Sandia National Laboratories

Los Alamos NATIONAL LABORATORY EST. 1943

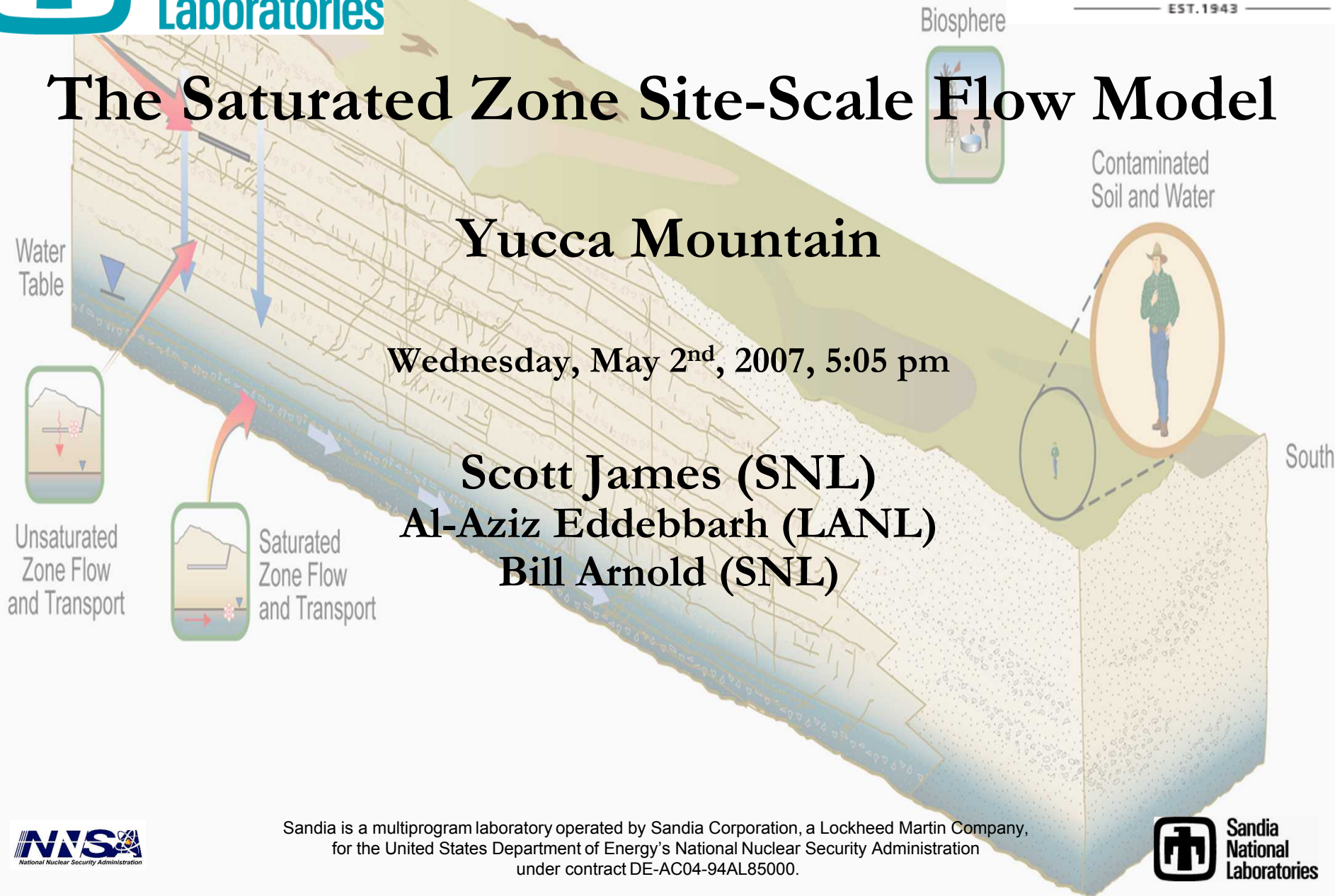
SAND2007-2357C

The Saturated Zone Site-Scale Flow Model

Yucca Mountain

Wednesday, May 2nd, 2007, 5:05 pm

Scott James (SNL)
Al-Aziz Eddebbarh (LANL)
Bill Arnold (SNL)

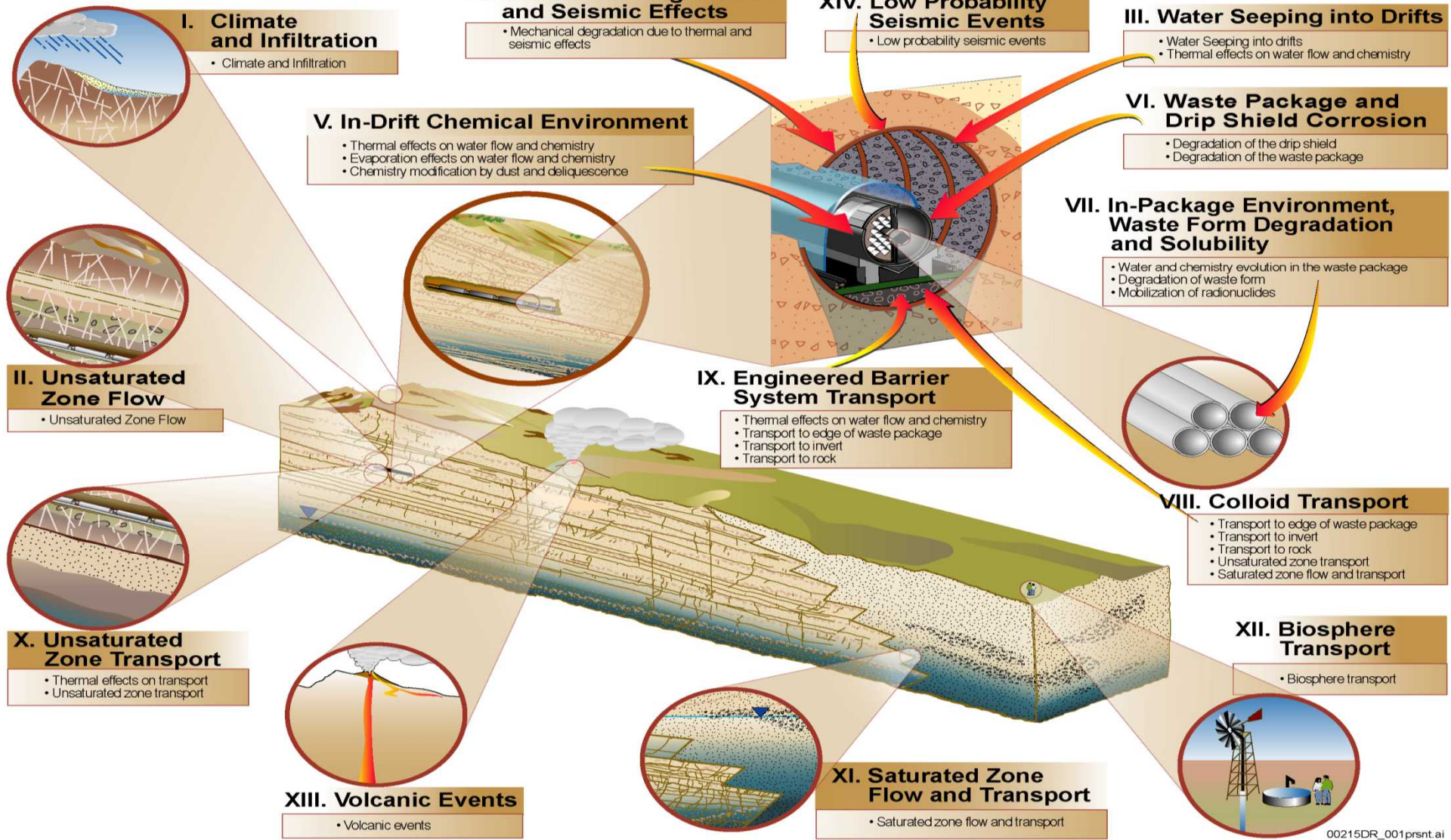


Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

NNSA National Nuclear Security Administration

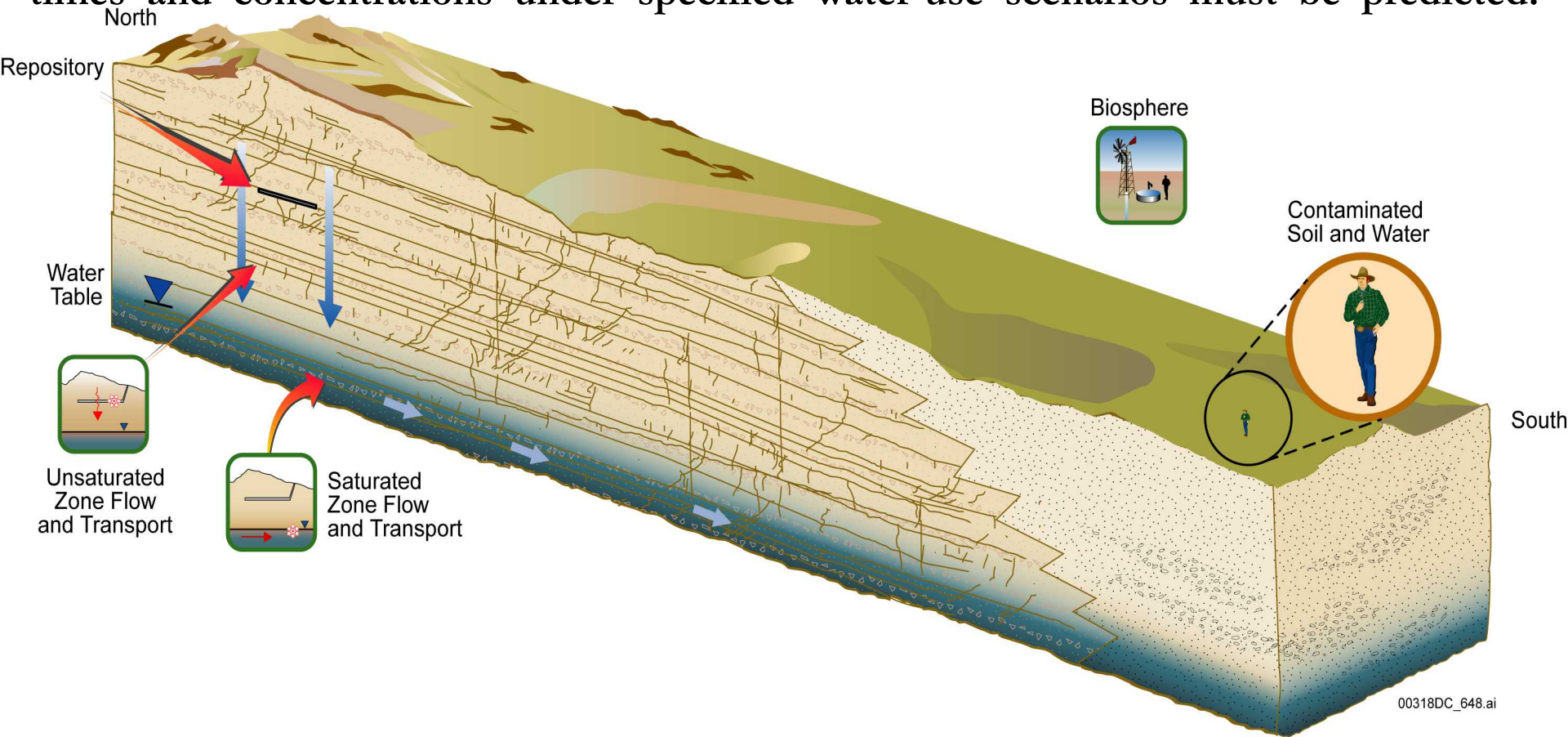
Sandia National Laboratories

The Yucca Mountain Project



The Yucca Mountain Project

A scientifically defensible model of flow and transport in the saturated zone is required to assess the ability of the natural system to retard the migration of radionuclides escaping the engineered system and reaching the groundwater. Travel times and concentrations under specified water-use scenarios must be predicted.



Purpose

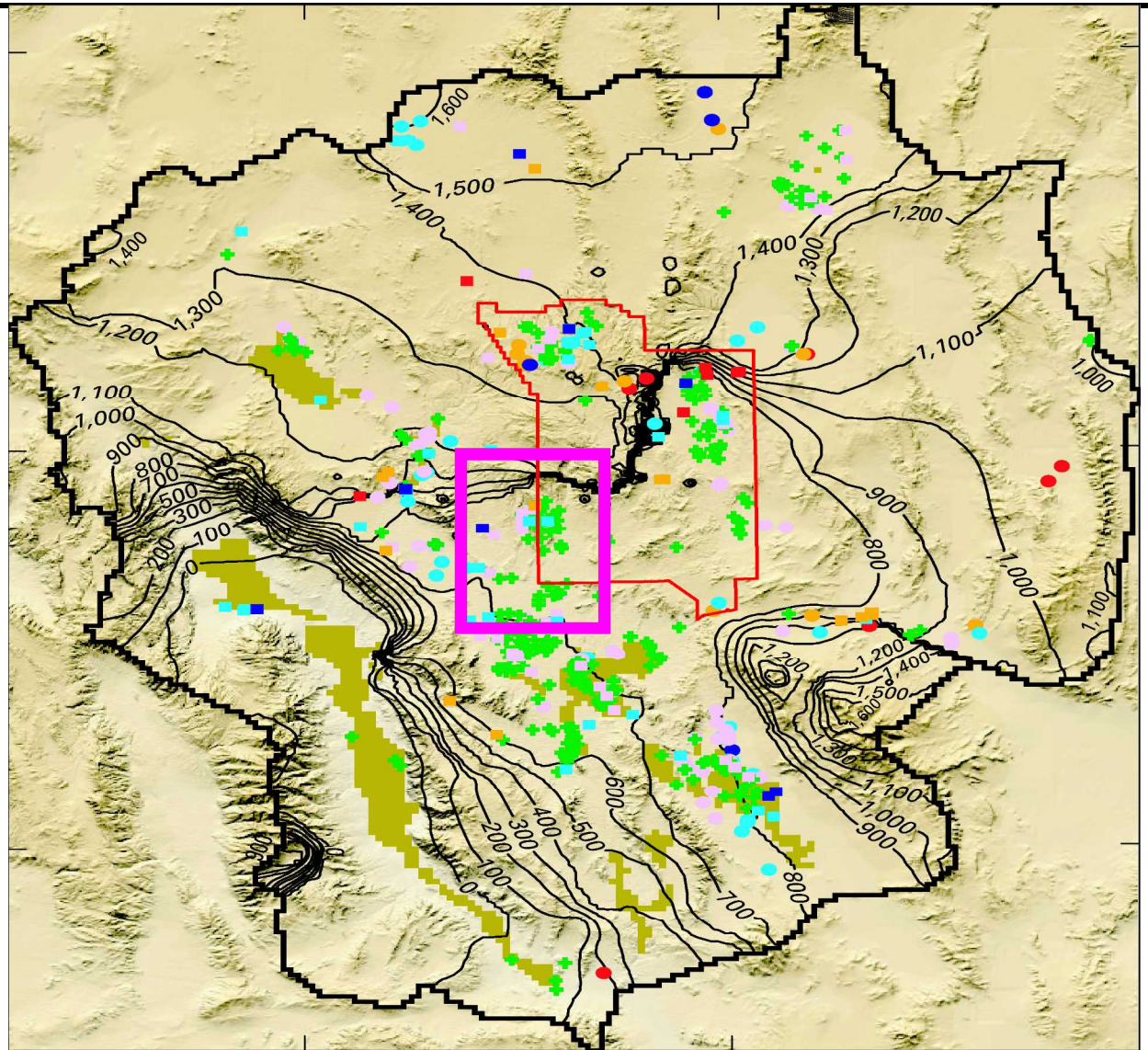
- Update the *Saturated Zone Site-Scale Flow Model* Analysis and Model Report (2004)
- This model develops flow fields in the saturated zone that can be used to estimate specific discharge
- This model provides direct input to the *Saturated Zone Site-Scale Transport* and *Saturated Zone Flow and Transport Model Abstraction* Model Analysis and Model Report

Model Advances

- HFM2006 (27 HGUs to match 2004 DVRFS)
- Refined grid, 500×500 m^2 with 67 layers (used to be 250×250 m^2 with 39 layers)
- Model ranges from −4,000 to 2,200 m (used to be −2,750 to 1,200 m)
- 956,345 total nodes (used to be 142,853)
- Improved fault representation (from USGS)
- Infiltration and boundary condition flux targets from the 2004 DVRFS
- New water-level data

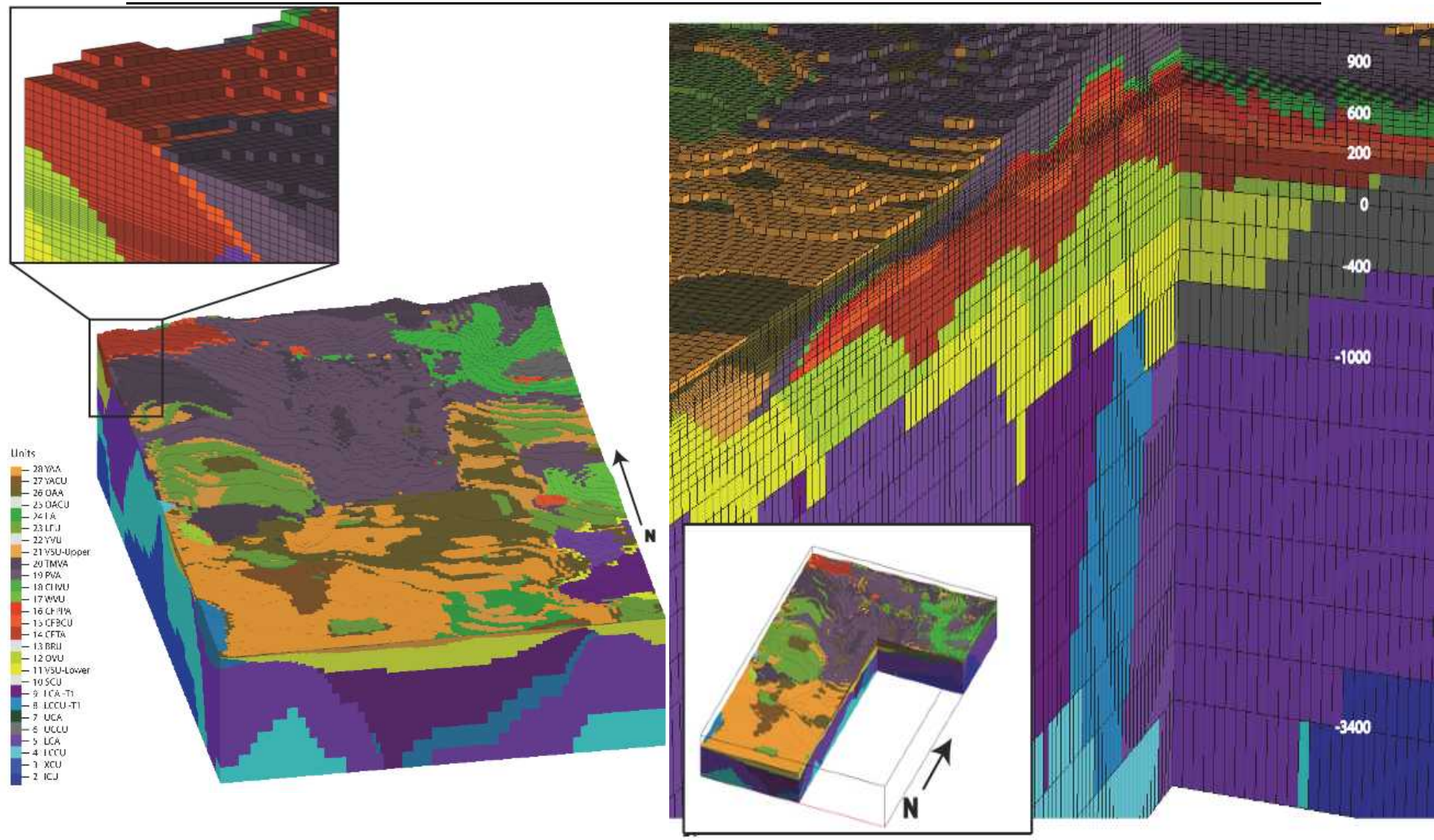
Sandia National Laboratories

Location

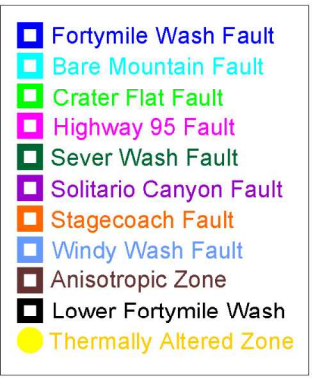


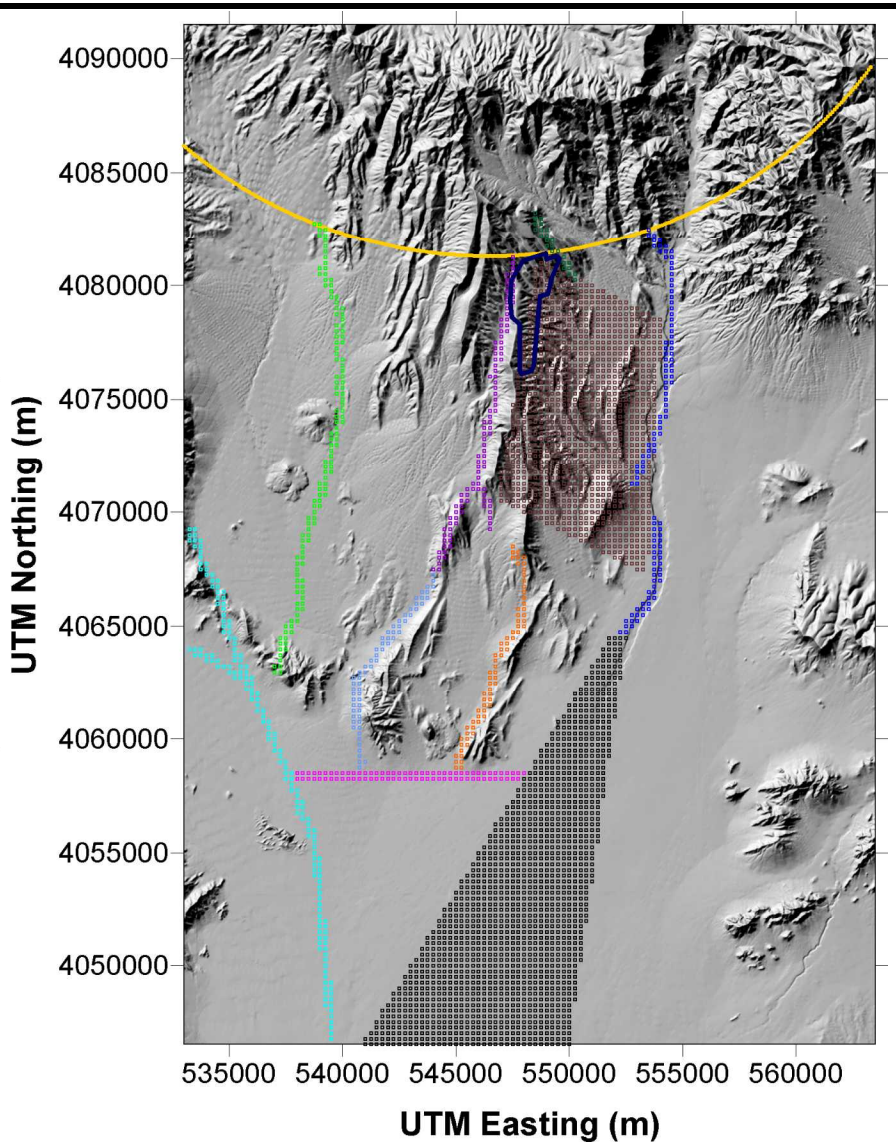
Sandia National Laboratories

LaGriT v1.1 Grid



Features

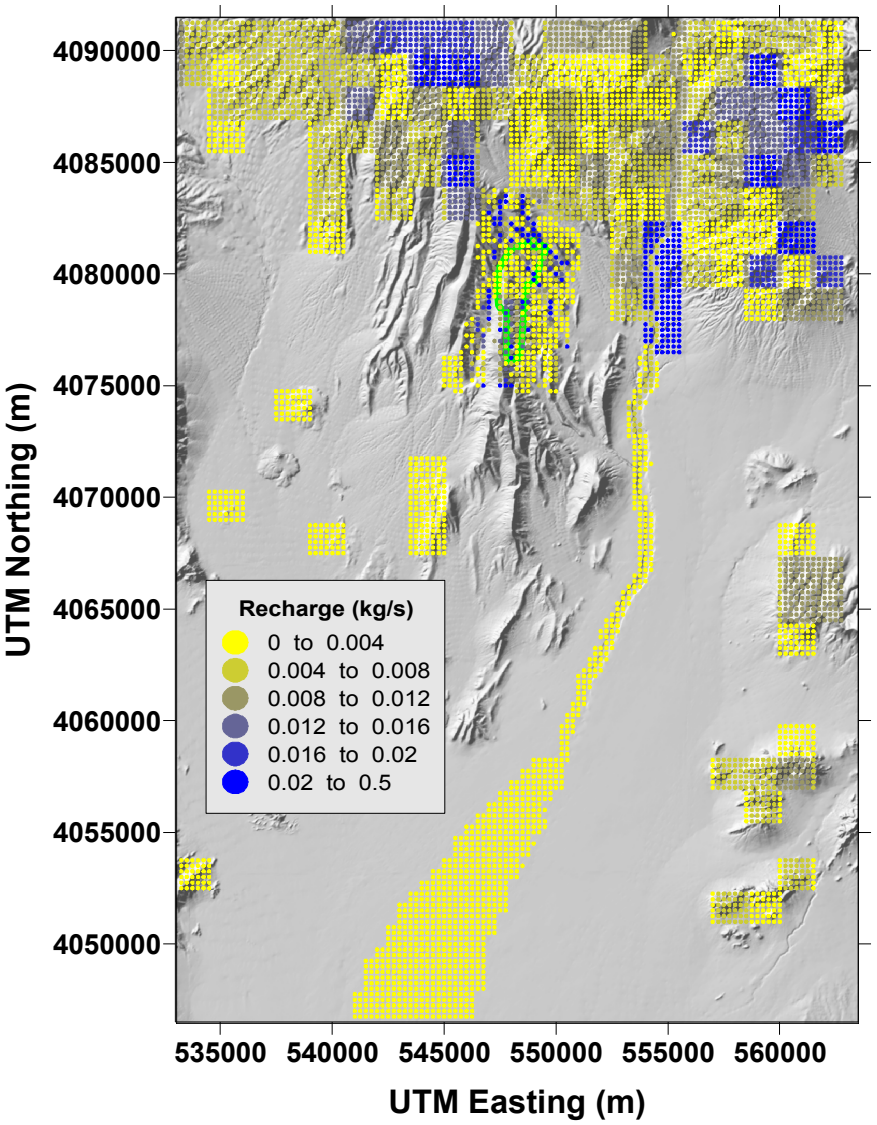




Fortymile Wash Fault
Bare Mountain Fault
Crater Flat Fault
Highway 95 Fault
Sever Wash Fault
Solitario Canyon Fault
Stagecoach Fault
Windy Wash Fault
Anisotropic Zone
Lower Fortymile Wash
Thermally Altered Zone

Sandia National Laboratories

Infiltration

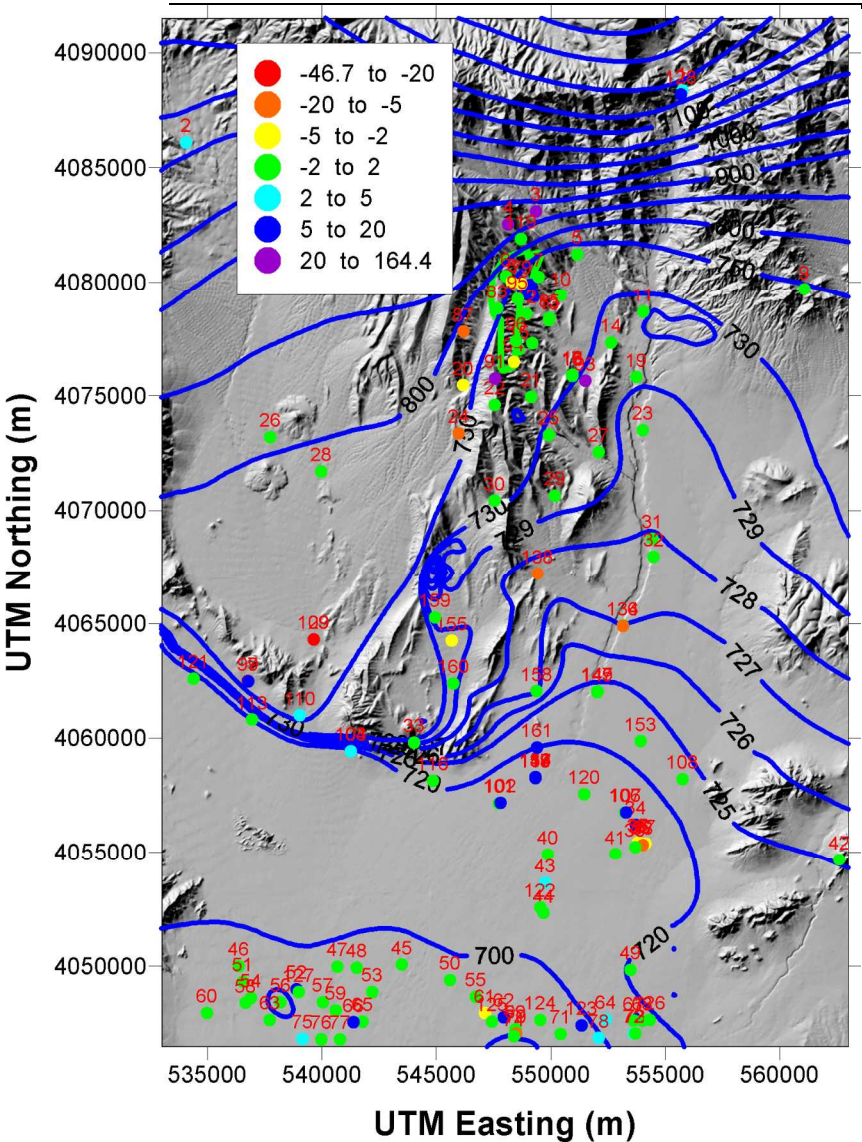


Three sources of mass flow:

- The first stress period of the 2004 DVRFS model (61.3 kg/s)
- The bottom boundary of the 2003 UZ site-scale flow model (5.6 kg/s)
- Infiltration through Fortymile Wash (2.0 kg/s)

Sandia National Laboratories

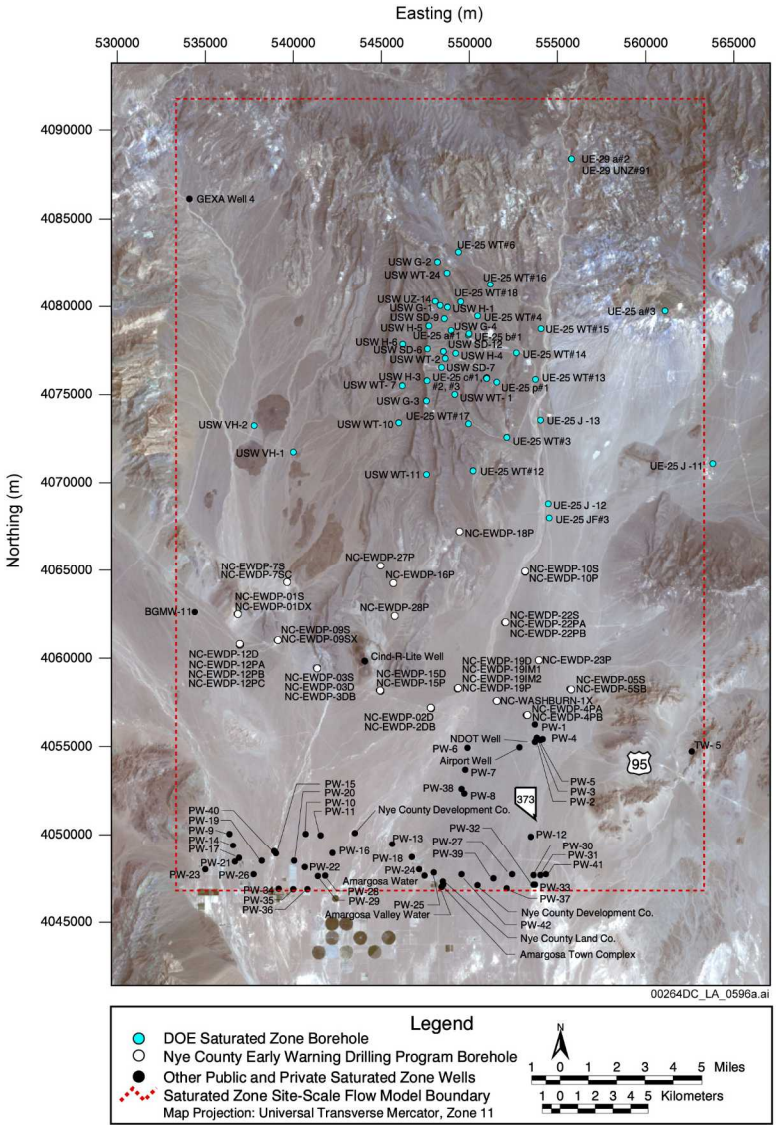
Constant Head BCs



Heads along the model boundaries are extracted from the best estimate of the potentiometric surface, which is an update of previous potentiometric surfaces that now uses water-level altitudes measured through 2005 (NC–EWDP wells)

Sandia National Laboratories

Well Locations



Total number of calibration head measurements: **166** (used to be 113)

Total number of wells: **136**

Nye County wells: **33**

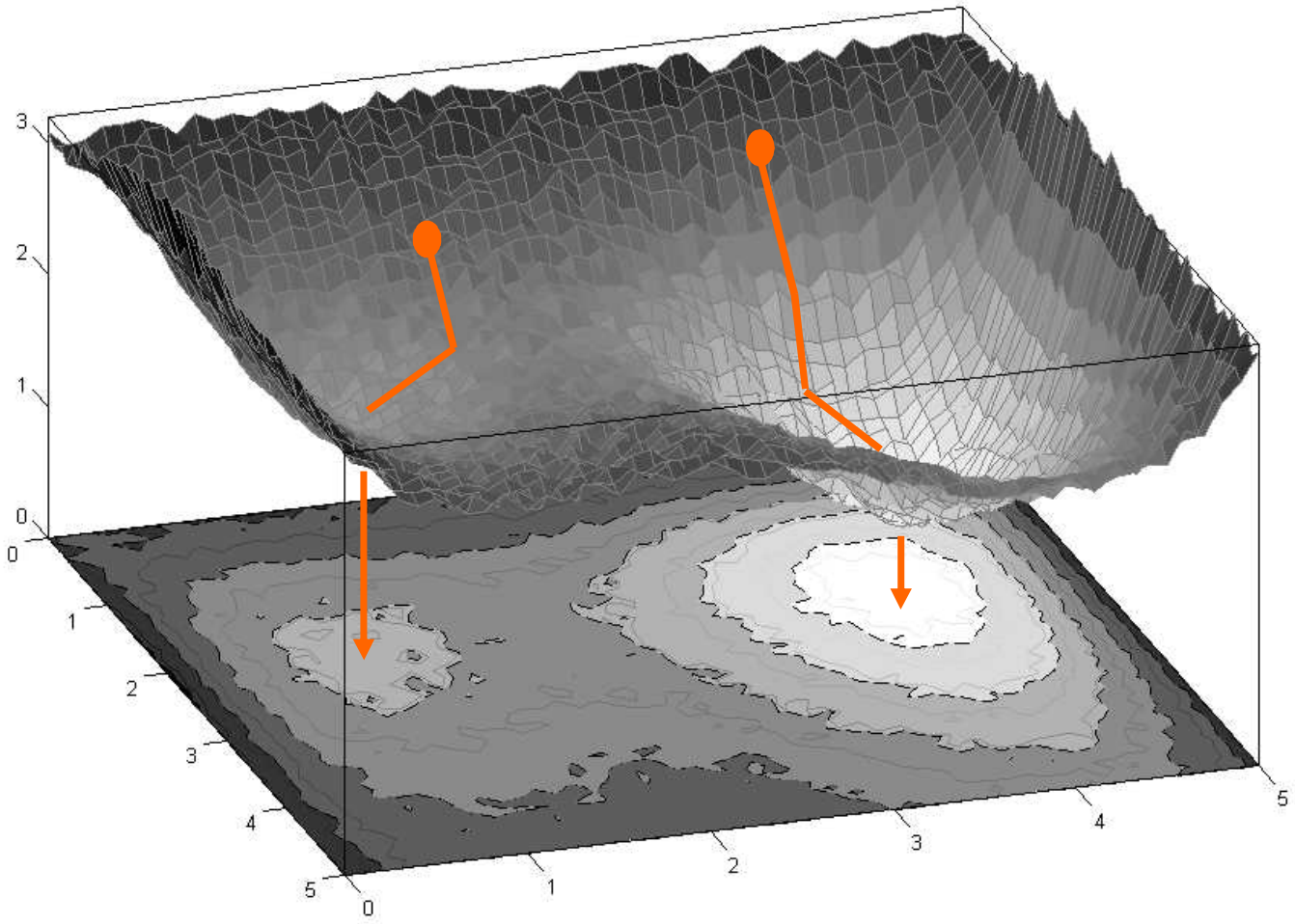
Sandia National Laboratories

Calibration

- (Parameter Estimation) PEST v5.5 used to run (Finite Element Heat and Mass) FEHM v2.24
- Initial guesses for unit permeabilities are based upon site data
- 23 unique hydrogeologic units (15 additional permeability multipliers for the altered northern region)
- 8 fault permeabilities
- 1 permeability for the Lower Fortymile Wash alluvium

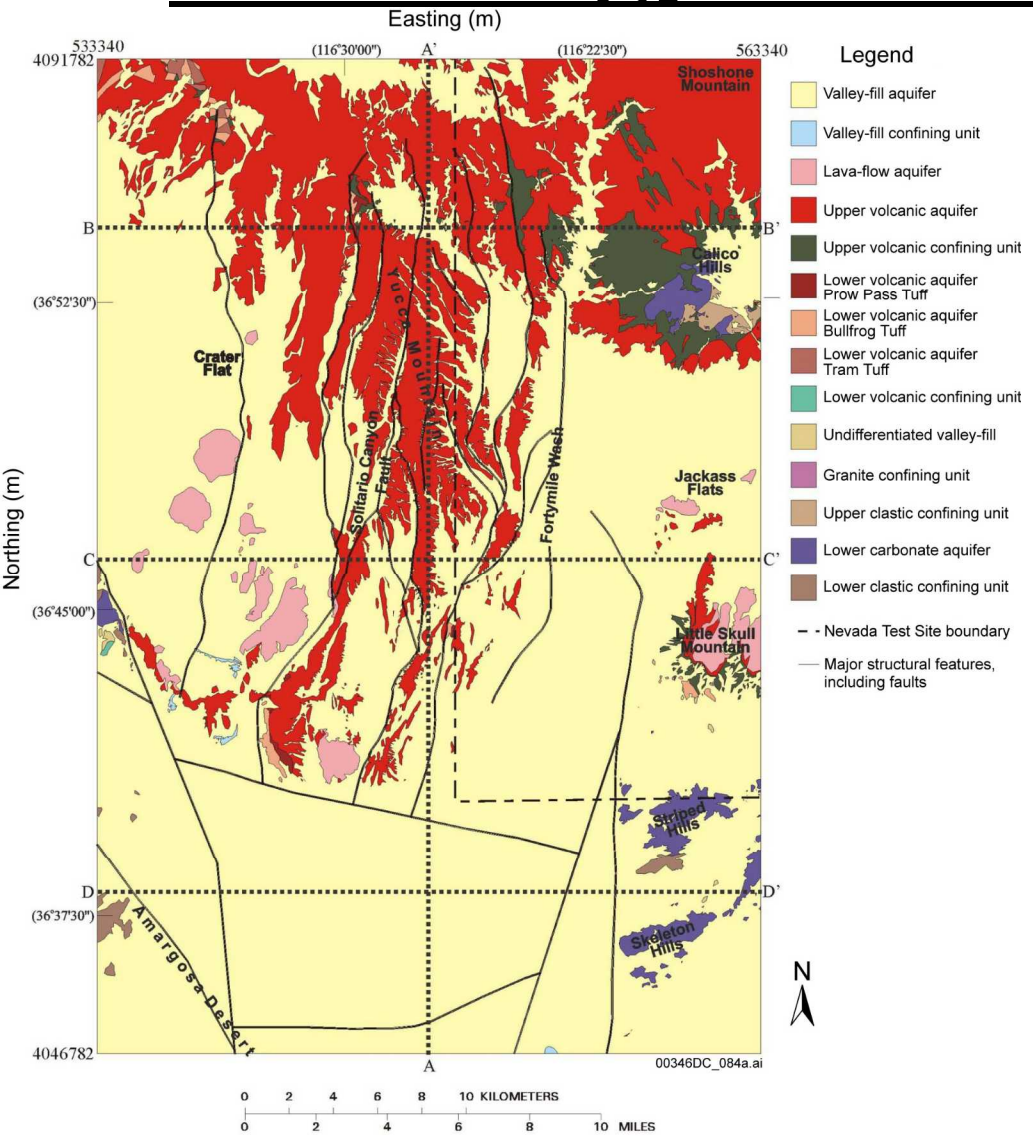
Sandia National Laboratories

Flat Response Surface



Sandia National Laboratories

Lithology at the Water Table

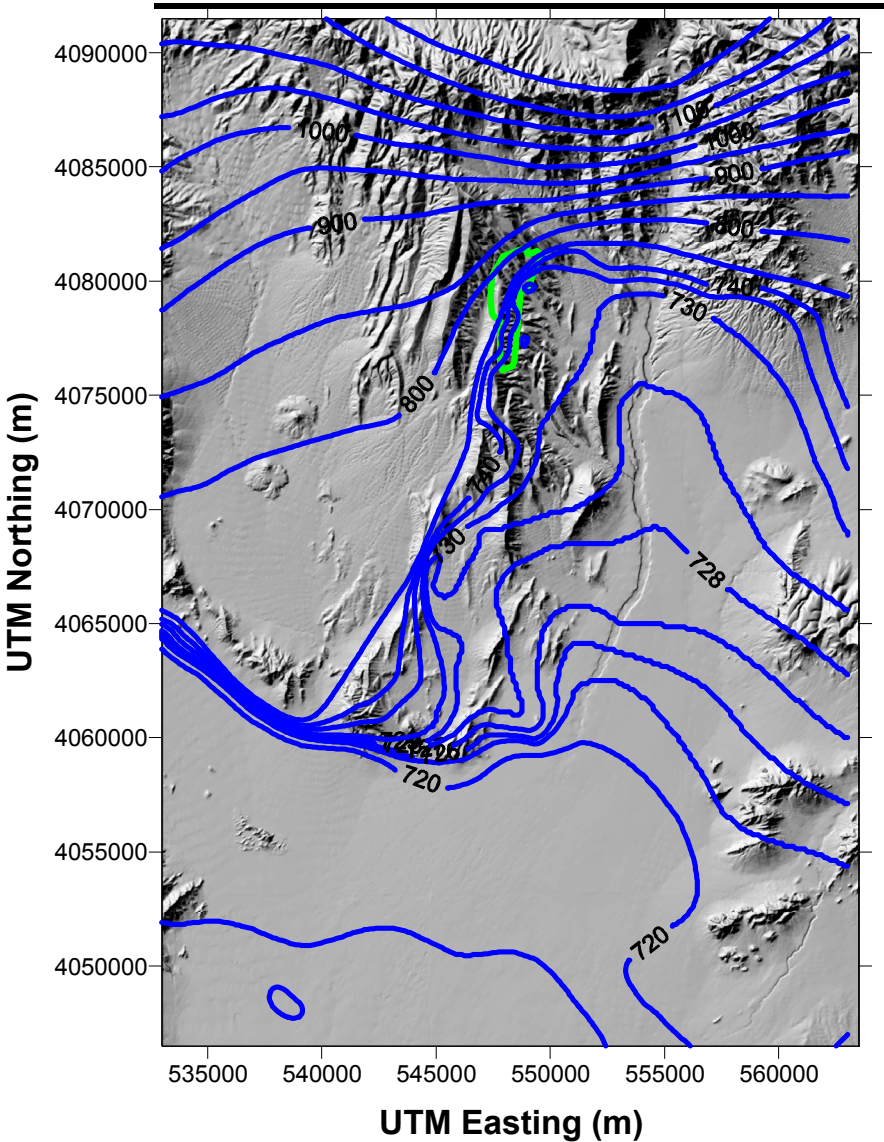


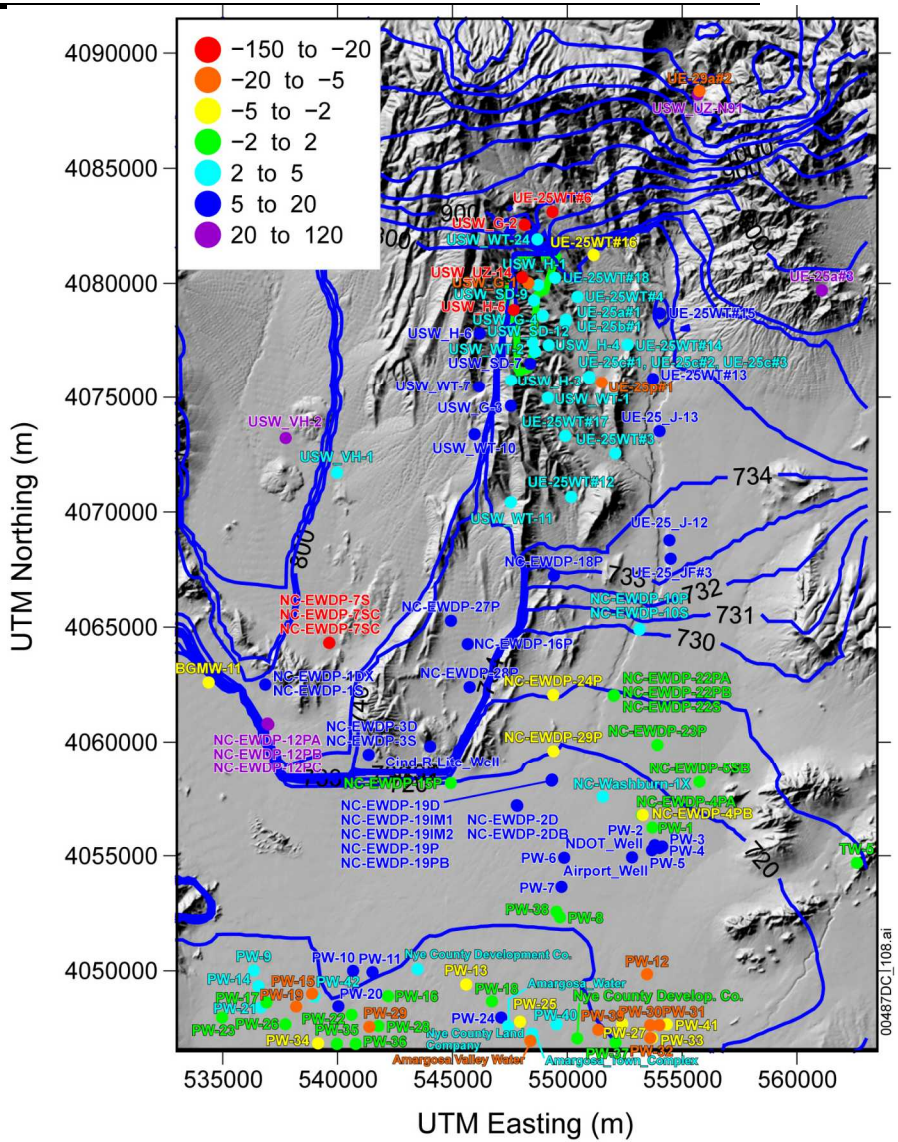
Volcanics: red

Alluvium: yellow

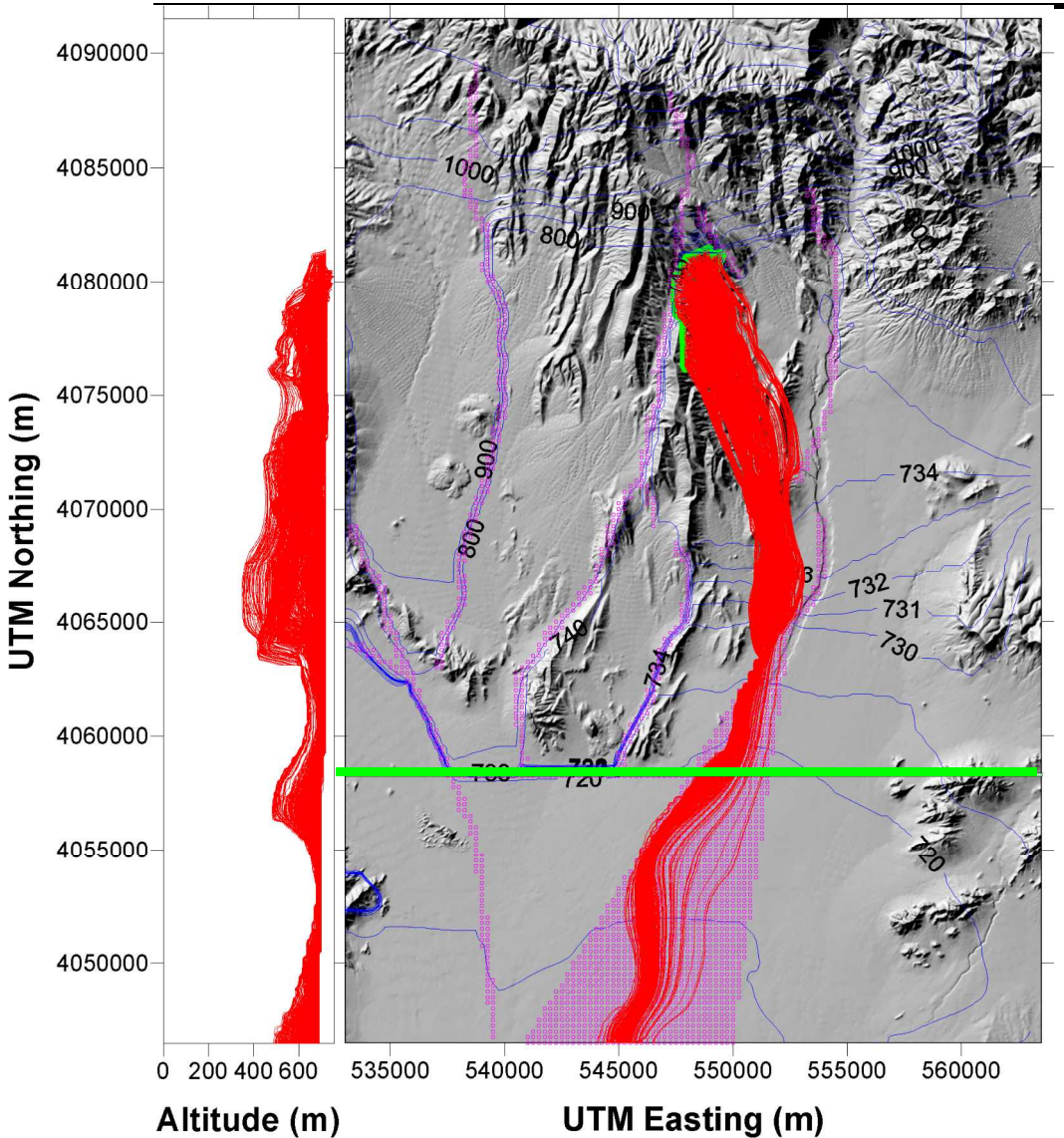
Sandia National Laboratories

Potentiometric Surface





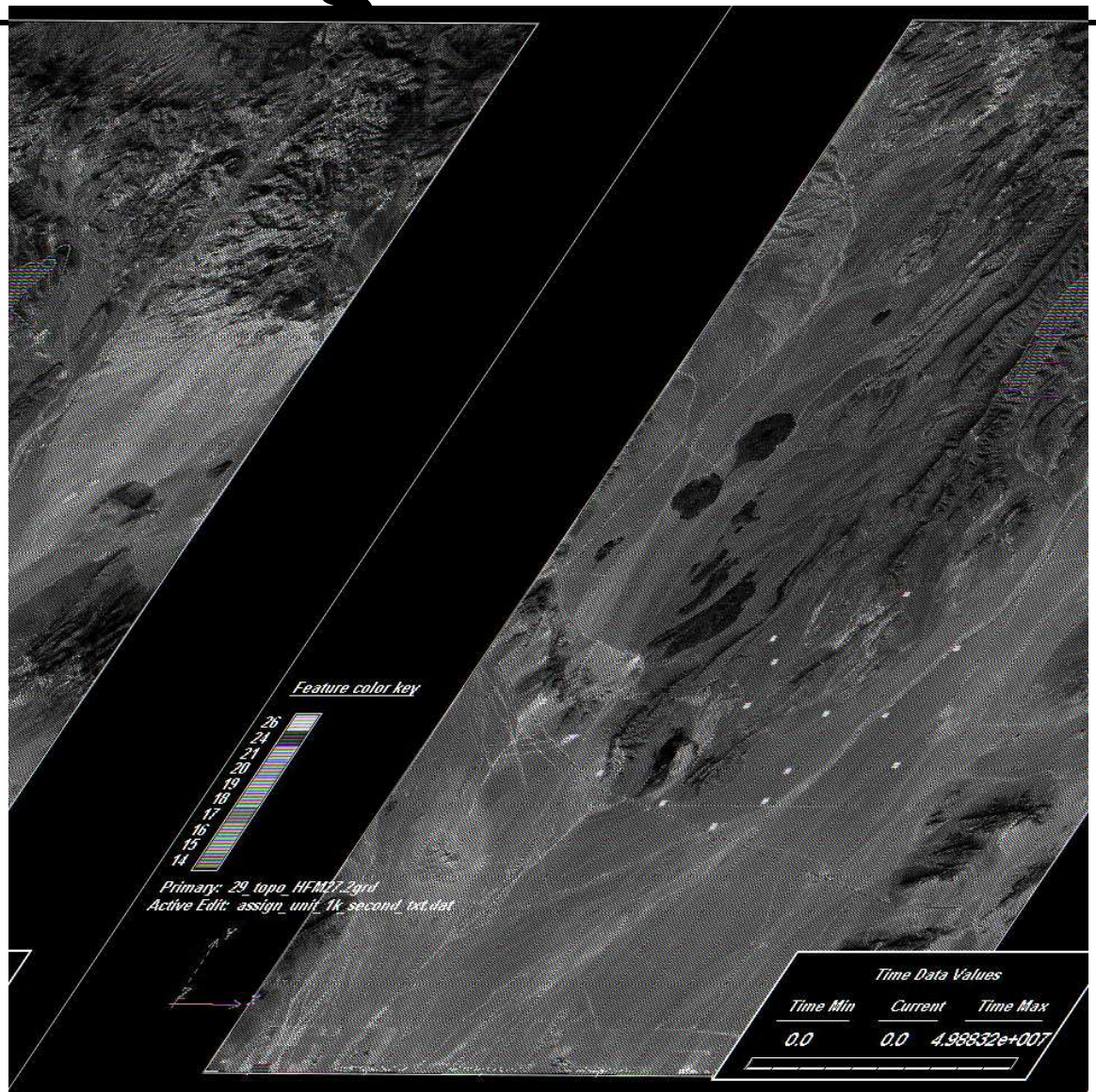
Particle Tracks



1,000 particles distributed randomly below the footprint of the repository flow southeast until they enter the Lower Fortymile Wash Alluvial zone where they cross the 18-km compliance boundary

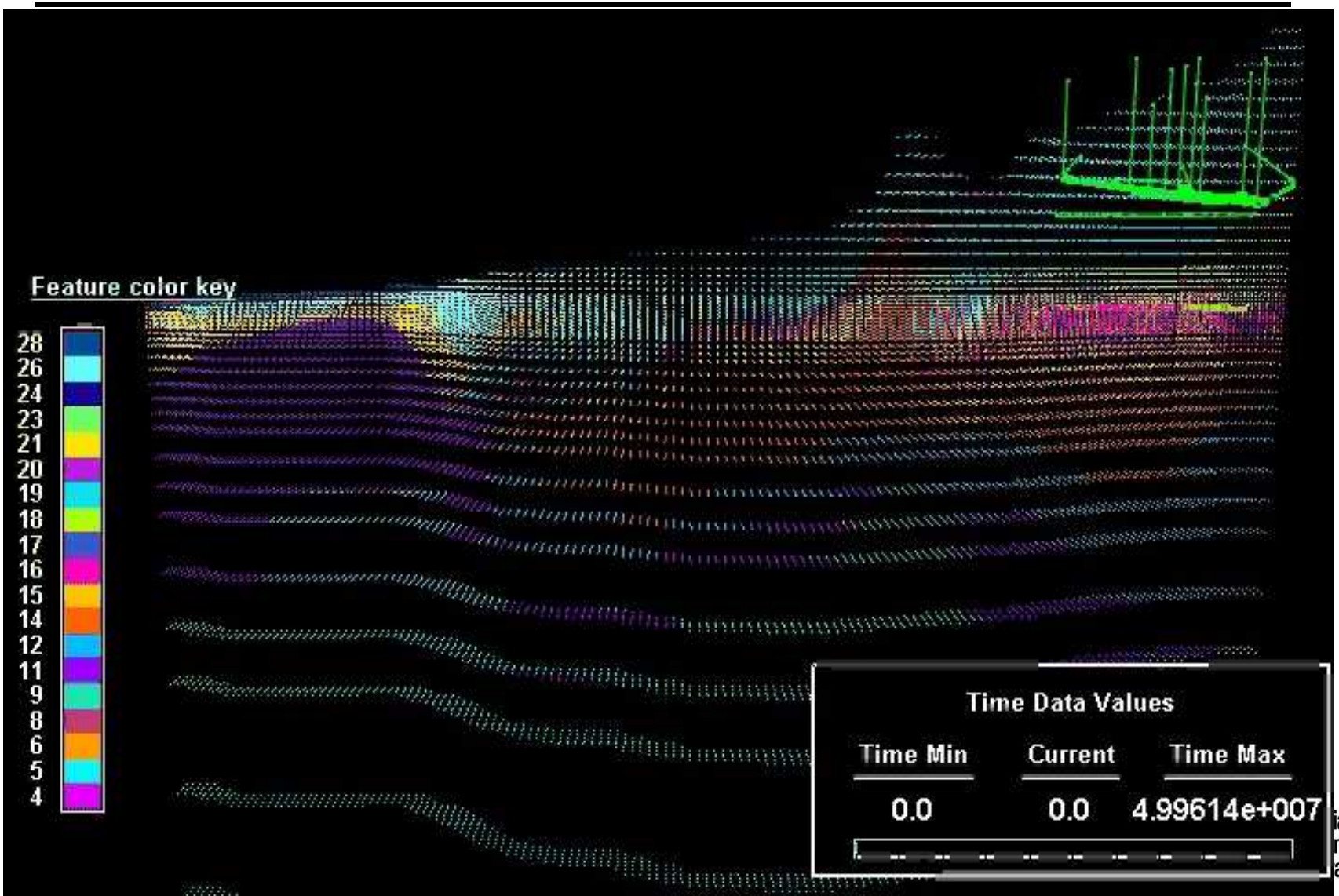
Sandia National Laboratories

Evolving Particle Tracks

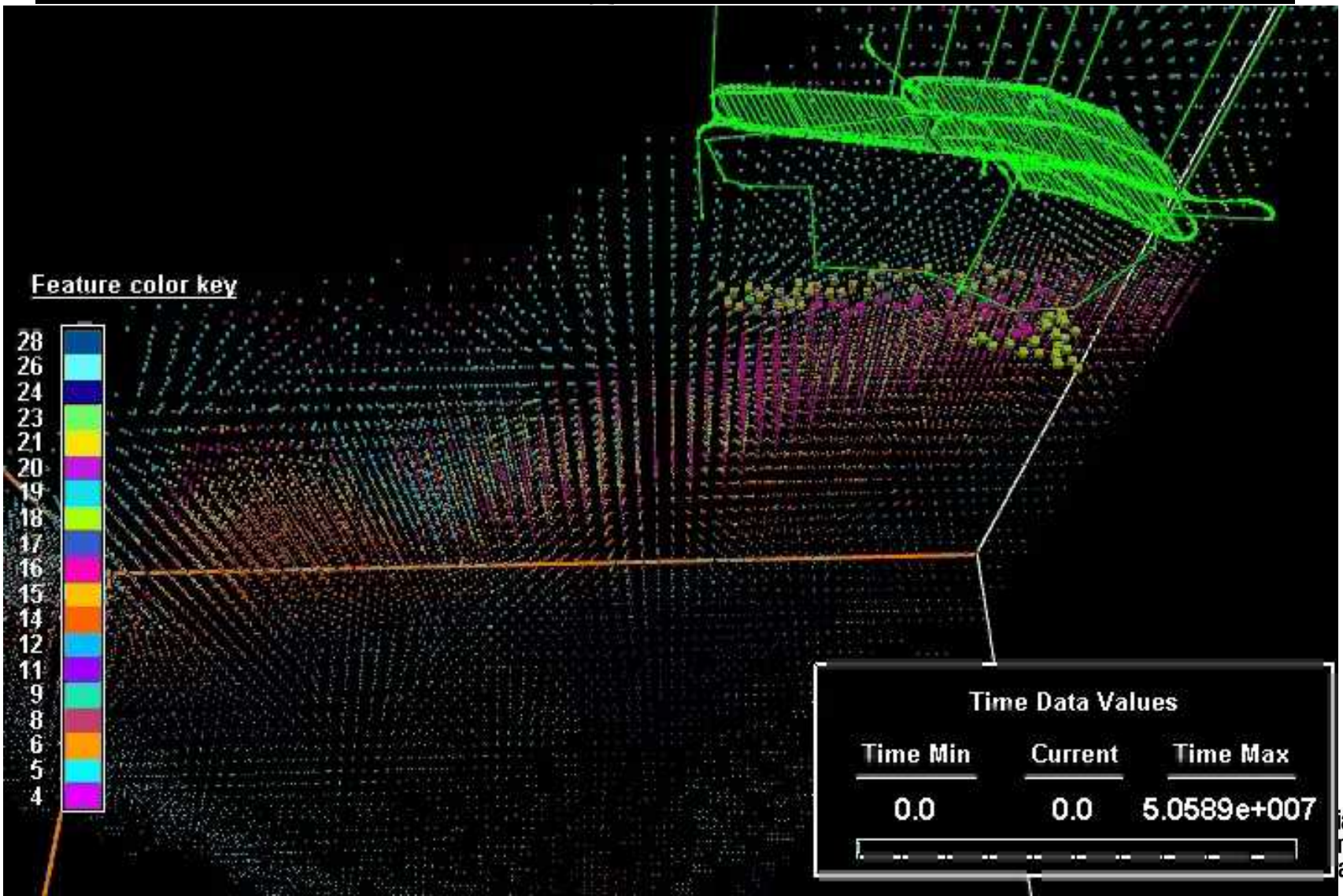


Sandia National Laboratories

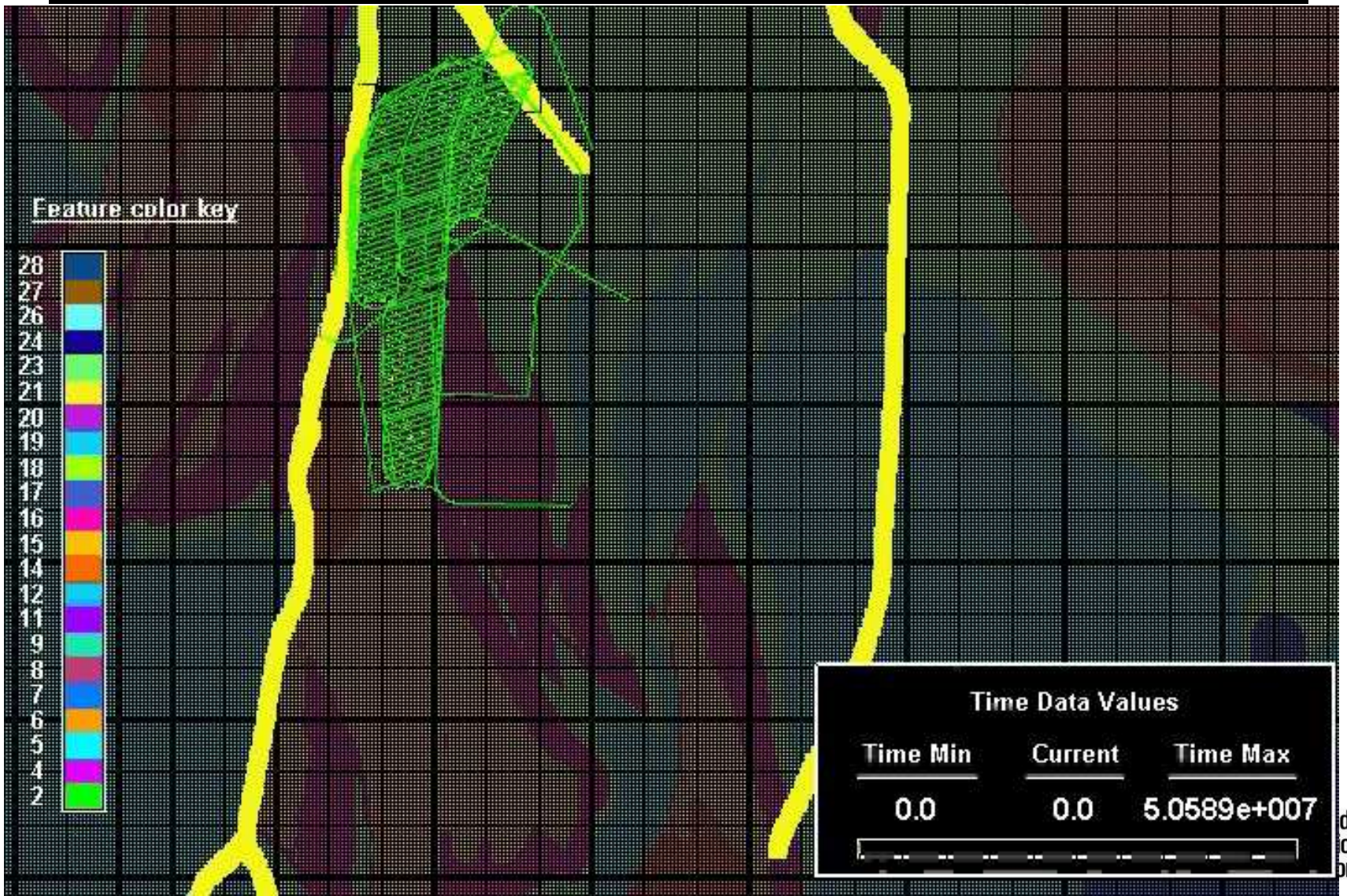
Side View


Feature color key
28
26
24
23
21
20
19
18
17
16
15
14
12
11
9
8
6
5
4
Time Data Values
Time Min
Current
Time Max
0.0
0.0
4.99614e+007

Oblique View



Plan View Close-up



Thank you

Sandia National Laboratories