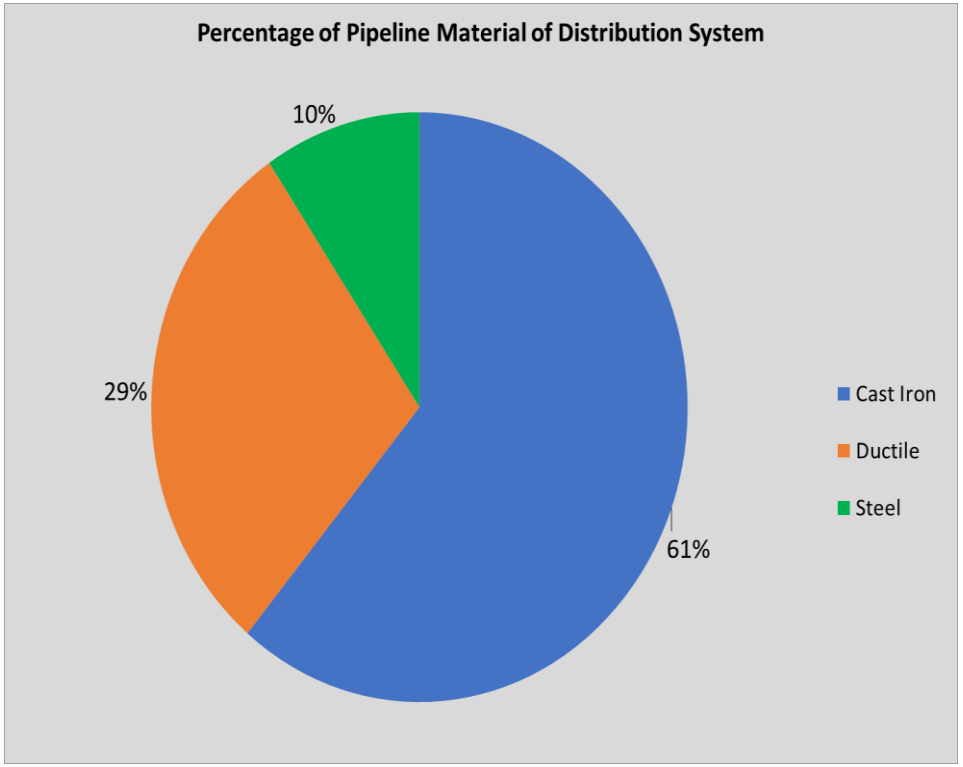
SF Water System Overview

- 5 regional transmission mains
- 1,240 miles of distribution pipeline
- 17 storage tanks and reservoirs
- 10 pump stations
- 24 pressure zones



SF Water Distribution System

- 1,240 miles of pipeline
  - Cast iron
  - Ductile iron
  - Steel
- 220 miles over 100 yrs
- Average age of pipes: 57yrs



WSIP Local Projects

- 27 Seismic Upgrade Projects
- Reservoirs, Pump Stations and Tanks
- Large transmission pipelines and valves

SF Potable Water Seismic LOS

- WSIP LOS provides post-earthquake water to 4 out of 5 locations in San Francisco
- Expand LOS for SF post-earthquake reliability
- SF Seismic Reliability LOS being developed
- "Critical Network" to be determined
- Earthquake Resistant Ductile Iron Pipe (ERDIP)

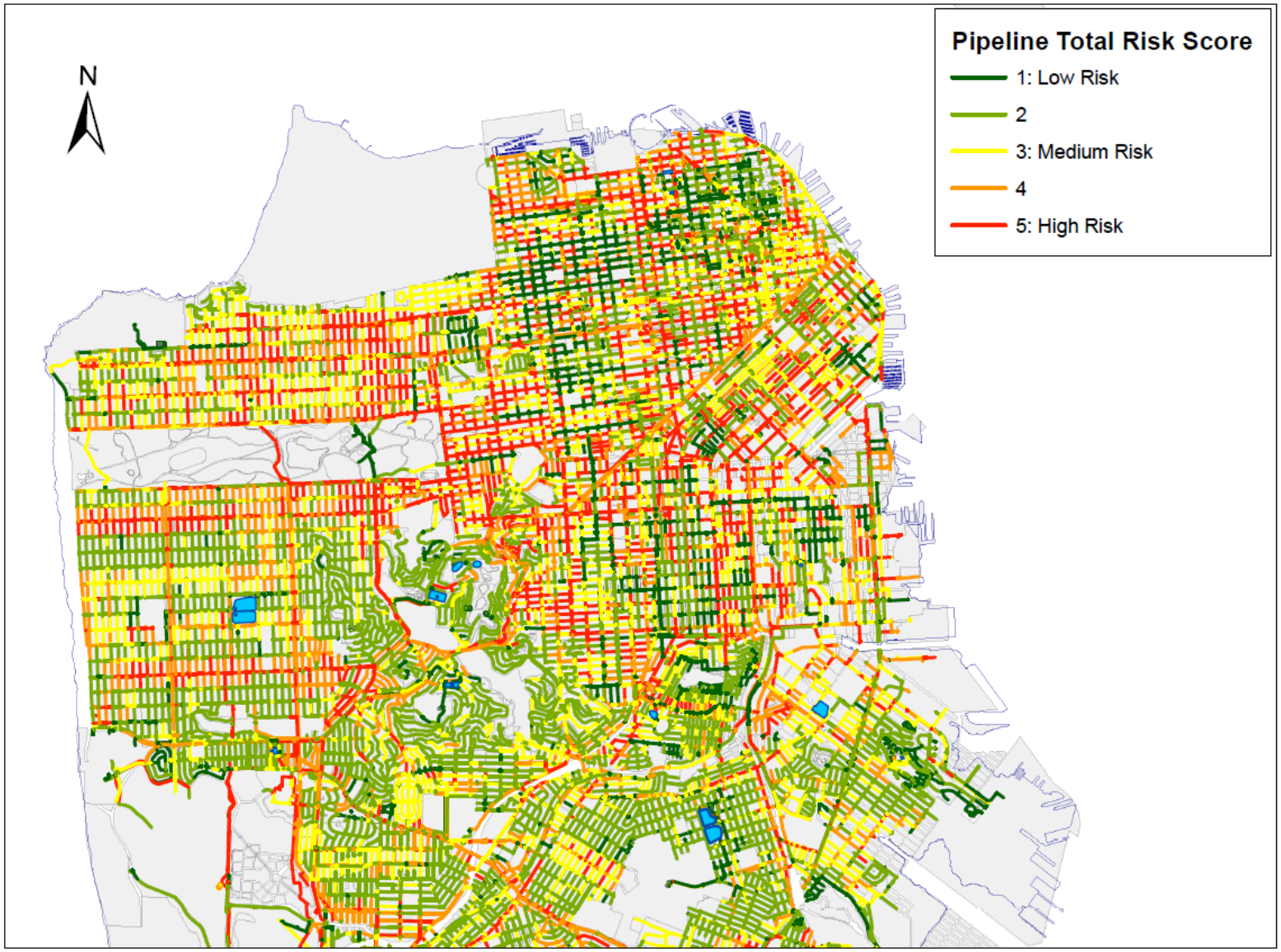
SF Potable Water Seismic LOS

- Storage: 2 days average day demand + 2 hours of fire suppression each pressure zone
- Water Supply Restoration
  - 24 hours - limited services to Critical Care Facilities
  - 72 hours - limited secondary distribution system pressurized
  - 7 days - limited transmission and distribution mains restored to potable service.
  - 90 days - secondary distribution system restored to potable service.

Pipeline Replacement Program

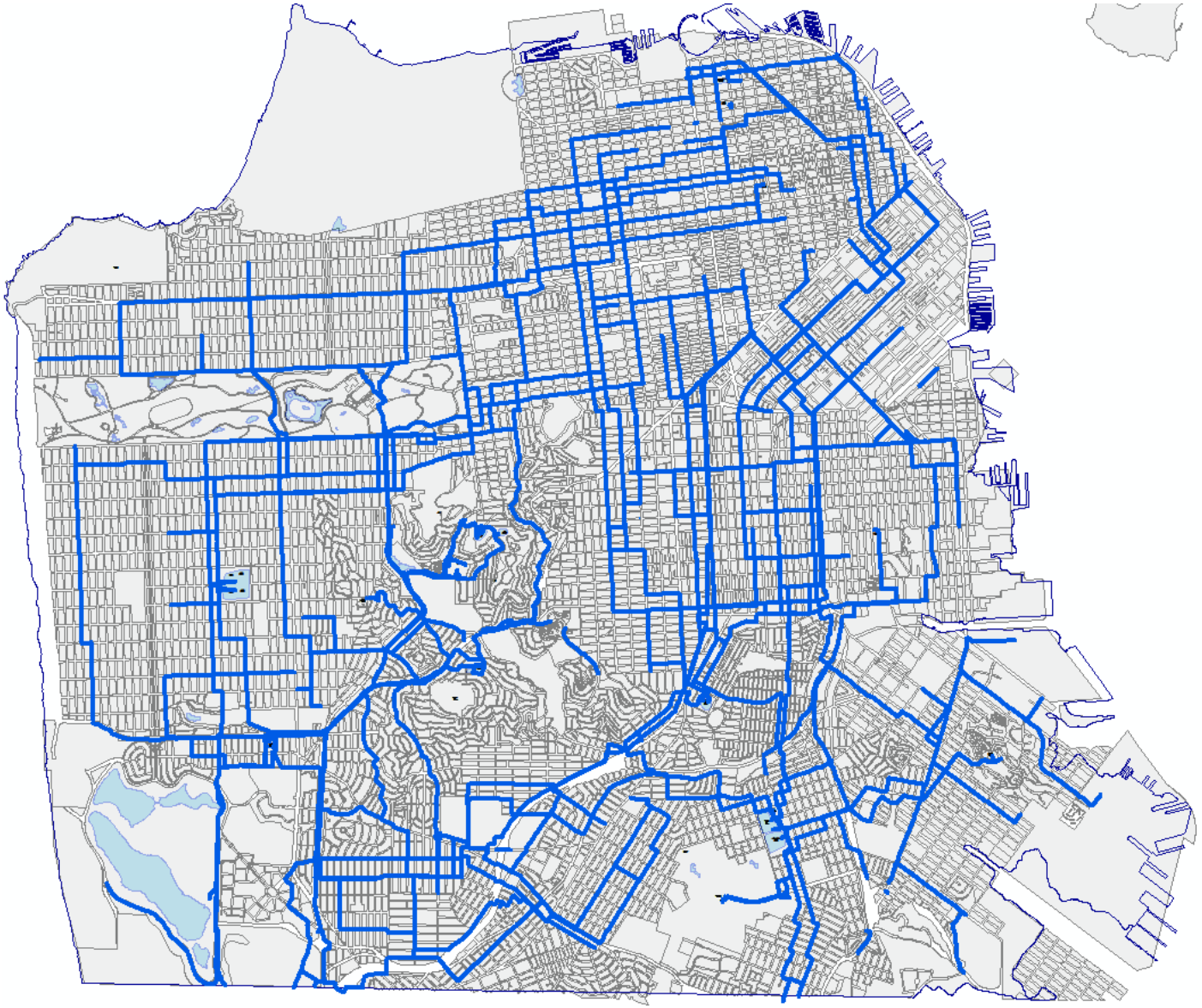
- Reliability Analysis (2011)
- Total Risk Scores for all pipes
- 320 miles identified for priority replacement
- Replacement goal: 15 miles/year
- $55M Annual Budget

320 Miles of **Priority Pipeline**



San Francisco Water Power Sewer

Seismic Backbone System



Summary

- LOS need to be matched to customer/stakeholder expectations, funding/resources, & delivery schedules.
- Consistent LOS help control project scopes and budgets, and assist in recovery planning.
- Resources/facilities needed to achieve and maintain LOS should be carefully predicted through iterative planning and modeling, and extensive stakeholder involvement.

Questions?

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