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Burn Site Groundwater Area of Concern Characterization Activities Update, August 2017

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Sandia National Laboratories, New Mexico

Update SAND number after R&A

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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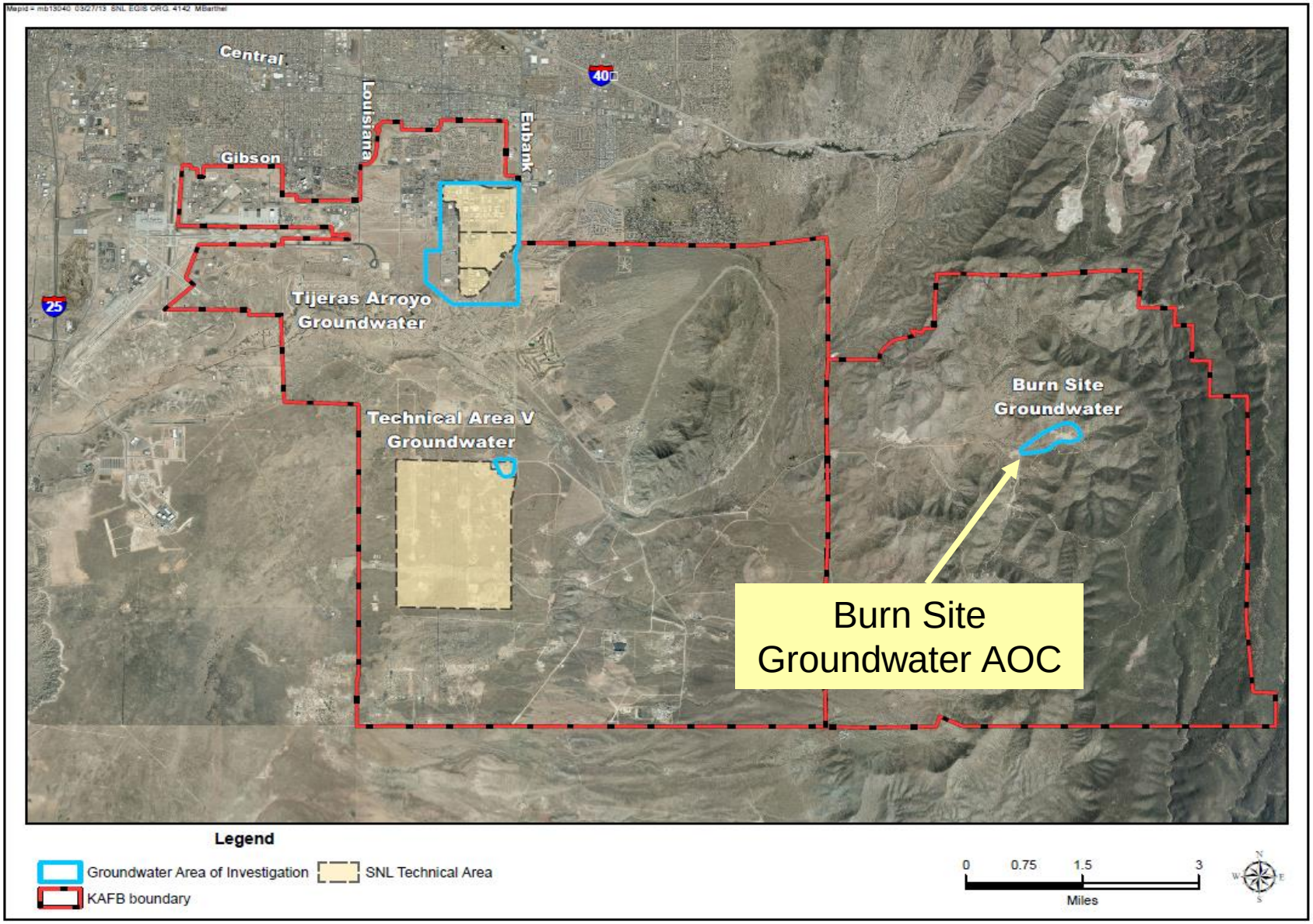
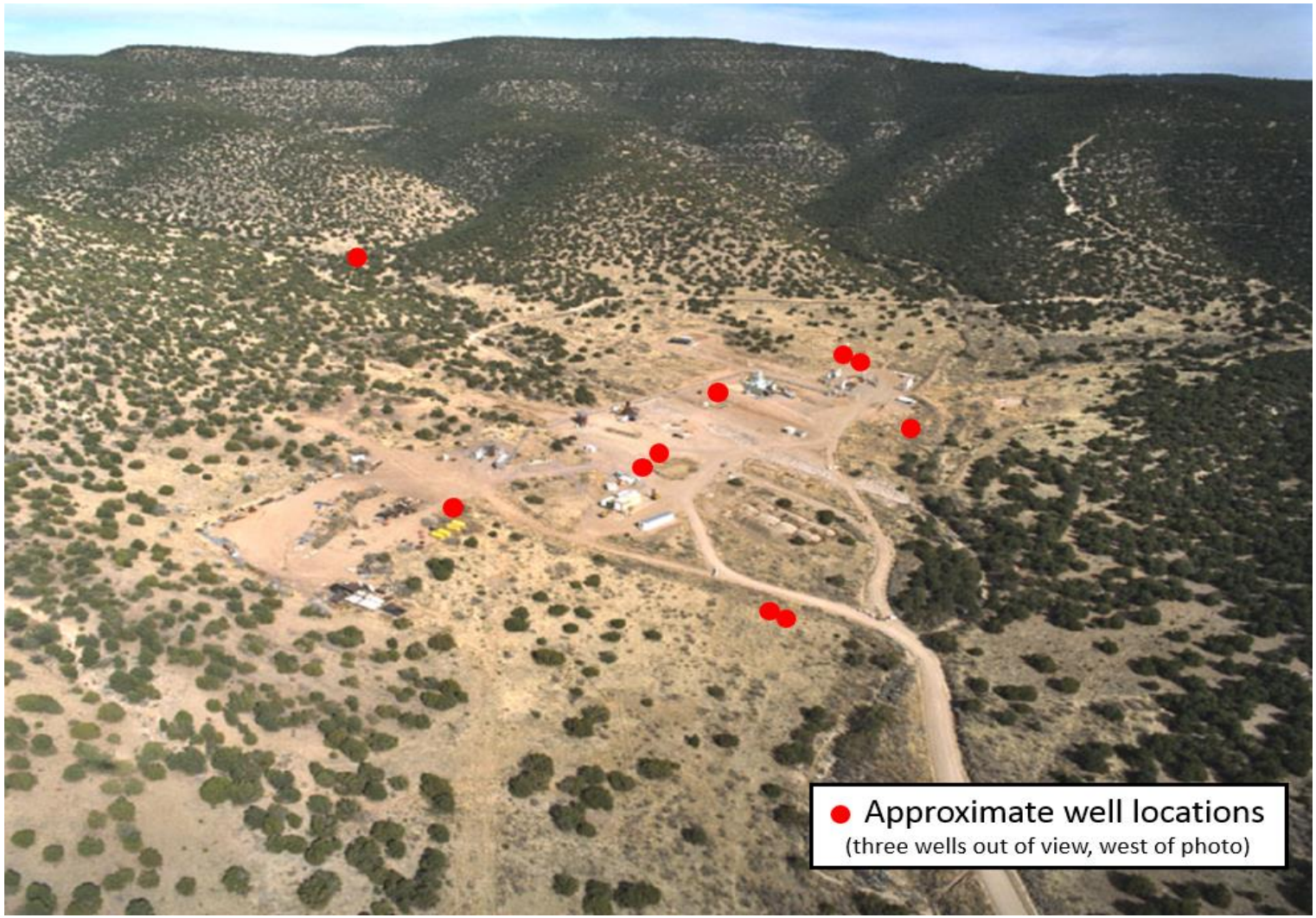

Central
Louisiana
Eubank
Gibson
40
25
Tijeras Arroyo
Groundwater
Technical Area V
Groundwater
Burn Site
Groundwater
Burn Site
Groundwater AOC
Legend
Groundwater Area of Investigation
SNL Technical Area
KAFB boundary
0
0.75
1.5
3
Miles

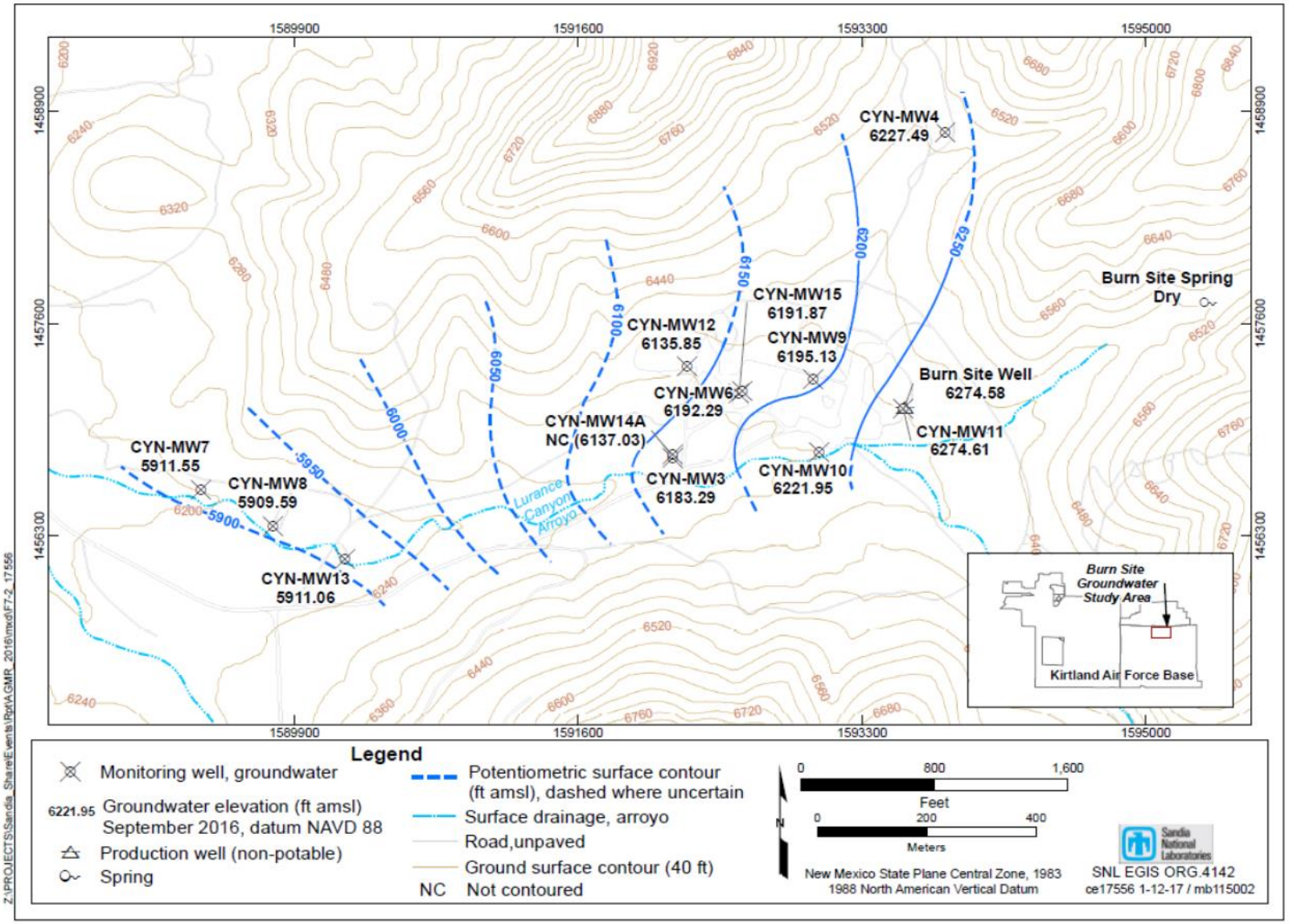
Burn Site Groundwater AOC

- In remote area in Manzanita Mountains
- Testing activities with explosives and “burn pans” began 1967
- GW monitoring began 1996
- GW occurs in fractured bedrock from 108 to 326 ft. below surface
- 7 of 10 monitoring wells contain nitrate (NO_3) > 10 ppm
- 2 wells with ~ 40 ppm nitrate
- GW in one monitoring well also contains perchlorate ~ 4 ppb
- Currently finalizing weight-of-evidence (WOE) process to determine origin of nitrate

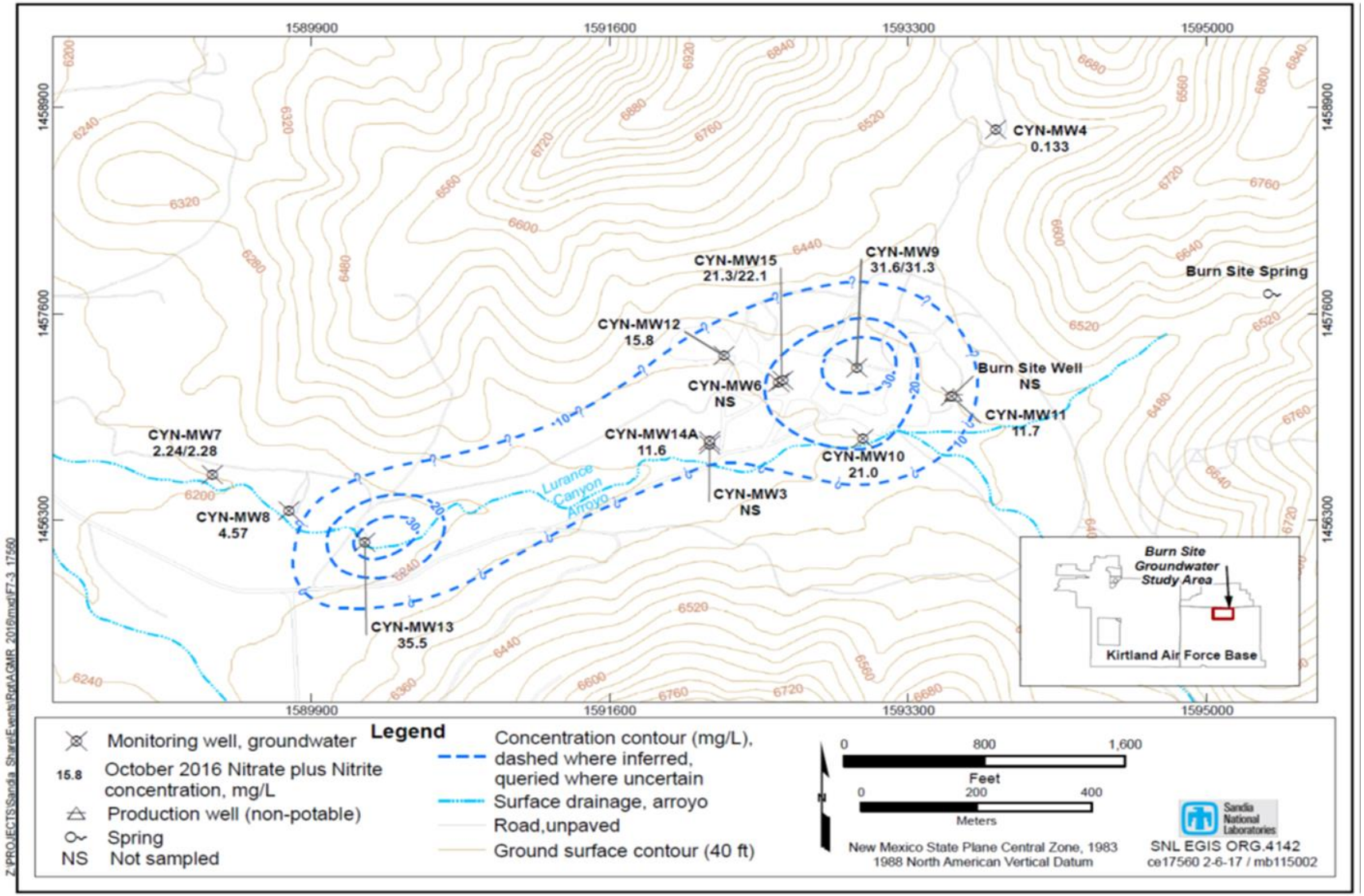
Aerial View of the BSG AOC (View is toward the East)



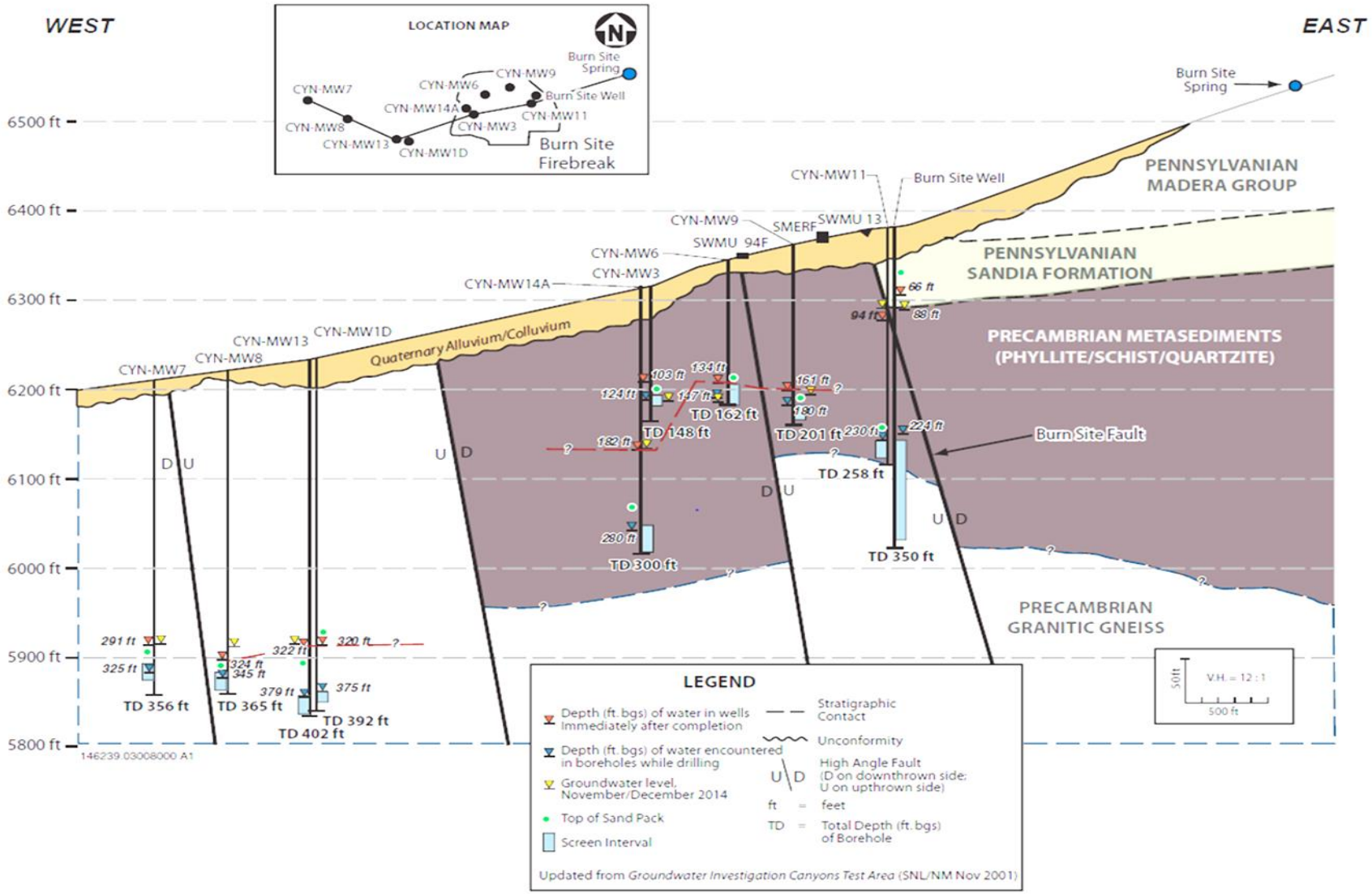
Potentiometric Surface Map—September 2016



Nitrate Concentrations—October 2016



Fence Diagram across BSG AOC



Weight Of Evidence Process and Regulatory Requirements

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- NMED approved *CME Workplan* & Sandia internal draft *CME Report Fall* 2013
- Fall 2013, DOE HQ initiated independent, Internal Remedy Review (IRR) of proposed corrective actions for nitrates groundwater
- Results IRR documented in 3 memos
- IRR key points
  - Aquifer appears “confined” and contaminants can not infiltrate
  - Nitrate contamination maybe from off-site or natural?
  - Recommend WOE process to determine if nitrates from DOE operations
- NMED agrees to delay *CME Report* for DOE’s WOE process

Weight Of Evidence Activities

Investigation Techniques included:

- Isotopic Analysis of Groundwater (i.e., age dating)
- Long-Term Transducer Study
- Aquifer Pumping Test

Aquifer Pumping Test

- *Aquifer Pumping Test Work Plan* submitted to NMED on **June 6, 2016**
- *Work Plan* approved **June 21, 2016**
- All wells instrumented, pumping performed at Burn Site Well
  - Long-Term Transducer Study
  - Step-Drawdown Test
  - Constant-Rate Test
  - Interval sampling for nitrate in discharge water
- Field work completed March 13 through 17, 2017

Transducer Study for Barometric Efficiency

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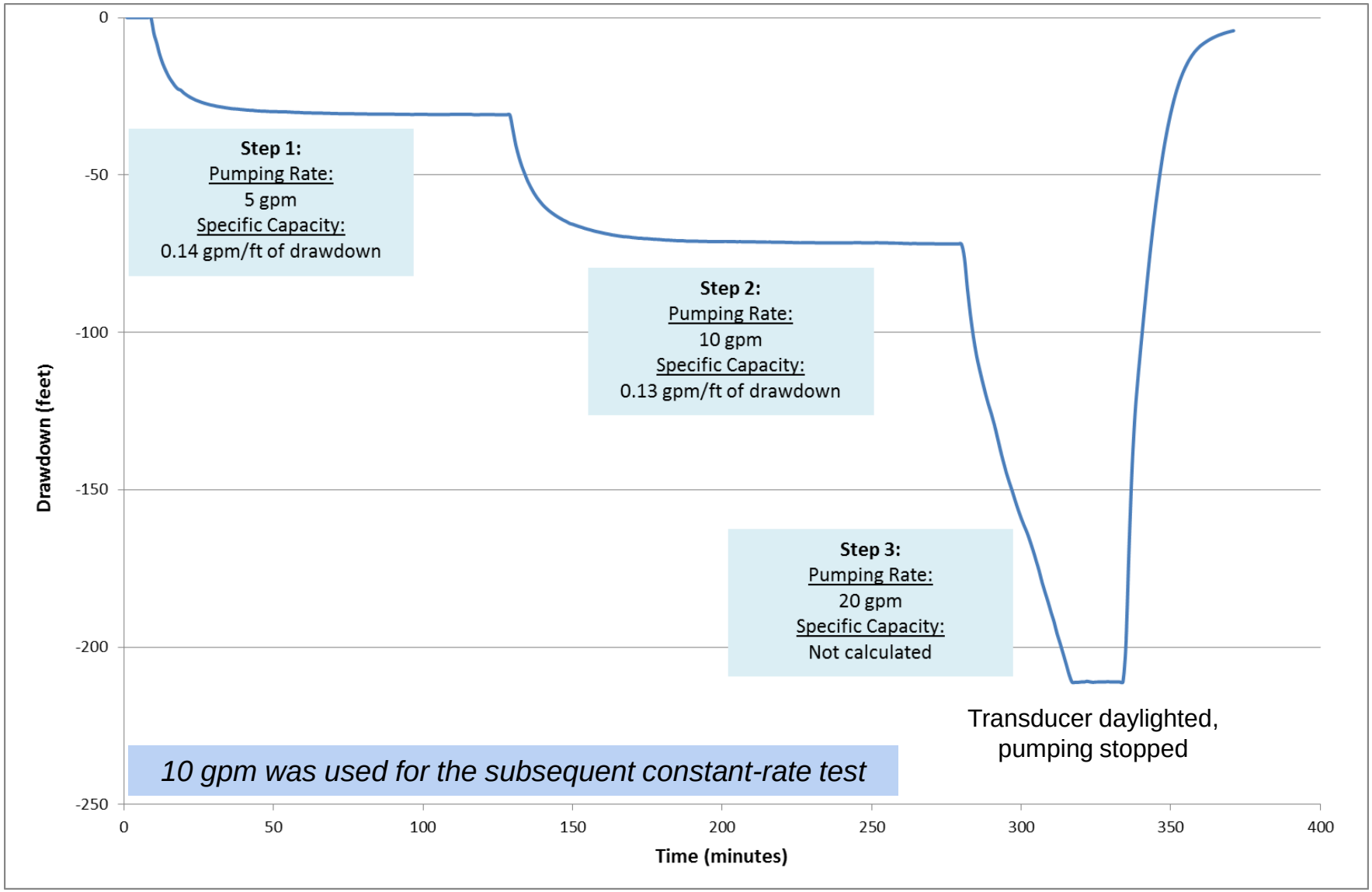
- Barometric efficiency is a general indicator of the degree of hydraulic confinement of an aquifer system and isolation from vertical recharge
- Barometric efficiencies:
  - Unconfined aquifer: 0% (analogous to a glass of water)
  - Semi-confined: 1-59% (leaky barometer)
  - Confined: 60-100% (a good barometer)

Summary: Barometric Efficiency Tests

- CYN-MW3 and CYN-MW10 are unconfined (both respond to precipitation infiltration)
- CYN-MW4 – uphill well confined
- All other wells are semi-confined
- Infiltration of nitrate-contaminated waste water (from testing activities) can occur

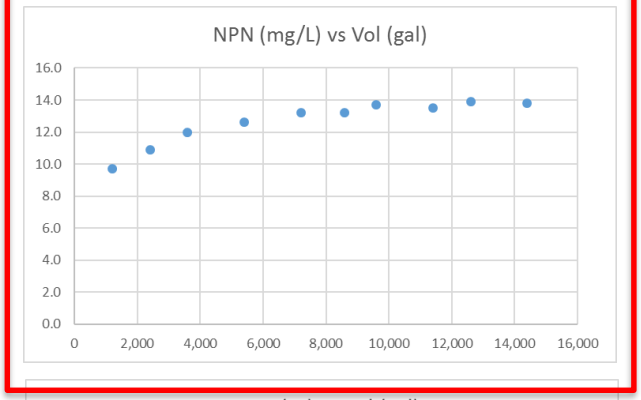
Burn Site Well Step-Drawdown Test

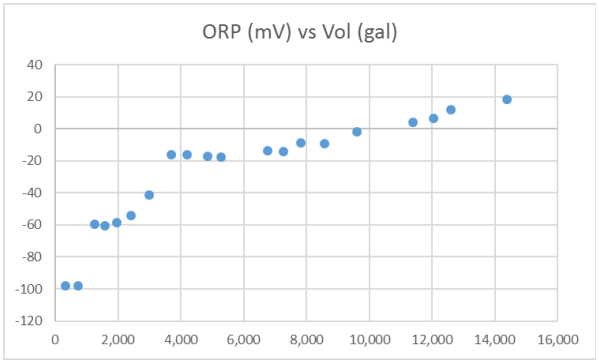


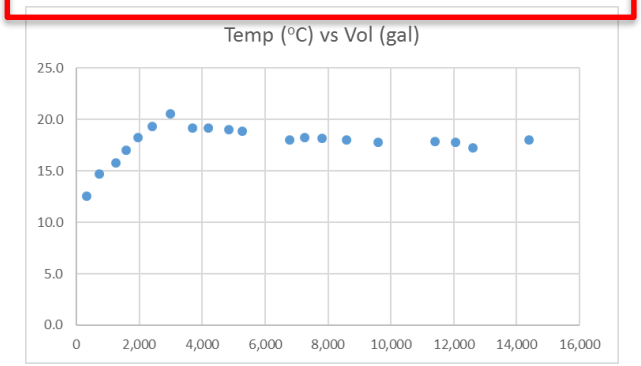
Summary: Burn Site Well Hydraulic Tests

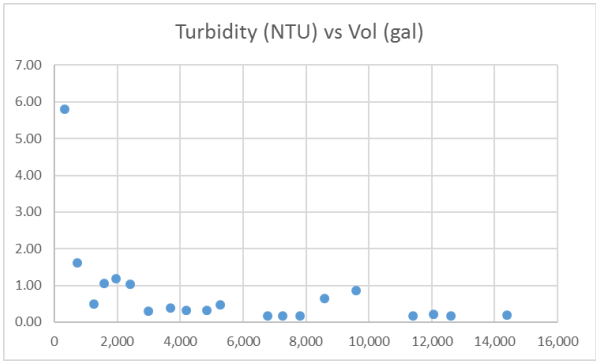
- Constant-rate test: No hydraulic response detected in any observation wells (except nearby well CYN-MW11)
- Heavily fractured bedrock approximates a porous media
- Significant compartmentalization of groundwater

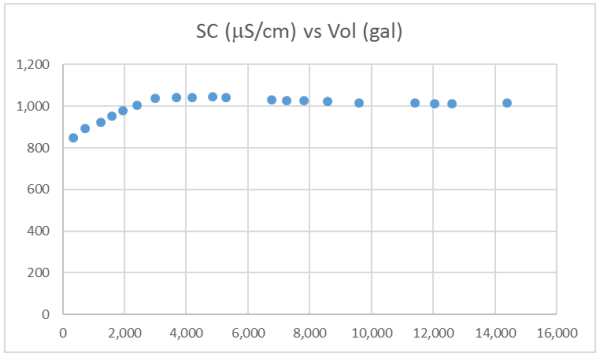
Constant Rate Test Nitrate Results and Field Parameter Measurements

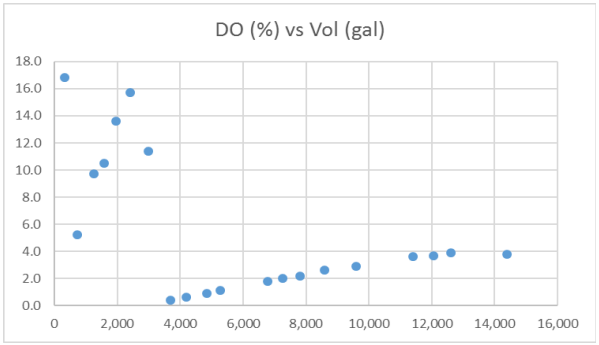








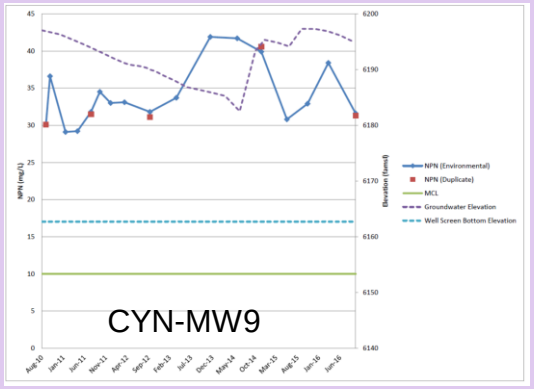


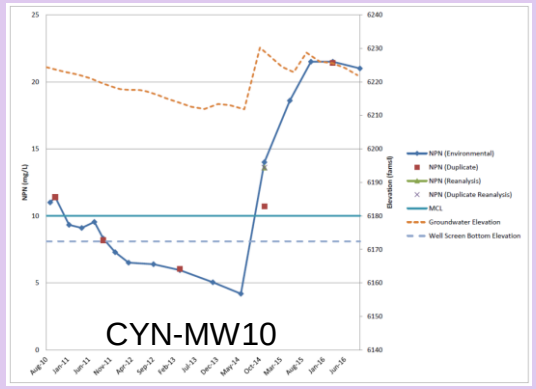


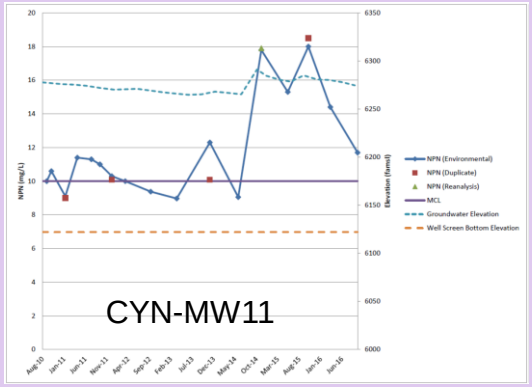
Constant Rate Test Nitrate Results

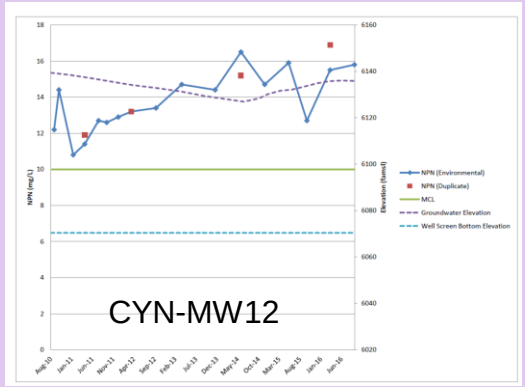
- After 6000 gallons purged, nitrate concentrations leveled off at ~13 to 14 mg/L
- These concentrations are within the historical concentration range found in CYN-MW11 (~10 to 18 mg/L)
- Field parameter measurements mimic nitrate concentration trends
- Nitrate results may represent:
  - ~~naturally high background, or~~
  - plume being pulled toward Burn Site Well and mixing with low-nitrate background to produce the 14 mg/L blend

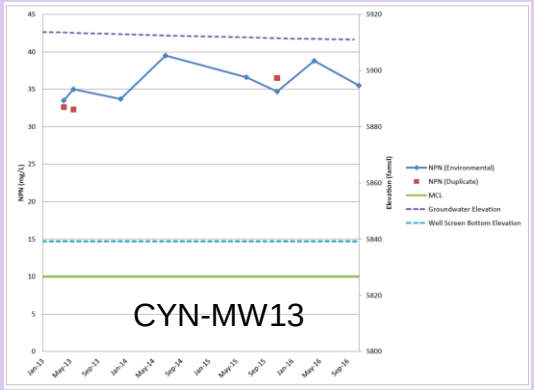
BSG Nitrate Concentrations Over Time

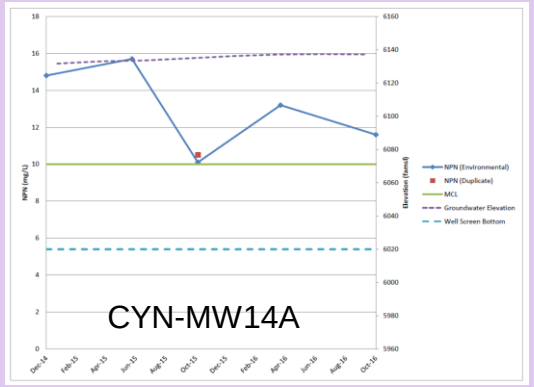


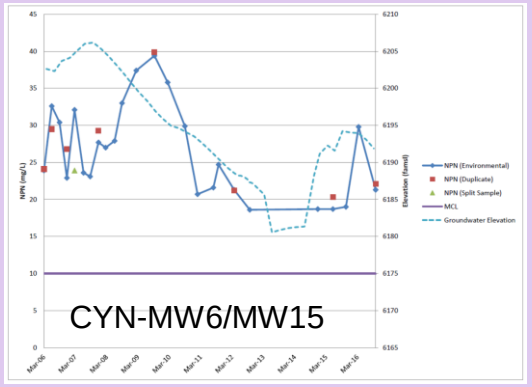






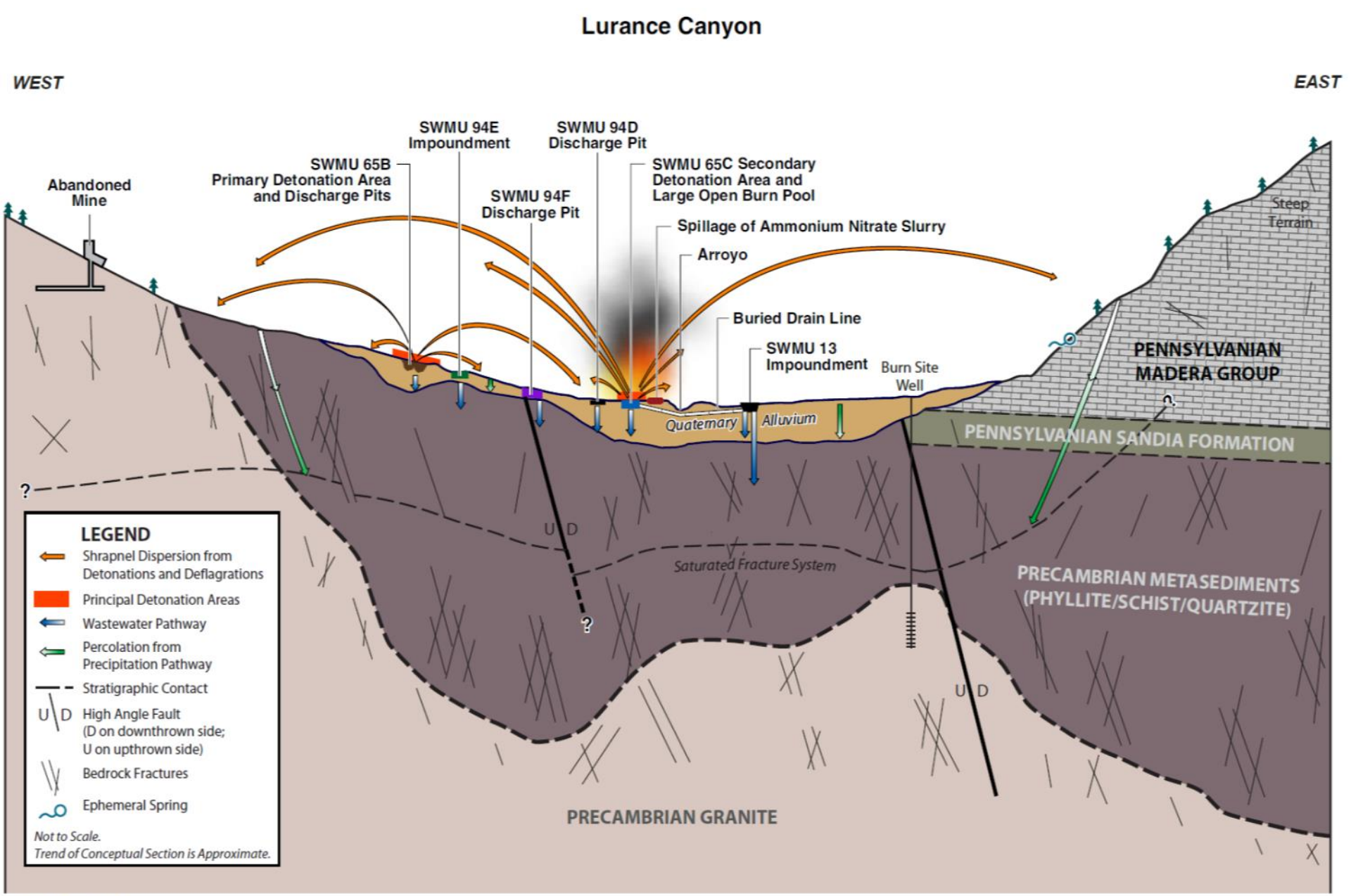






Conceptual Site Model (Contaminant Sources)

- Anthropogenic nitrate sources may include:
  - 1) ammonium nitrate slurry
  - 2) wastewater discharges
  - 3) degradation of HE compounds
- 1969-1987 waste water discharges at SWMUs 13, 65C, 94D, 94E, and 94F included 127 pool-fire tests in unlined pits using ~500,000 gallons (total)
- Discharges may have driven nitrate in soil to groundwater



Potential Contaminant Release Mechanisms at the Burn Site Groundwater Area of Concern

Next Steps

- Detailed results presented to NMED May 10, 2017
- All agree – 1) no conclusive evidence nitrate contamination is natural or from off-site sources; and 2) stakeholders should close WOE Process
- NMED requests additional monitoring wells to 1) investigate 2000-ft data gap; and 2) determine downgradient extent
- Preparing *Aquifer Pumping Test Report* (December 10, 2017)