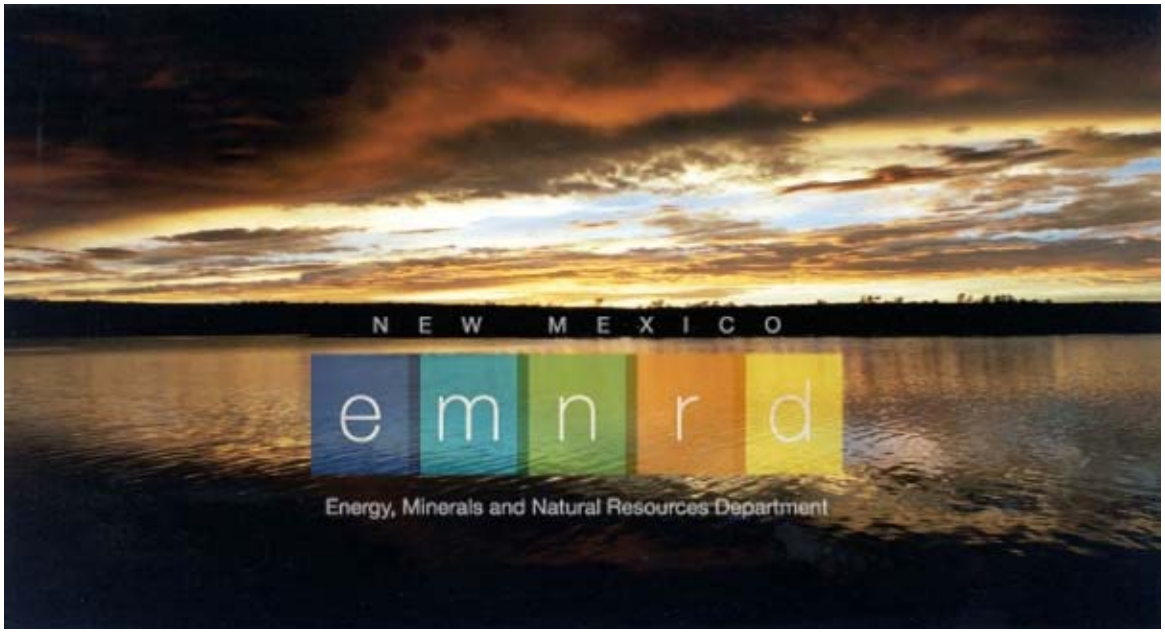


Progress Update
Remediation of Unstable Brine Cavern in Carlsbad, New Mexico

by Energy Minerals & Natural Resources Department
to Radioactive & Hazardous Materials Committee

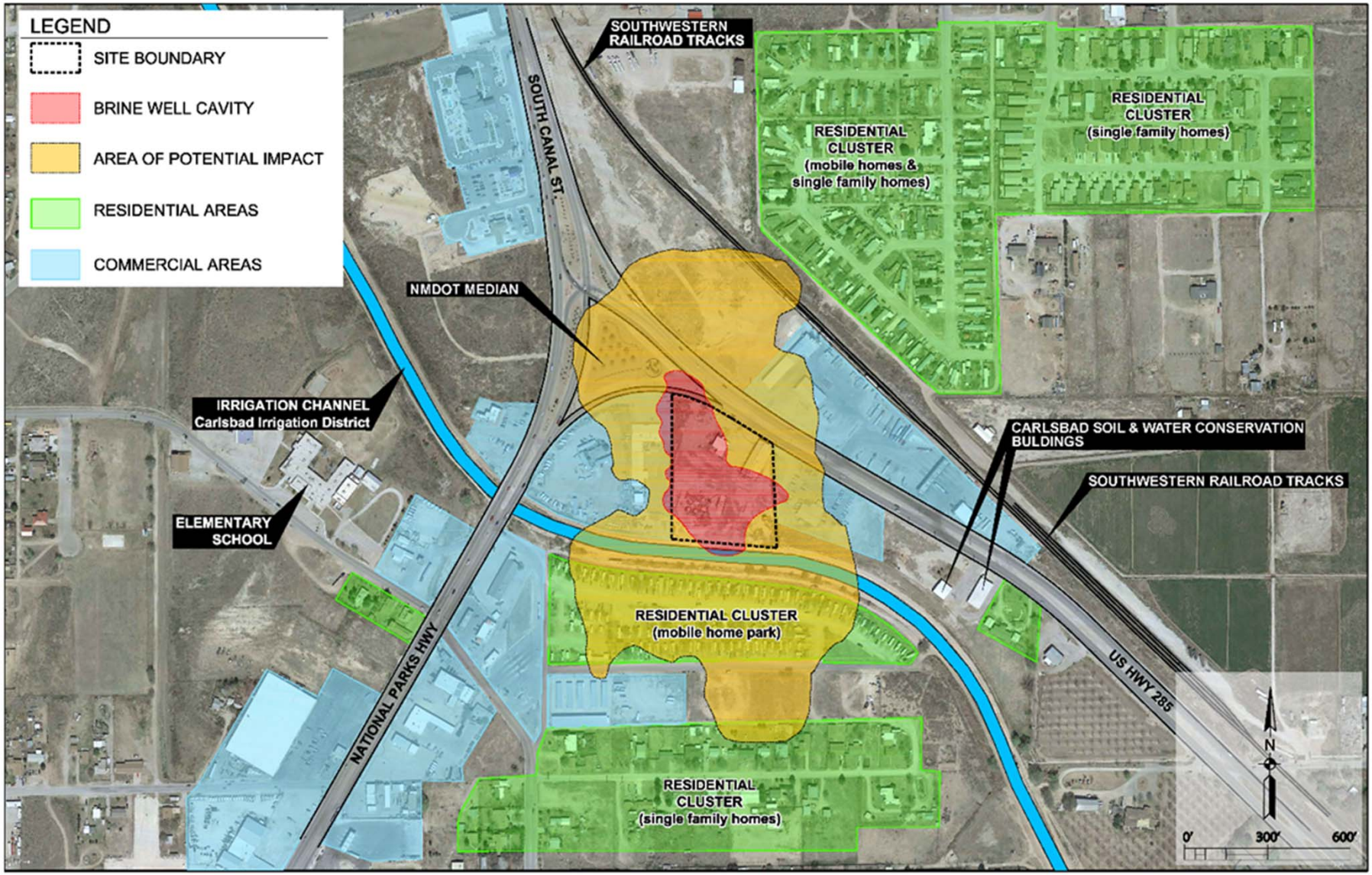
November 4, 2019

What This Project Is Attempting To Avoid

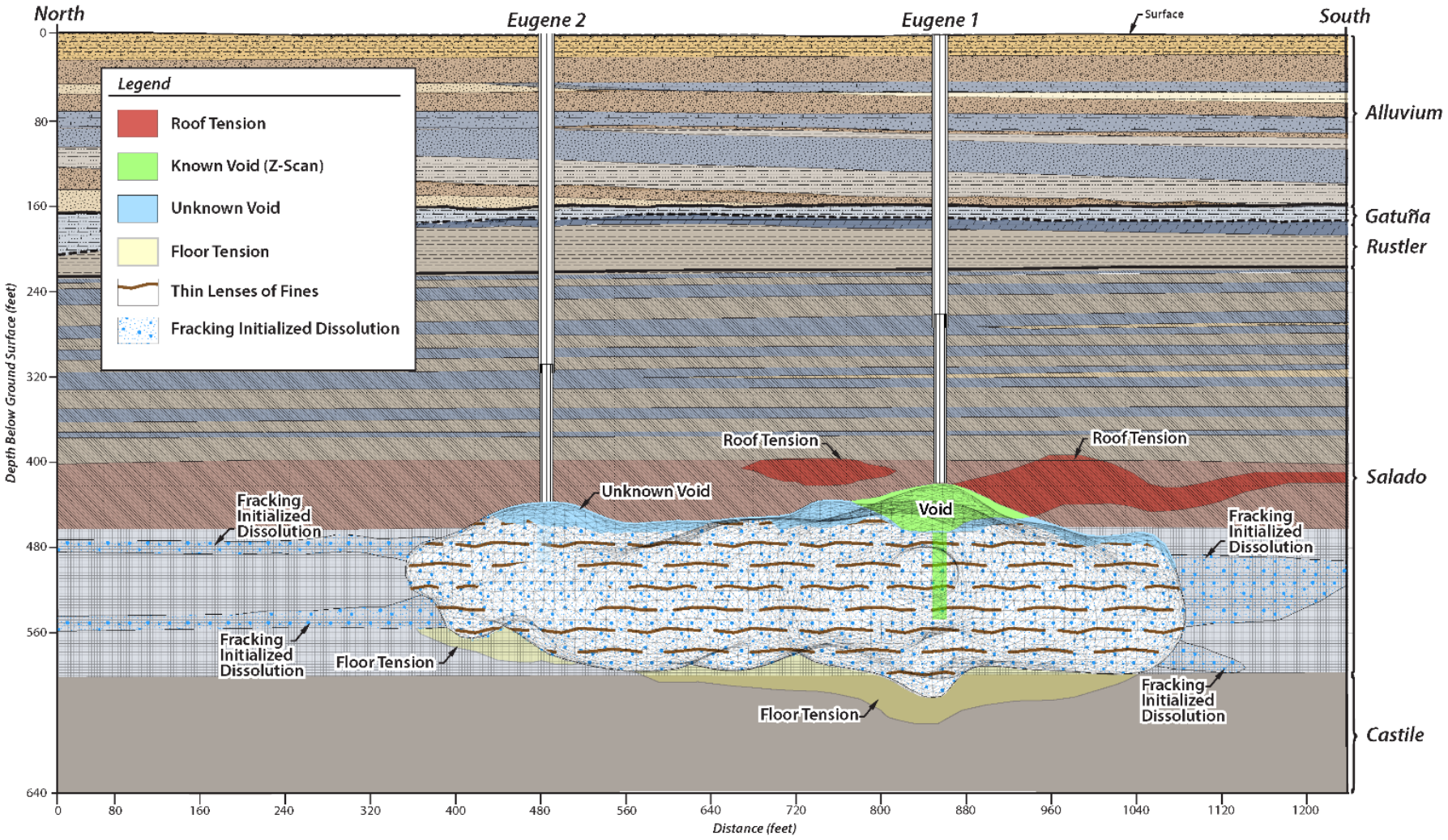
Jim's Water Service – July 2008

Loco Hills Disposal – November 2008

I&W Brine Cavern in Carlsbad

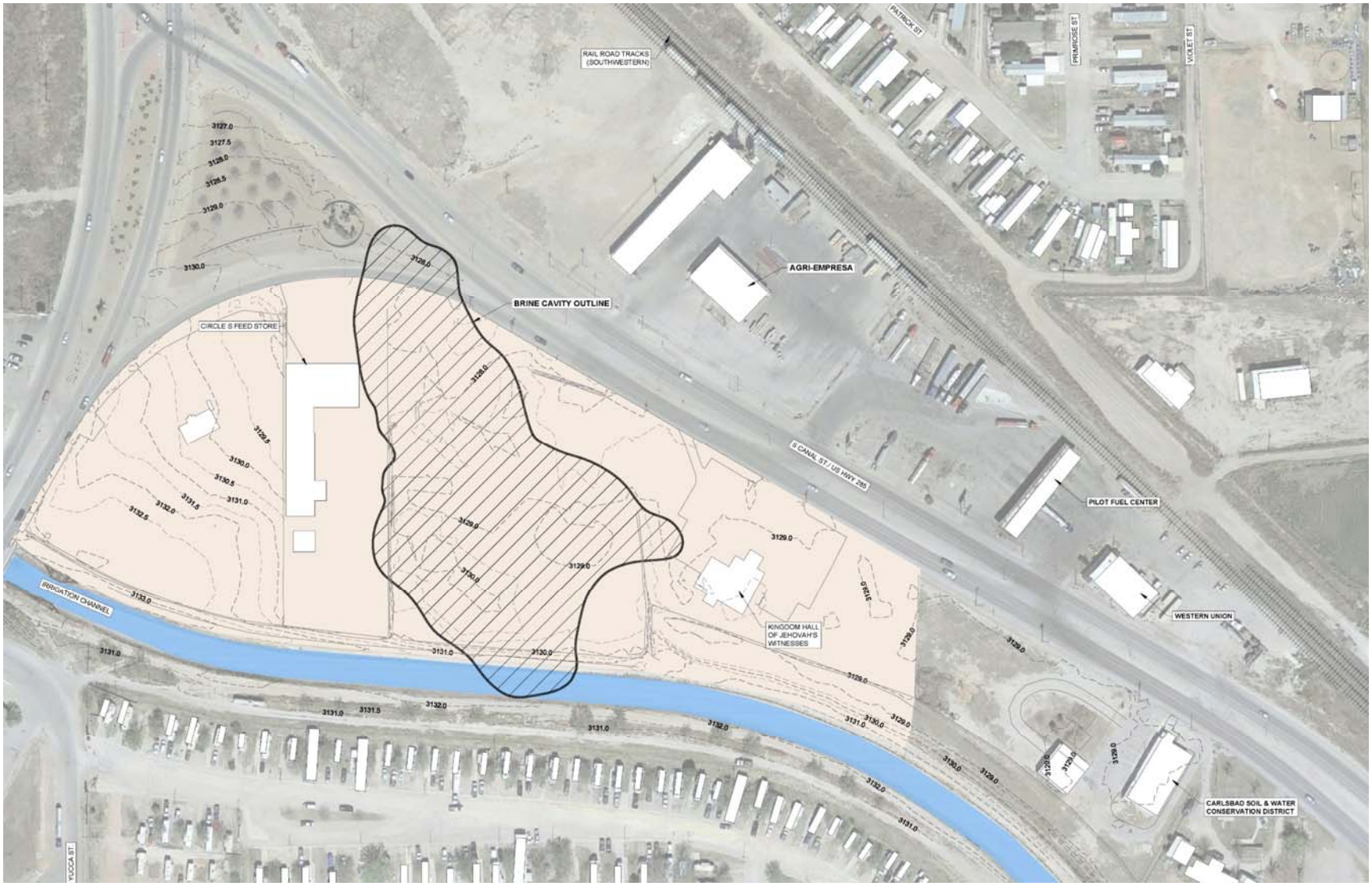


I&W Brine Cavern in Carlsbad

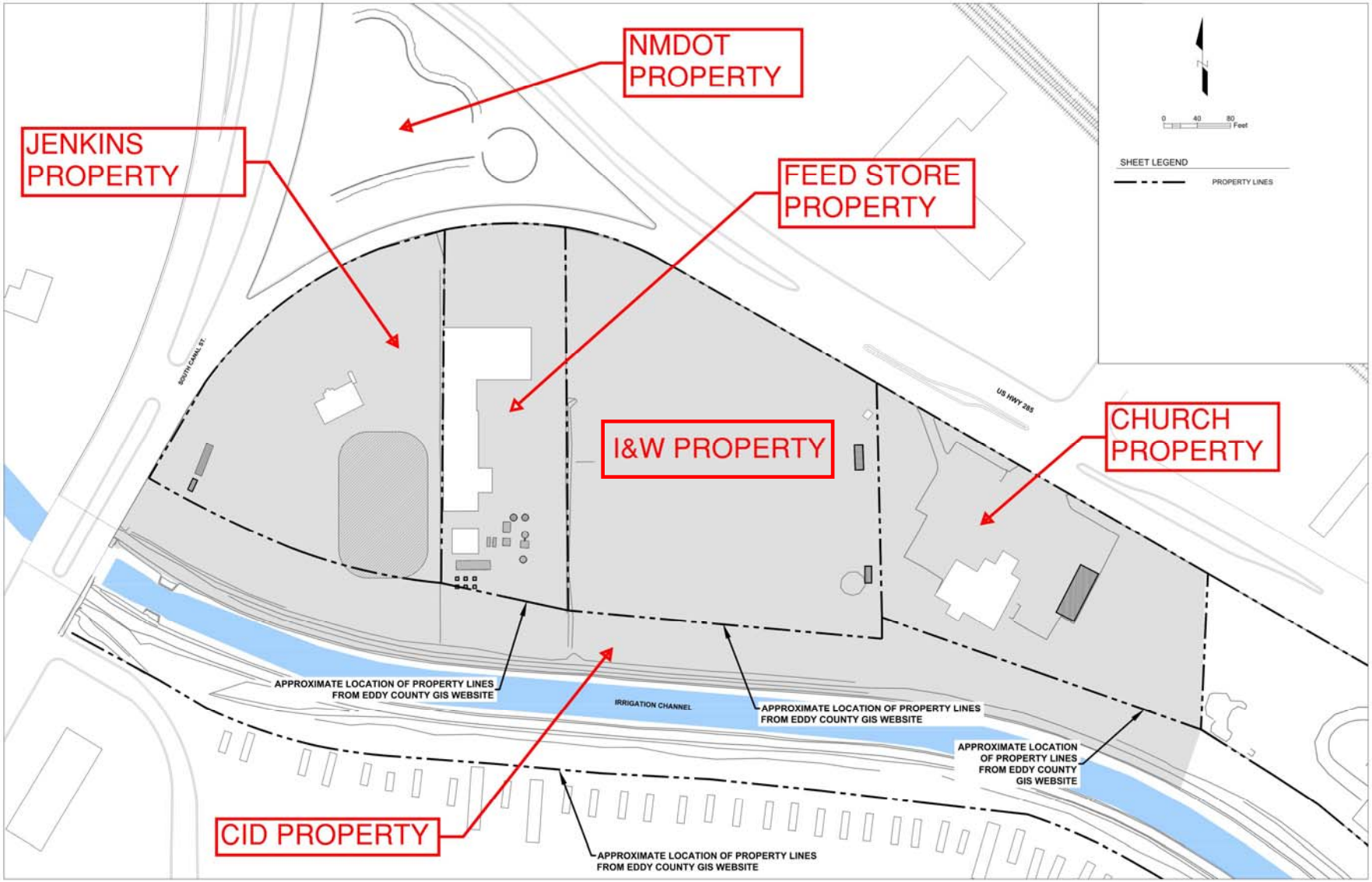


Section of Cavity (Looking East)

I&W Brine Cavern in Carlsbad



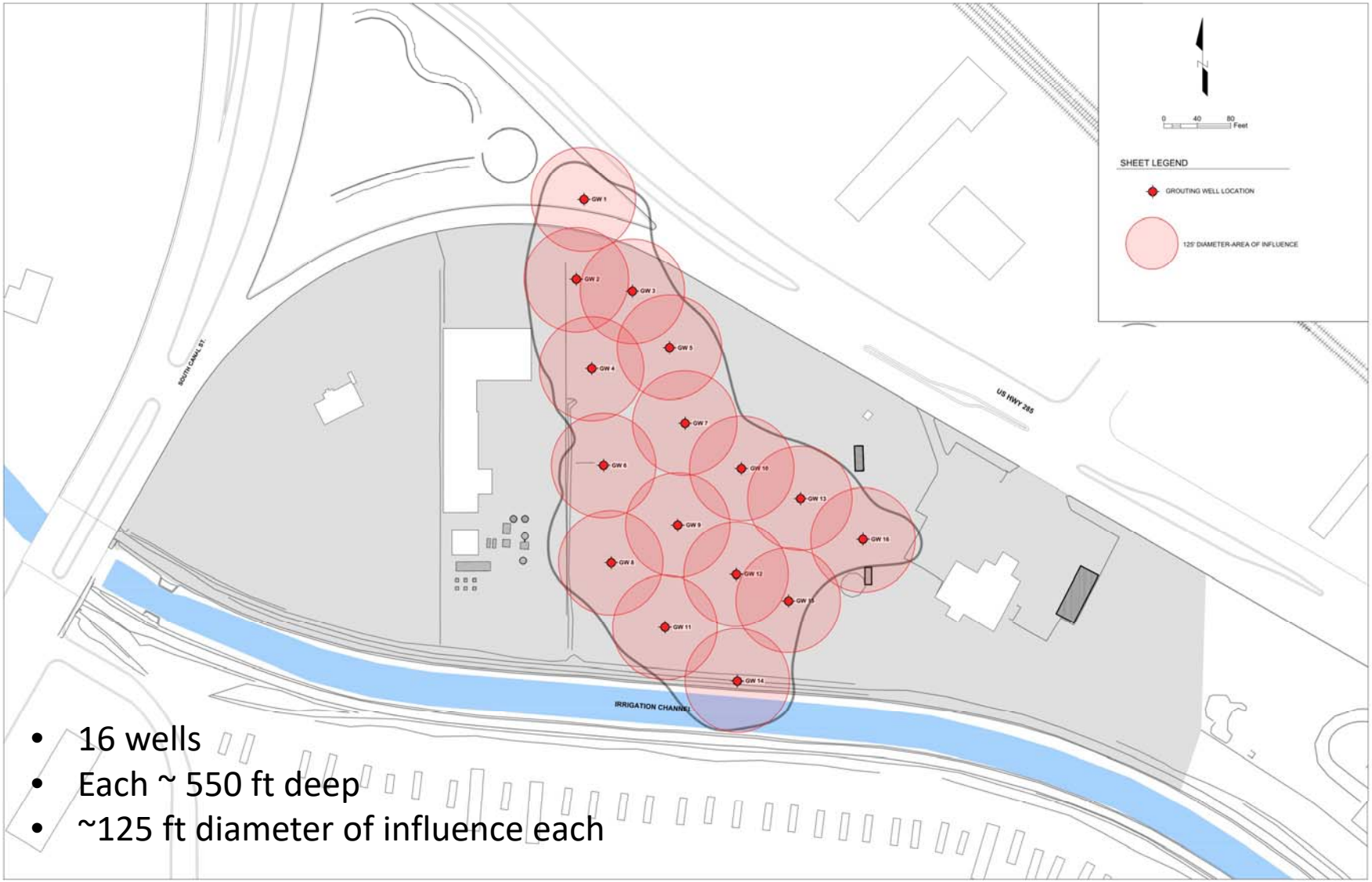
I&W Brine Cavern in Carlsbad



Remedy

- Install a series of wells to sequentially pressure inject grout in two phases while simultaneously extracting brine
  - Injection Phase 1 - Establish a subsurface cap using high mobility grout materials to support the weakened cavity roof
  - Injection Phase 2 – Consolidate the existing partially dissolved cavern rubble using low mobility grout to structurally support the new grout cap
  - Maintain cavity pressure
  - Balance the volume of brine removed with the volume of grout injected

Grout Well Locations



- 16 wells
- Each ~ 550 ft deep
- ~125 ft diameter of influence each

Cavity Filling Process

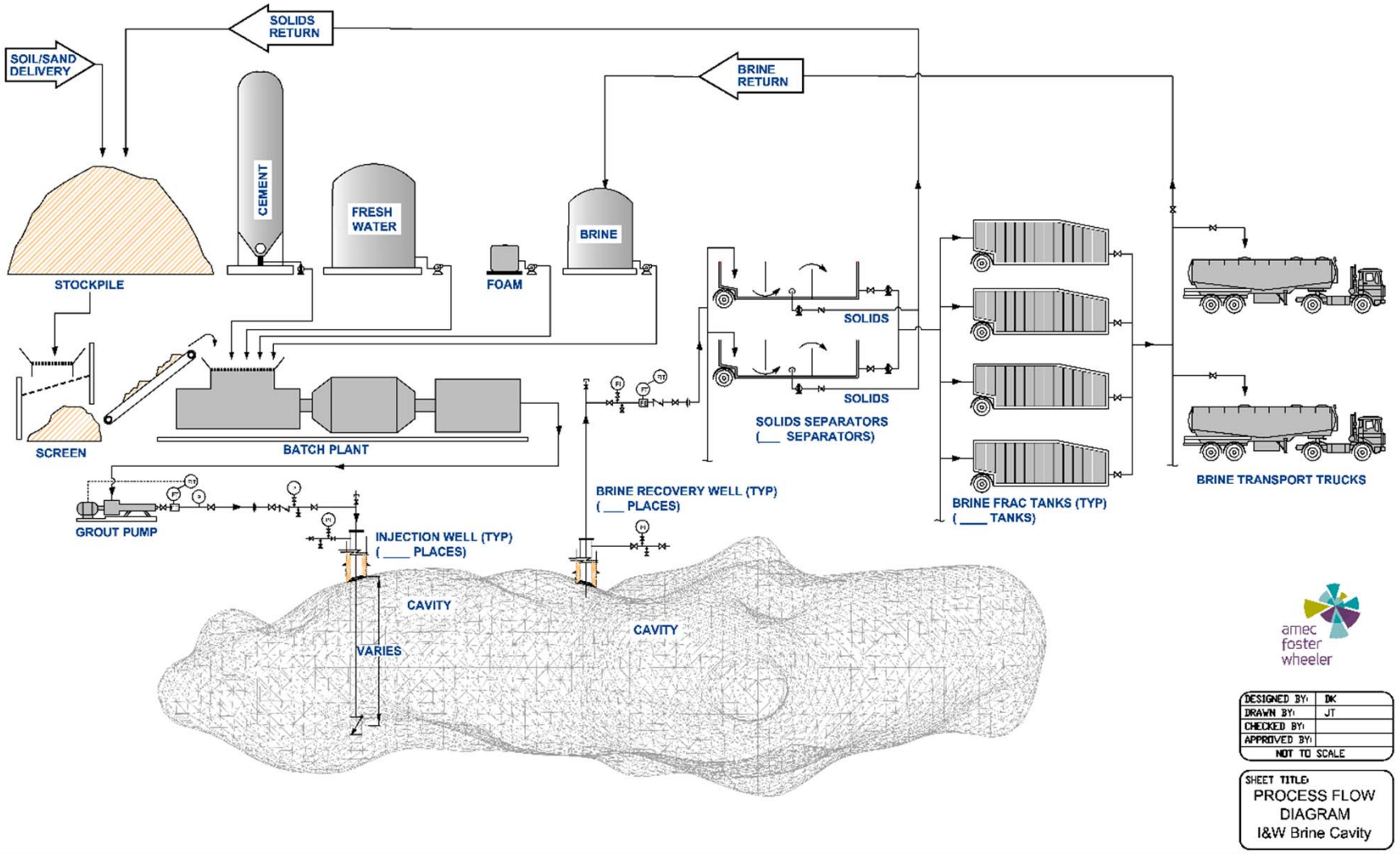
- Drill 8 wells in the south with two rigs

- Move one rig to the north and continue drilling 8 additional wells while keeping the other rig in the south to support grouting from the south to the north.

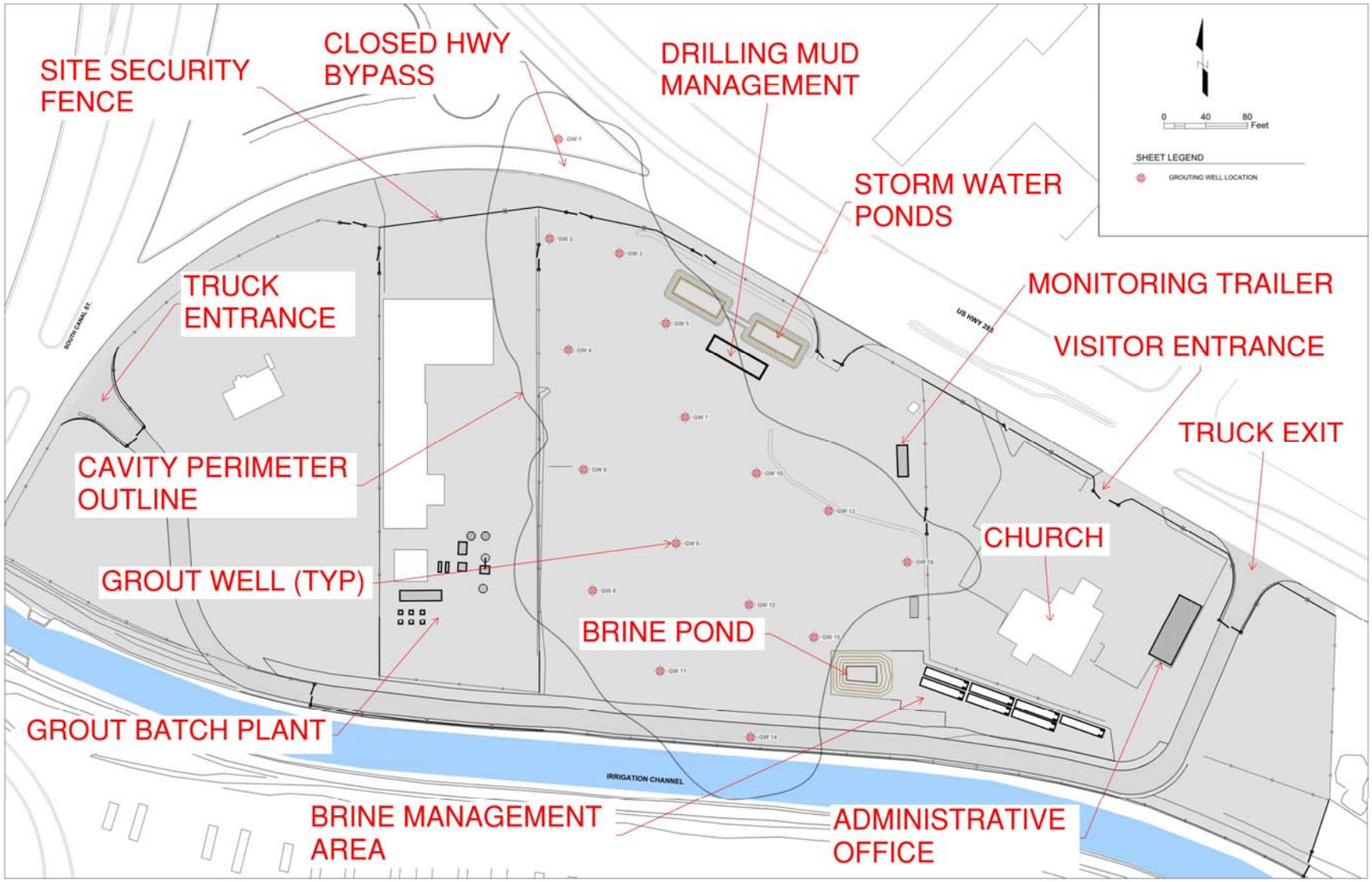
- High mobility grout first at the **TOP** of the salt layer to fill void.
  - Pump until BTMs show mounding surface
  - Pump until fracking pressure of formation is reached
  - Pump until 1/16 of 833,355 cubic feet of grout is deployed

- Drill thru to approximate **BOTTOM** of salt layer and pump low mobility grout to compress and consolidate the formation.

Cavity Filling Process



Site Plan


SITE SECURITY FENCE
CLOSED HWY BYPASS
DRILLING MUD MANAGEMENT
STORM WATER PONDS
MONITORING TRAILER
VISITOR ENTRANCE
TRUCK EXIT
TRUCK ENTRANCE
CAVITY PERIMETER OUTLINE
GROUT WELL (TYP)
CHURCH
BRINE POND
GROUT BATCH PLANT
BRINE MANAGEMENT AREA
ADMINISTRATIVE OFFICE
SOUTH CANAL ST.
US HWY 285
IRRIGATION CHANNEL
0 40 80 Feet
SHEET LEGEND
GROUTING WELL LOCATION

Drilling Equipment

One of Two Drill Rigs

40,000 gal of Brine Storage

Mud Management Unit

Drilling Mud Pumps

Drilling and Casing Procedure

- 17-1/2” diameter bore advanced to 250 feet using conventional mud rotary drilling.
- 13-3/8” casing installed to depth and cemented in place. This is our fresh water protection string.
- Cement is allowed to cure for 48 hours.
- While cement is curing, master valve and blowout preventer secured to casing at the surface.
- Smaller 12-1/4” drill bit then advanced to ~420 feet (about 30 feet above cavern).
- 7” casing installed to depth and cemented in place.
- Cement cures for 48 hours, then casing pressure tested at 350 psi for one hour. Approval from OSE required before drilling deeper.
- 6-1/4” drill bit is used to enter cavern.

Grouting Equipment

Material Silos

Pressure Grouting Equipment

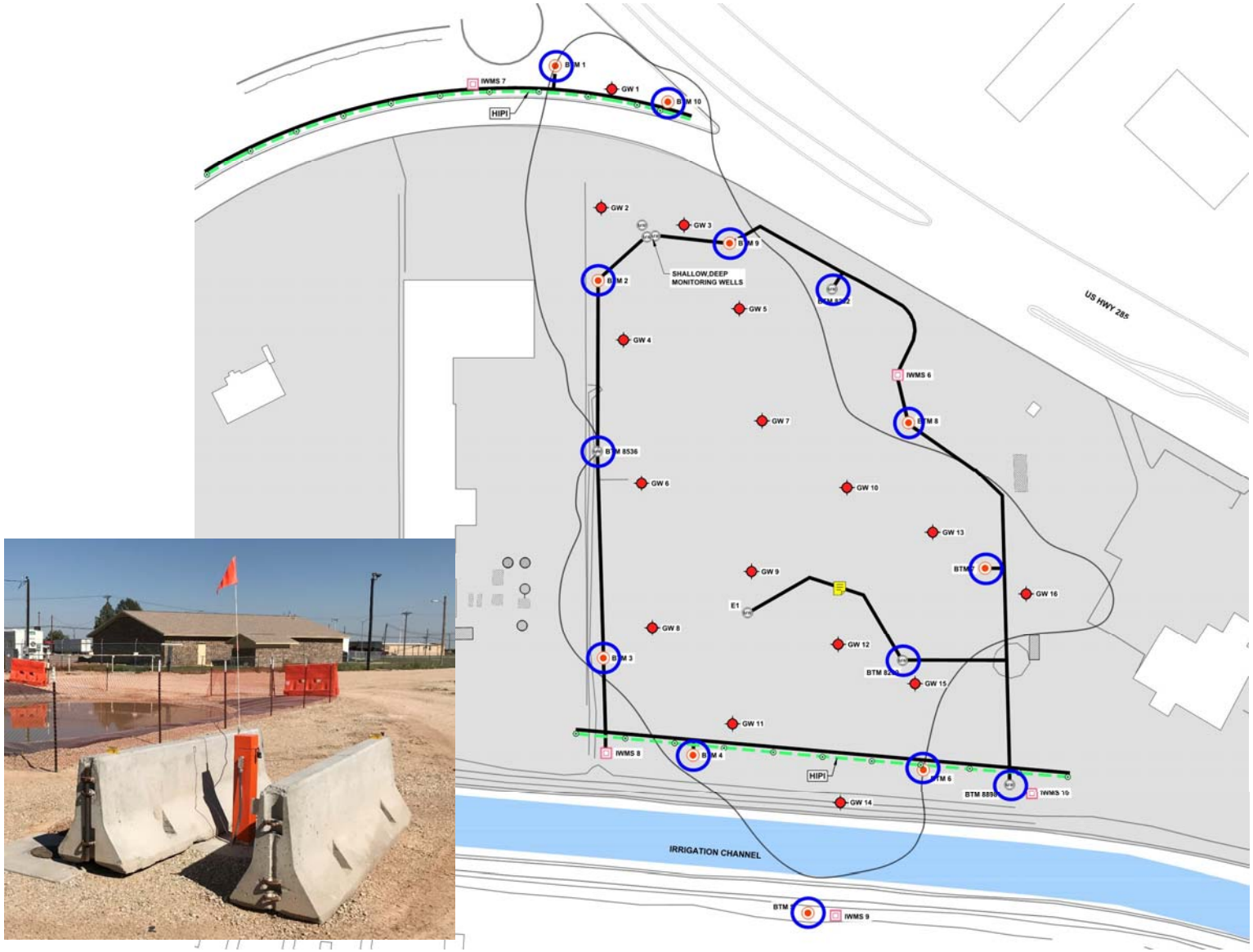
Risk Management

- Keep public and workers safe

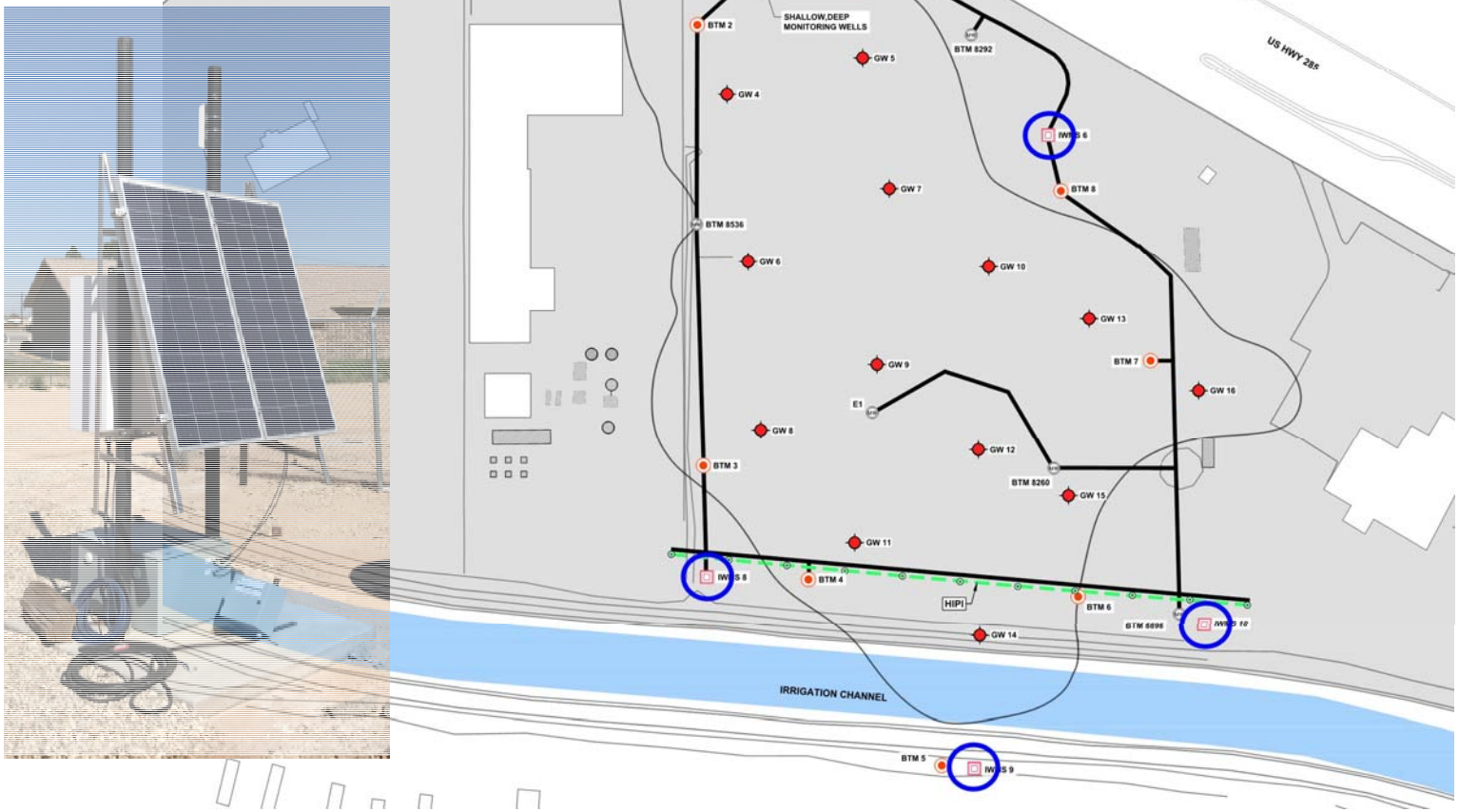
- Close monitoring during remedy implementation
  - Borehole Tilt Meters (10 new, 14 total)
  - Microseismic Arrays (5 new, 9 total)
  - Horizontal In-Place Inclinometer Arrays (2 new)
  - Constant feedback for advanced warning of cavern failure

- Post remedy monitoring
  - 2 years of post-injection monitoring to confirm success

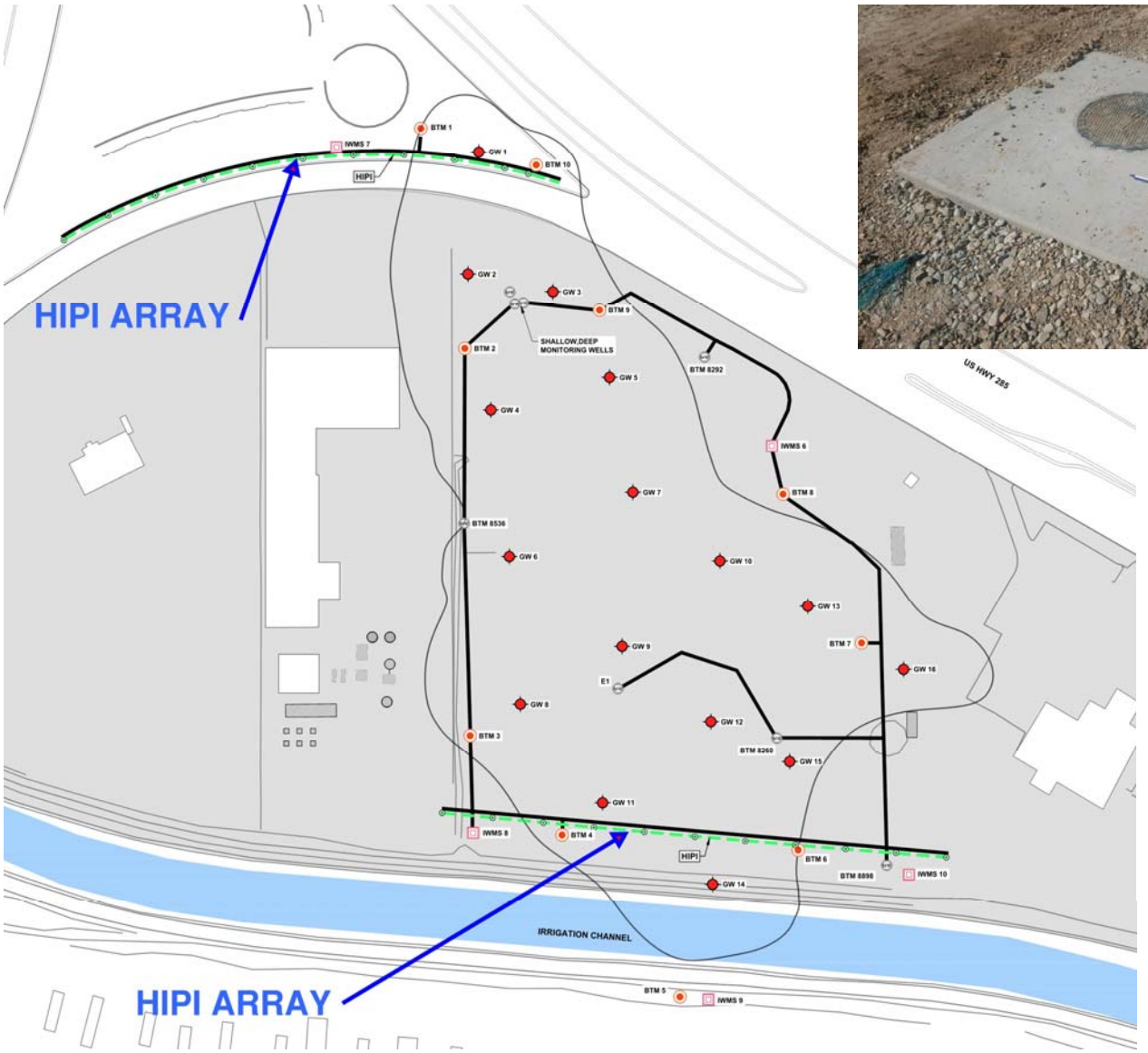
Borehole Tiltmeters



Microseismic Arrays



Horizontal In-Place Inclinometers



Project Status (slide 1 of 2)

Remediation Design Finalized

All Access Agreements Finalized

Traffic Modifications Constructed & Implemented

On-Site Buildings Demolished & Removed

Site Grading for Stormwater Control Completed

Utility Upgrade Completed

Monitoring System Upgrade - 95% Complete

Haul Roads in Process

Perimeter Fencing - 80% Complete

Project Status (slide 2 of 2)

Drilling Began September 30th (2 rigs operating 24/7)

4 Grouting Wells Completed

Currently Rigging Up on Wells 5 & 6

First 8 Wells Anticipated to be Complete by December 4th

Grouting Crews Mobilizing Now

First Grout Injection Anticipated on December 9th

Grout Injection Anticipated to be Completed during August 2020

Project Funding

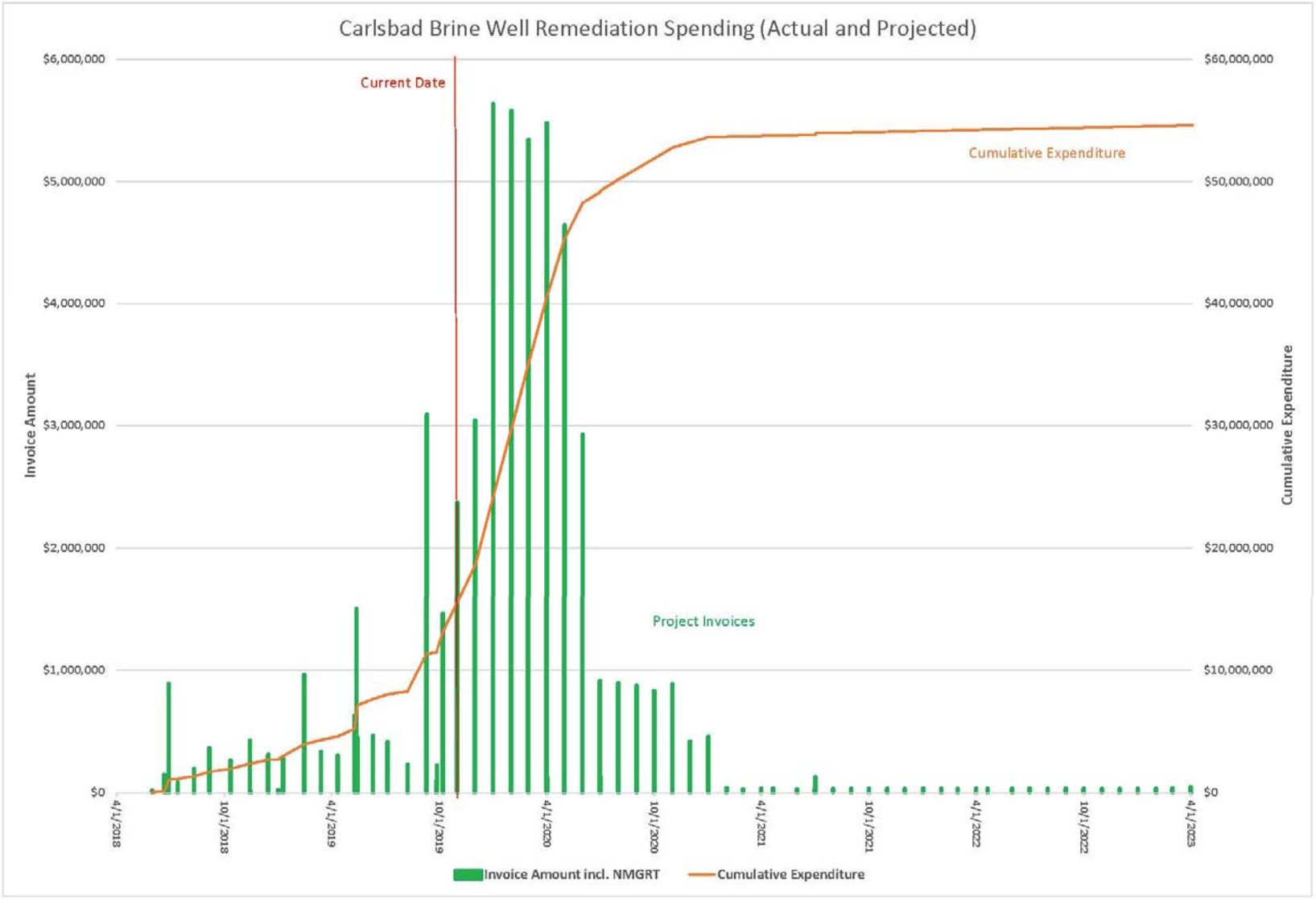
Total Funding Secured to Date - $45,498,800

- $4,020,000 - City of Carlsbad (phased over 3 years: FYs 19, 20, & 21)
- $4,020,000 - Eddy County (FYs 19, 20, & 21)
- $30,000,000 – NMDoT (FYs 19, 20, & 21)
- $2,000,000 - NM Environment Dept (FYs 18 & 19)
- $3,500,000 - General Fund (FY 19)
- $1,958,800 - Bonds

Current Budget & Expenditures

FEL2 Cost Estimate	43,985,000.00
FEL3 Cost Estimate (includes 10% contingency)	$47,928,706.00
NMGRT (7.875%)	3,774,385.60
Property Access	2,289,514.75
EMNRD Partial Overhead (3 years)	375,000.00
Total	$54,367,606.35
Funding to Date	45,498,800.00
Currently Anticipated Budget Shortfall	($8,909,606.35)
Expenditures to Date	$13,128,777.56

Project Expenditure Timeline (as of 11/1/19)



Questions

Thank You