Los Angeles Department of Water & Power

GEO-INFORMATION FOR IMPROVED INFRASTRUCTURE DECISIONS IN THE LADWP WATER SYSTEM

www.ladwp.com

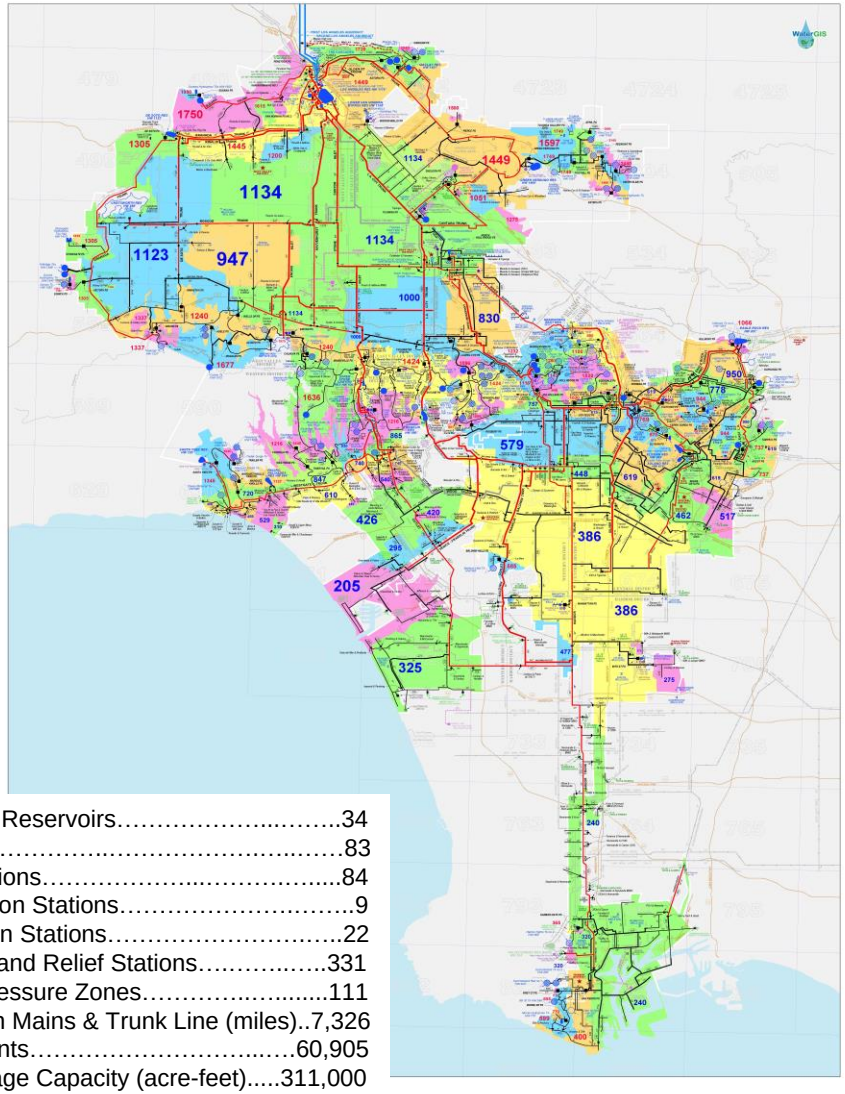
PROFESSIONAL BACKGROUND

- California-Licensed Civil Engineer
- Bachelor of Science from Ohio State University
- Former Naval Reserve Civil Engineer Corps Officer
- 29 years at LADWP
- Former Director of Water Quality Division
- Current Director of Water Engineering & Technical Services Division

Water Engineering & Technical Services

LADWP WATER SYSTEM

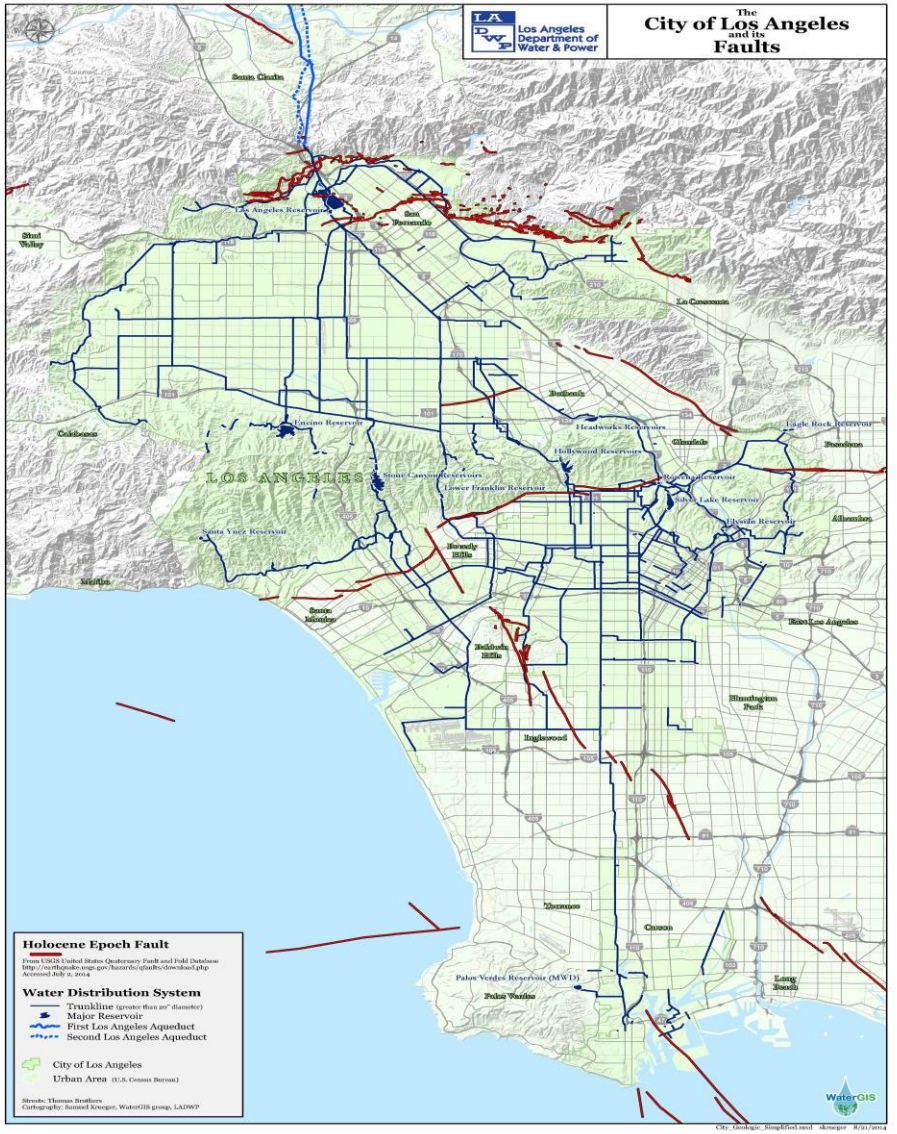
- Founded in 1902
- Serves 4 million people
  - Within 472 square miles
  - 170 billion gallons annually



Dams and Reservoirs	34
Tanks	83
Pump Stations	84
Ammoniation Stations	9
Chlorination Stations	22
Regulator and Relief Stations	331
System Pressure Zones	111
Distribution Mains & Trunk Line (miles)	7,326
Fire Hydrants	60,905
Total Storage Capacity (acre-feet)	311,000

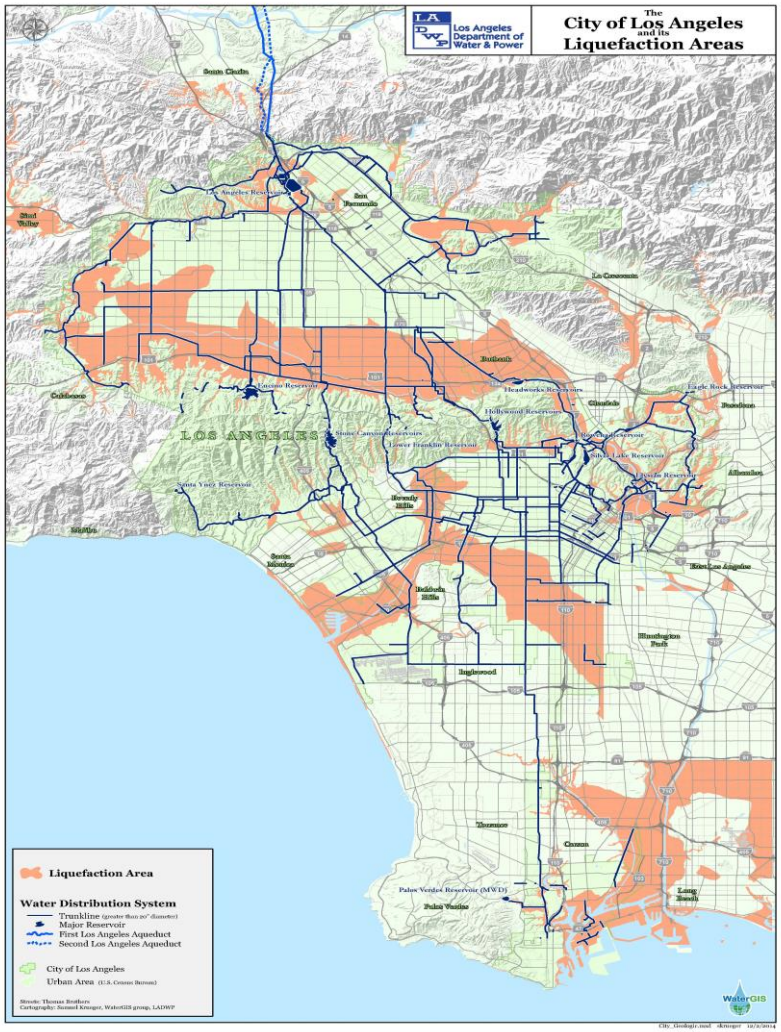
GEO-HAZARDS TO WATER SYSTEM

LAA CROSSING SAN ANDREAS FAULT

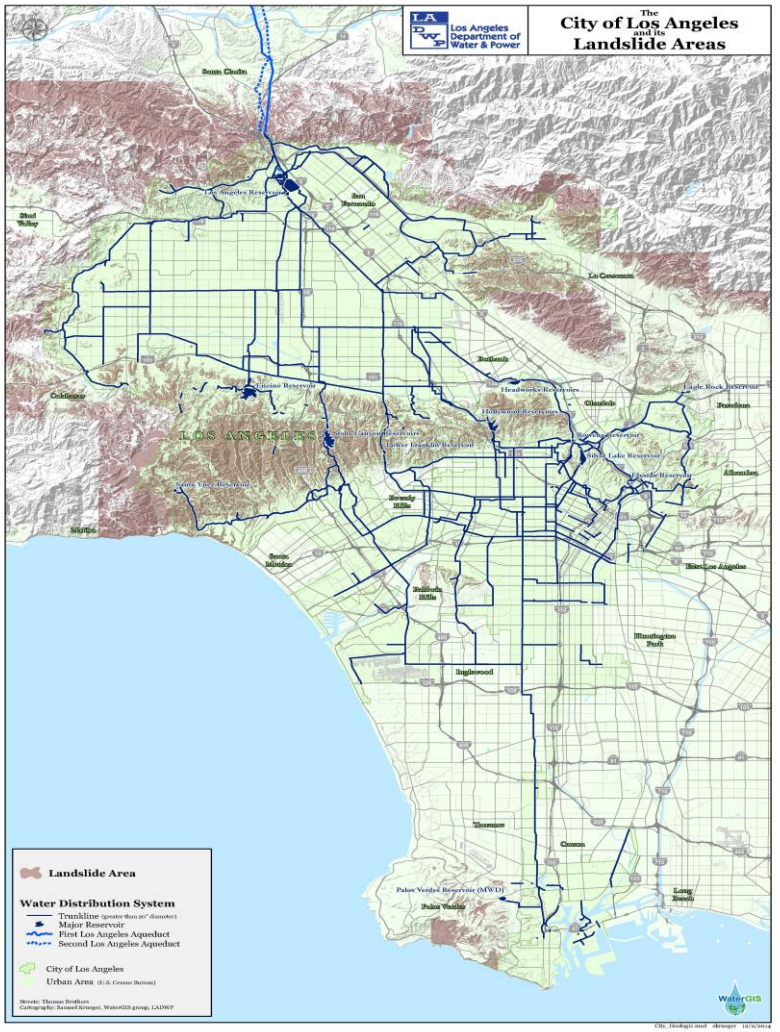


FAULTS WITHIN THE CITY OF LA DISTRIBUTION AREAS

GEO-HAZARDS TO WATER SYSTEM



LIQUEFACTION ZONES



LANDSLIDES

COMMUNICATION METHODS FOR GEO-INFORMATION AT LADWP

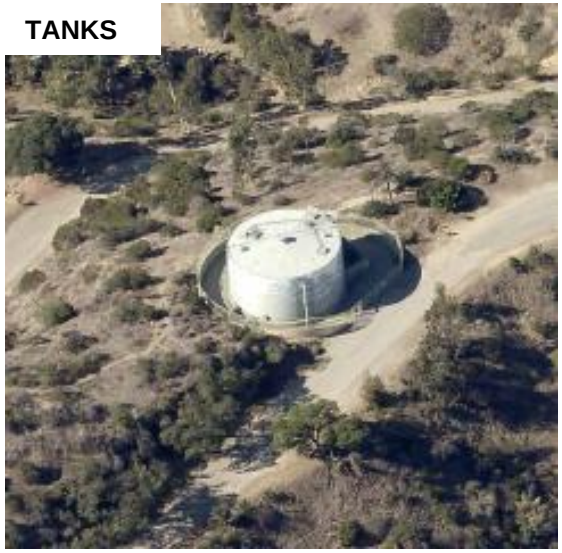
Technical Reports	WETS Leadership Meetings	CIP Quarterly Review Meetings
Emergency Response Plans and Emergency Action Plans	DSOD Review and Evaluation of Performance Reports	Monthly and Annual Inspections
Board of Consultants	Project Gate and User Review Meetings	Legal Claims and Forensics

WHERE GEO-INFORMATION IS USED FOR DECISION MAKING

TYPE AND SIZE OF INFRASTRUCTURE

DAMS AND RESERVOIRS

TANKS

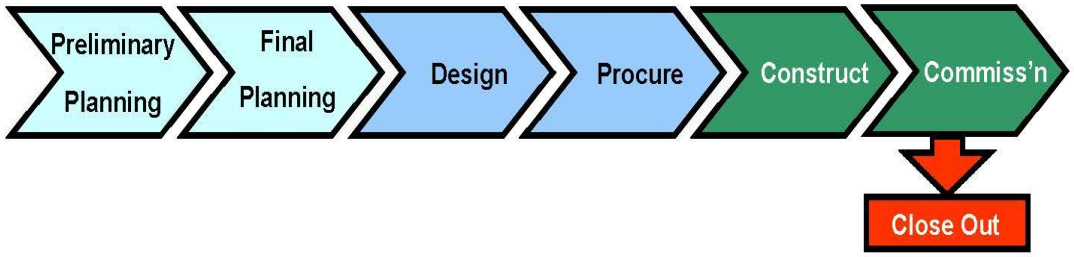


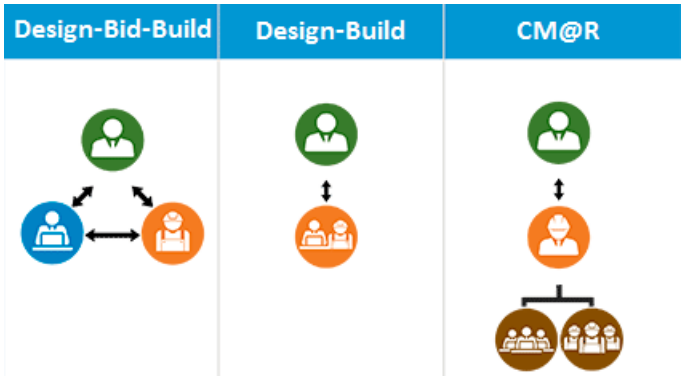
PIPELINES

PUMP STATIONS

- Use of existing geotechnical and geologic information
- Need for additional geotechnical and geologic information

PROJECT DELIVERY PROCESS AND METHODS





- Geo-information obtained during:
  - Preliminary Planning
  - Final Planning
  - Design
- Geo-information for different types of contracts:
  - Design-Bid-Build
  - Design-Build
  - CMAR
  - LADWP Forces

DESIGN

- Geo-information for Dam Design
  - Field investigations
  - Fault study
  - Analysis
  - Recommendations
  - Collaborations

North Haiwee Dam No. 2 Project

Fault Study

Field Investigation

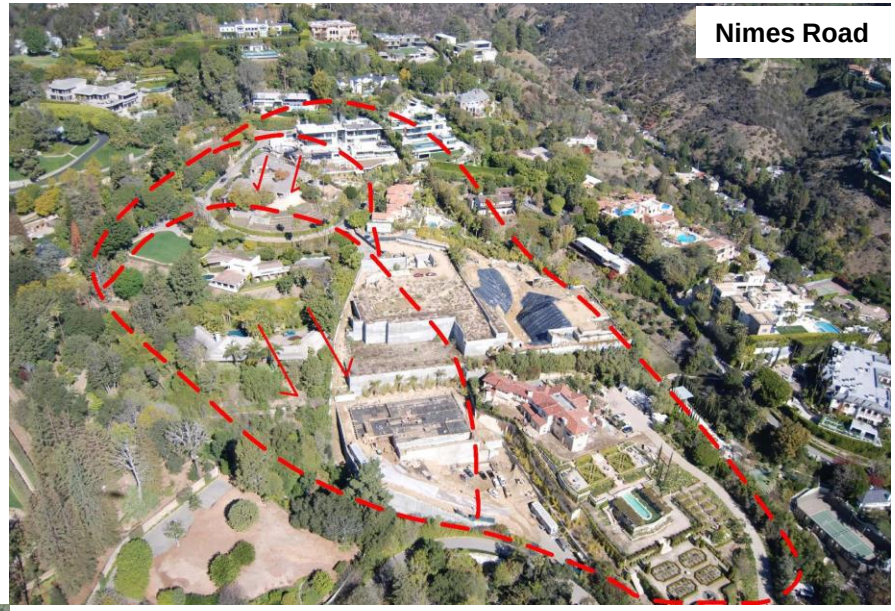
Ground Improvement - CDSM

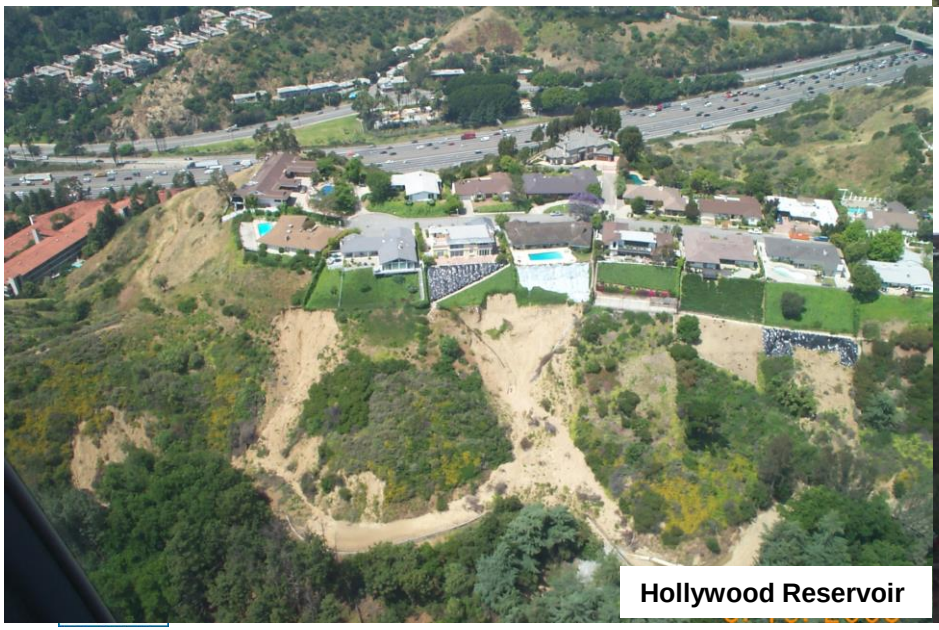
CONSTRUCTION

- Geo-information for Construction Excavations
  - Shoring design
  - Groundwater
  - Dewatering

LANDSLIDES

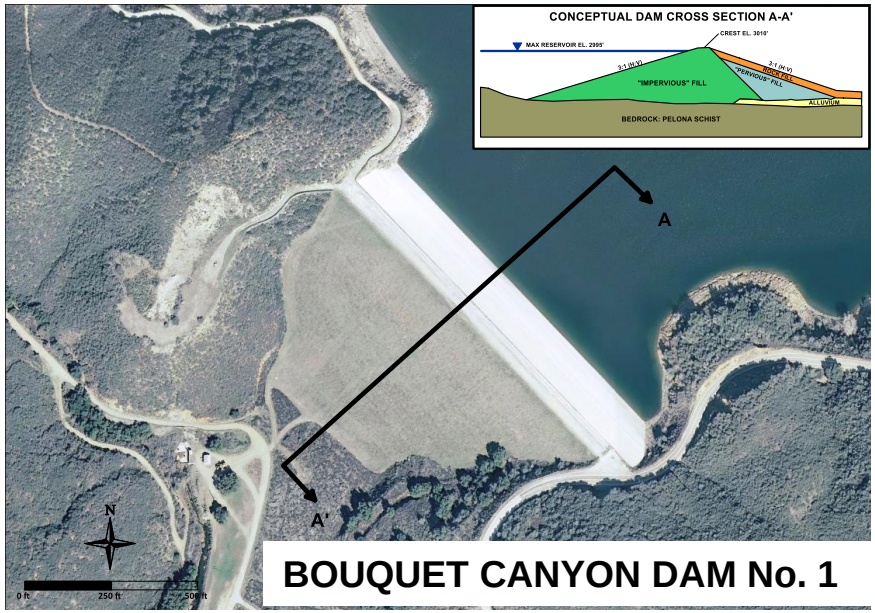
- Nimes Road - Bel Air Estates (2005)
- Hollywood Reservoir (2005)


Nimes Road


Hollywood Reservoir


Hollywood Reservoir

DAM STABILITY



BOUQUET CANYON DAM No. 1

Bouquet Canyon Dam and Reservoir:

- Largest storage south of San Andreas Fault
- Seismic stability concerns
- Remediation vs. Additional evaluations/analysis
- Additional effort on Fault characterization
- Additional geo-information resulted in significant scope reduction

EMERGENCY RESPONSE

Sinkhole In Dam Embankment:

- Earth Embankment
- Downstream Hazards

South Haiwee Dam Sinkhole

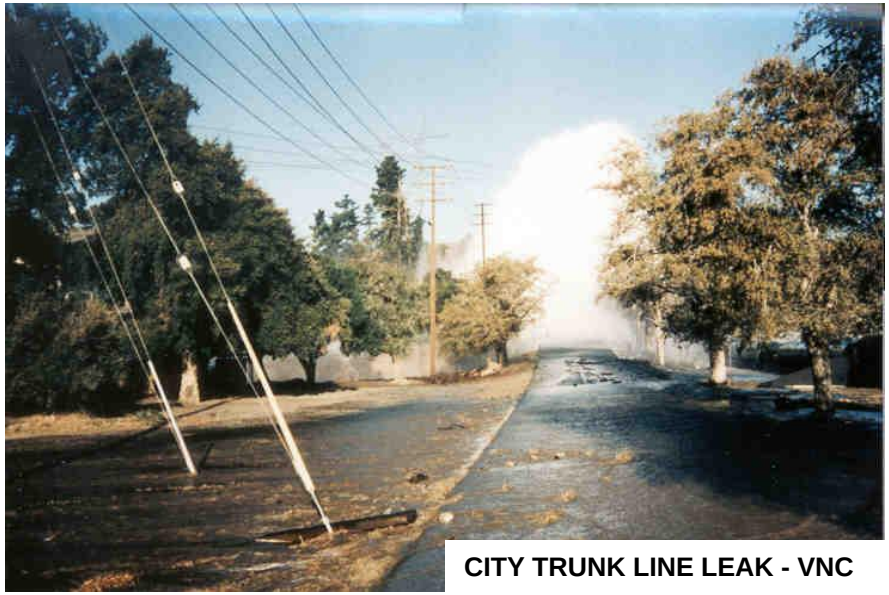
South Haiwee Dam

EMERGENCY RESPONSE

1994 Northridge Earthquake

- Operations
- Supply

GRANADA TRUNK LINE
AT BALBOA BLVD.



CITY TRUNK LINE LEAK - VNC

GRANADA TRUNK LINE FAILURE

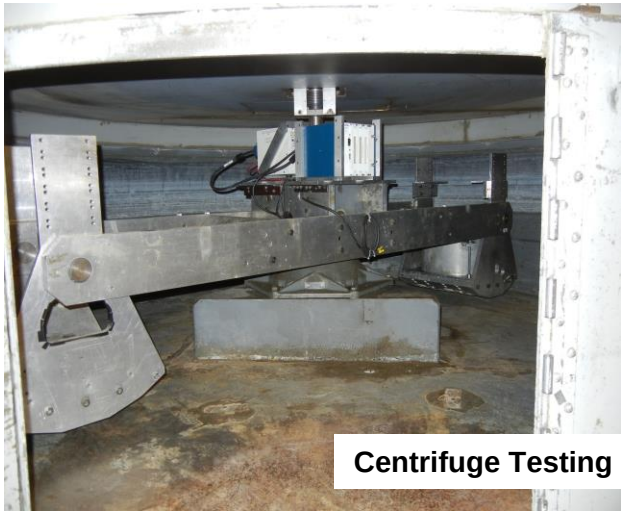
IMPACTS TO GEO-INFORMATION DUE TO CLIMATE CHANGE

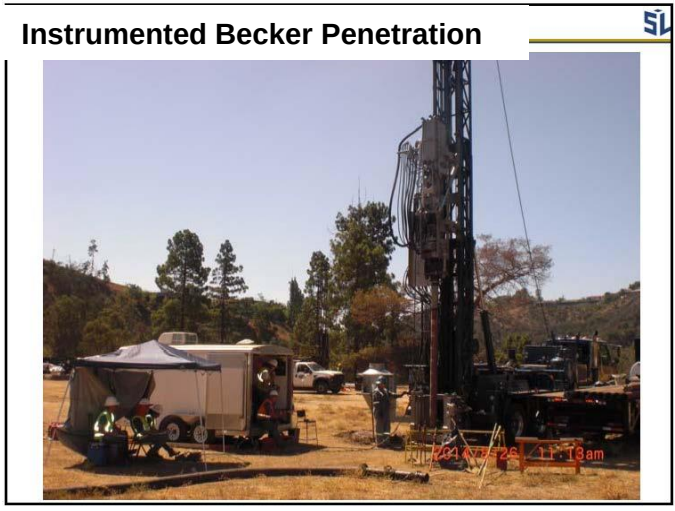
- Climate Change Study Eastern Sierras
  - Reduction in annual runoff
  - Groundwater management
  - Environmental Concerns
    - Owens Lake Dust Mitigation
  - Operational changes
    - Water quality
    - System capacity
    - Flow management

COLLABORATIONS & KNOWLEDGE TRANSFER

- Collaborations and knowledge transfer with universities, technical experts, and state and federal agencies
  - Lab and field testing
  - Dam safety – Potential Failure Mode Analysis (PFMA)
  - Design and construction methods


Pipe Testing

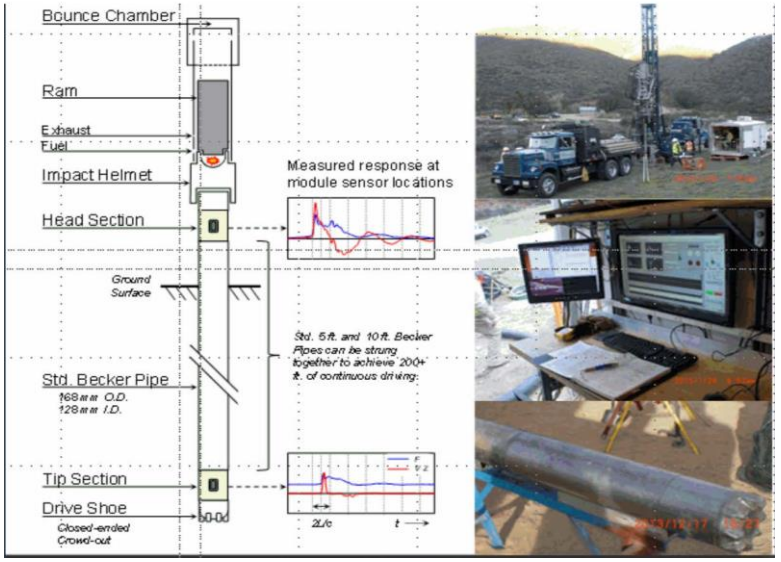

Centrifuge Testing



ENGINEERING INNOVATION

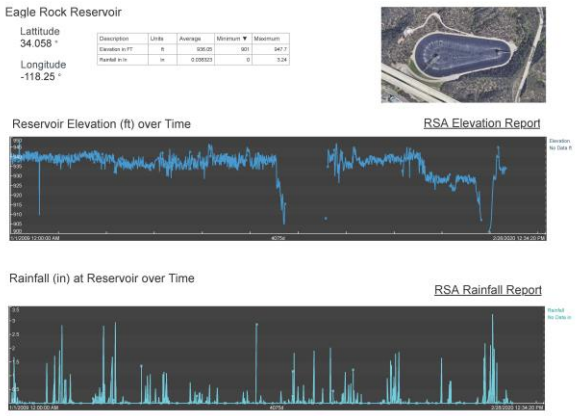
- Earthquake Resistant Ductile Iron Pipe
  - Distribution Pilot Project (Reseda Blvd.)

- Field Investigations
  - Instrumented Becker Penetration Testing
  - Headworks Reservoir and North Haiwee Dam No. 2 Sites



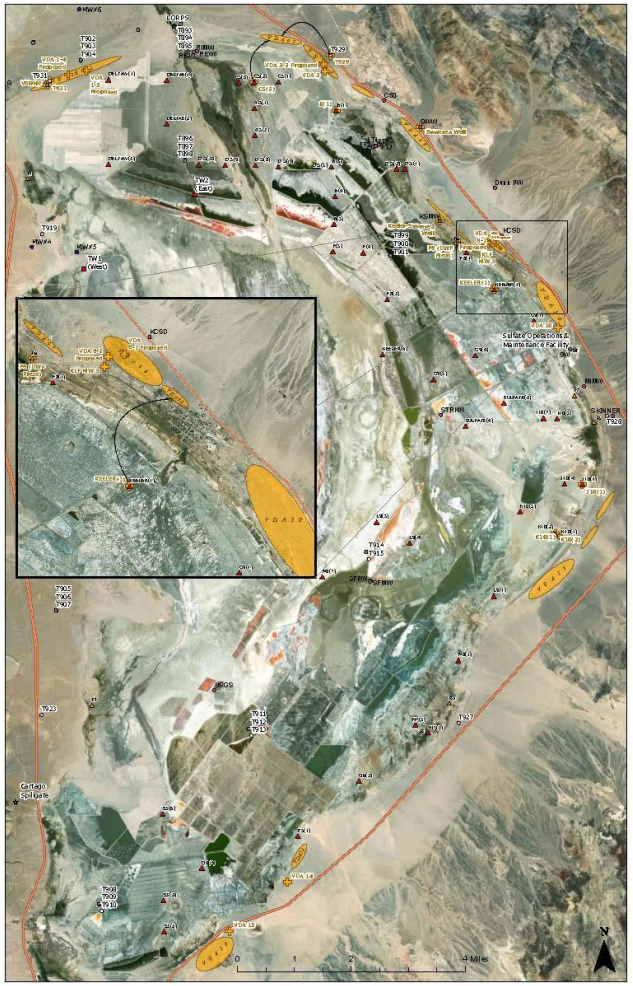
FUTURE

- Real time data
- Seismic Instrumentation – collaboration with USGS and CGS
- Fiber Optics – collaboration with Caltech



Real Time Data at Facilities

Seismic Instrumentation



Fiber Optics at Owens Lake

EXPERIENCE OUTSIDE LADWP

- IRAQ
  - Infrastructure
  - Subsurface conditions