# Demonstration of Wide Area Assessment Technologies to Characterize Munitions Density

## Closed Castner Firing Range
## Fort Bliss, TX

Restoration Advisory Board Meeting
4 August 2010

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# Agenda

- Project Team
- Review project objectives
- Helicopter-borne Magnetometry Results
- Ground-based Geophysics Results
- Weight of Evidence
- Intrusive Investigation
- Schedule Update & Questions

# Points of Contact

- US Army Environmental Command: Ms. Kimberly Watts and Mr. Scott Reed
- US Army Corps of Engineers, Omaha: Mr. Jerry Hodgson
- US Army Corps of Engineers, Huntsville: Mr. Andy Schwartz and Mr. Bill Veith
- URS: Ms. Victoria Kantsios and Mr. Brian Helmlinger

# Project Objectives

# Characterization Challenge

- Millions of acres of closed ranges in Military Munitions Response Program (MMRP) site inventory
- Many acres do not contain Unexploded Ordnance (UXO)
- Need methods to cost effectively:
  - Focus characterization efforts on areas used for munitions related activities
  - Eliminate areas with no indication of munitions use

# Full Coverage: "Mag and Flag"

# Project Purpose

- Field test the WAA methods and conclusions included in the *Wide Area Assessment Cost-Benefit Analysis: Active Army Military Munitions Response Program* (USAEC 2009)
- Collect site characterization data using a variety of WAA methods in a manner to ensure usable data for subsequent MMRP investigations (i.e., RI/FS)

# Objective

Demonstrate non-traditional technology applications for detecting munitions on Army property

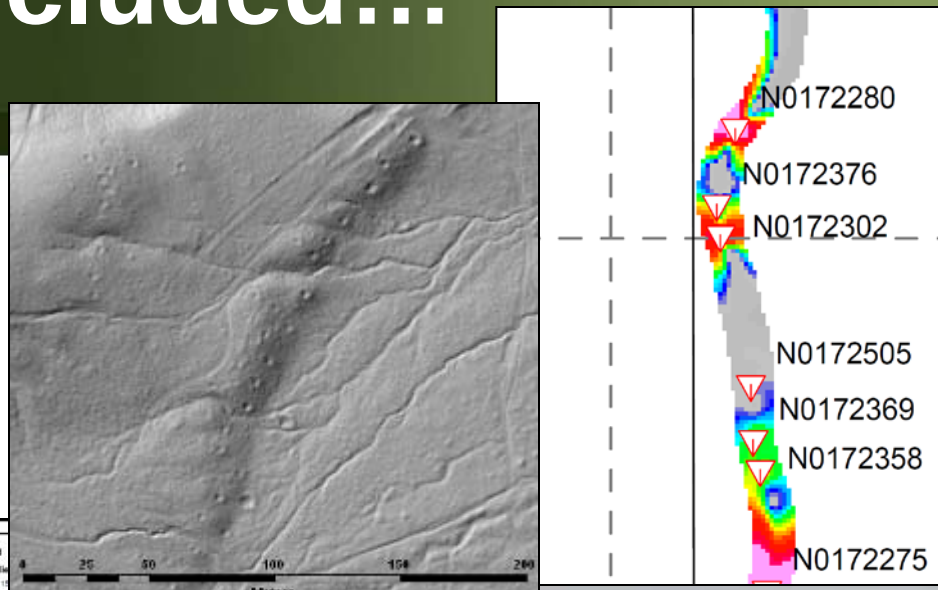
- Determine areas with evidence of past military munitions use
- Determine relative density of anomalies across these areas
- Determine areas with minimal evidence of past military munitions use

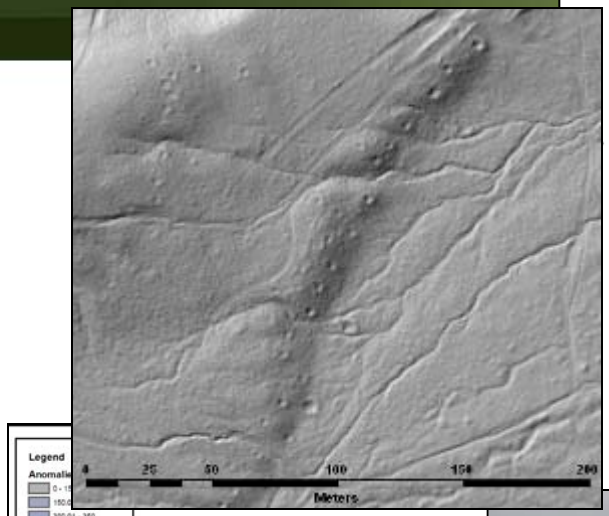
# What is not included…

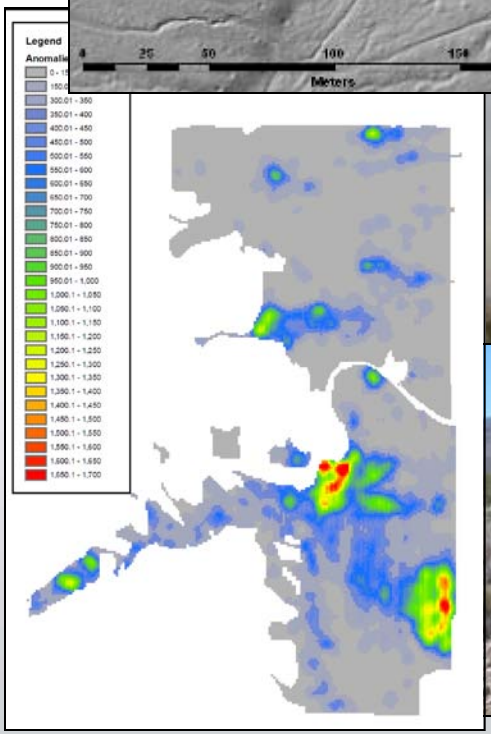
- Remedial Investigation
- Decisions about future land use
- Decisions about transferring the property
- Decisions about developing the property
- Decisions about mapping individual ordnance items
- Decisions about cleaning-up all the munitions

# What is included…

- Collecting data about the distribution and density of munitions on Closed Castner Range
- Demonstrating costs and benefits of applying proven technologies in innovative ways






# Project Scope

- Site Reconnaissance
- Lidar & Orthophotography
- Site Prep
  - Survey
  - Run VSP
  - Mark Transects
  - Install IVS
- Helicopter-borne Magnetometry
- Ground-based Geophysics (towed array & man-portable EMI)
- Analog Data Collection
- Intrusive Investigation
- Project Reports
  - WAA Field Demonstration Report for Castner Range
  - Revised WAA Cost-Benefit Analysis: Active Army MMRP
  - WAA Cost Estimating Equations

Complete: Results discussed at January RAB meeting

Complete. Results discussed today.

Yet to do.

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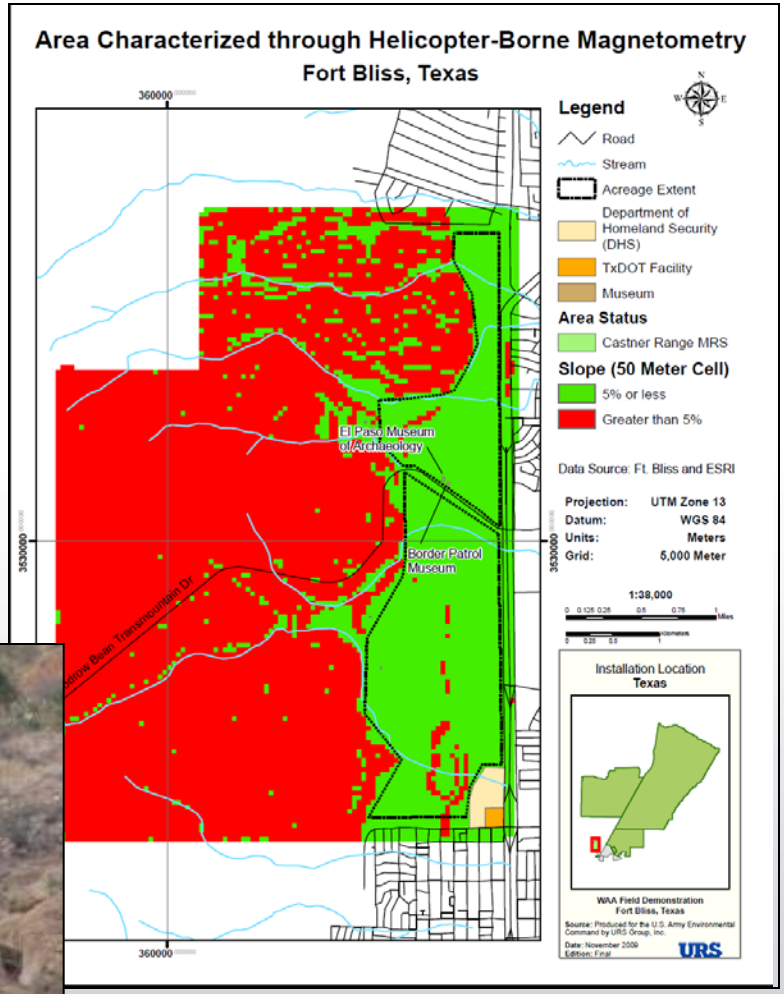
# Helicopter-borne Magnetometry

# Helicopter-Borne Magnetometry

- Objective: Map relative densities of ferrous metals
- Fly 1-3m above ground surface
- 7 sensors spaced 1.5m apart; provide swath width of approx 9m
- Flight lines 7m apart provide for 2m overlap
- 100% coverage of survey area (approx 1,577 acres; < 5% slope)
- Approx 300 - 500 acres/day
- 11 - 14 January 2010

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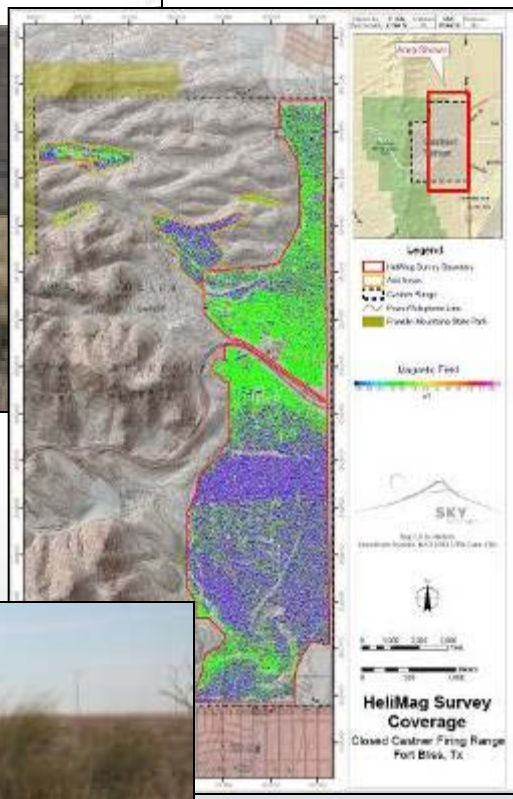
# Helicopter-Borne Magnetometry Results

- Production rate higher than expected; flew 500-700 acres/day
- Site conditions limited utility of helicopter-borne magnetometry
  - Magnetic geology more extensive than expected (created noise)
  - Vegetation more problematic than terrain (high altitude, low probability of detection)
- Data do not support conclusions about density and distribution of ferrous material at the site




# Ground-based Geophysics

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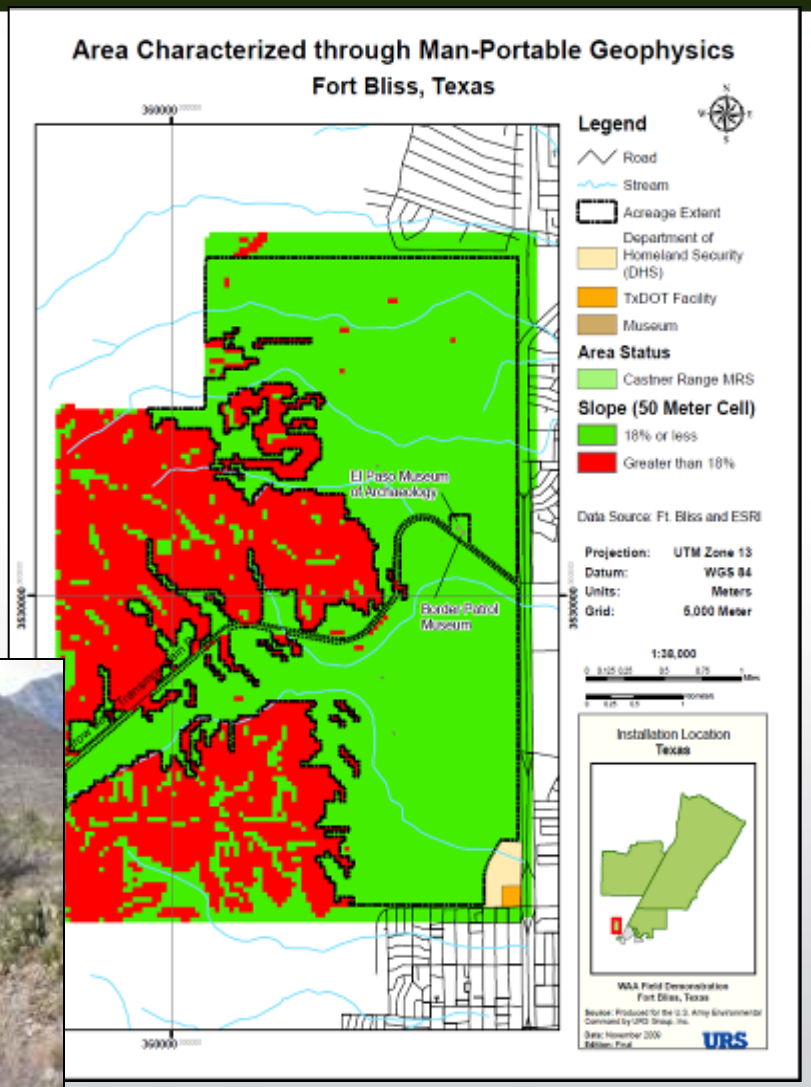
- Man-portable (litter) EMI array with transect-based coverage
- Estimated characterized acreage is 4,020
- Approximately 1 million linear feet of transects
- Performers: NAEVA Geophysics and Sky Research
- 27 Jan – 18 Feb 2010

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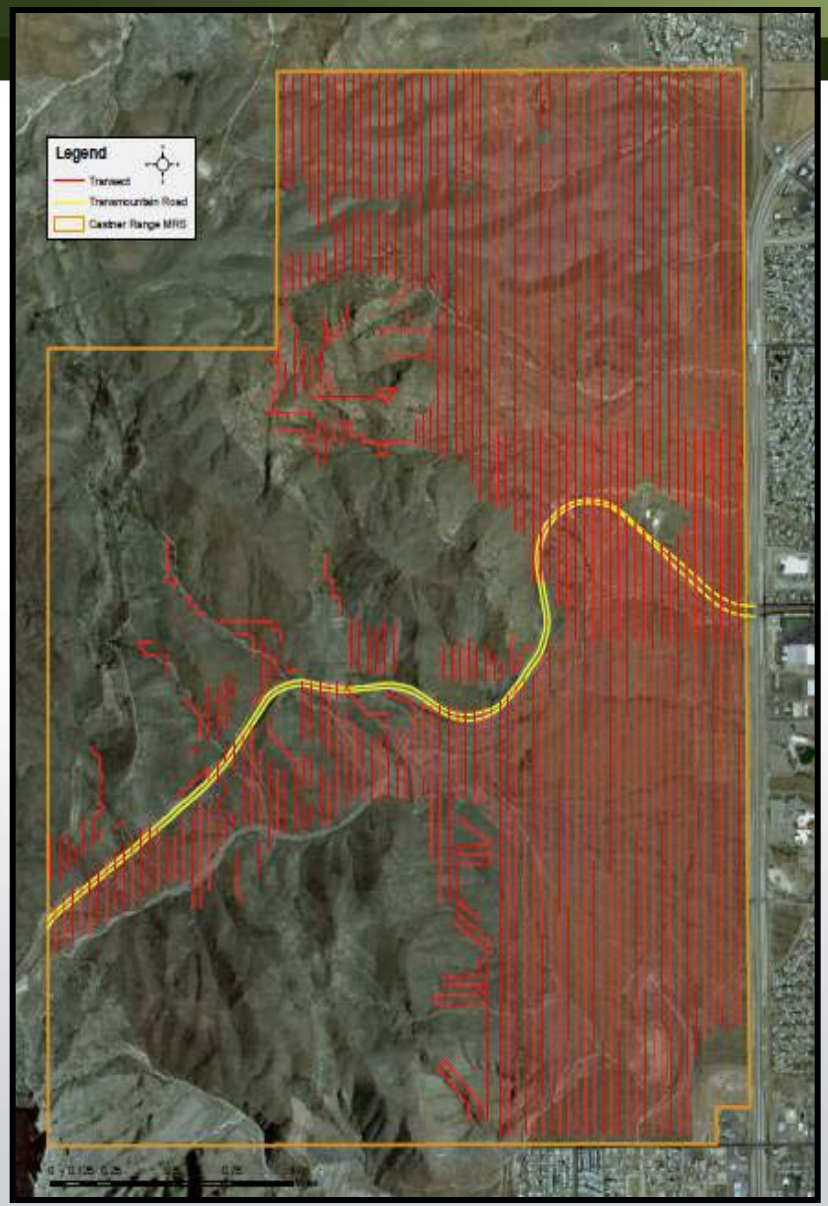
# Ground-Based Geophysics: Preliminary Results

- Able to characterize nearly all terrain up to 18% slope
- Production rates higher than anticipated
- Litter mode increases levels of uncertainty/error in DGM data
- Reproducibility of transect data is surprisingly good

Video

# Summary Statistics

- Collected data over >1 million linear feet (>200 miles) of transects
- Transect spacing approximately 57m apart
- Identified and georeferenced approximately 21,000 anomalies

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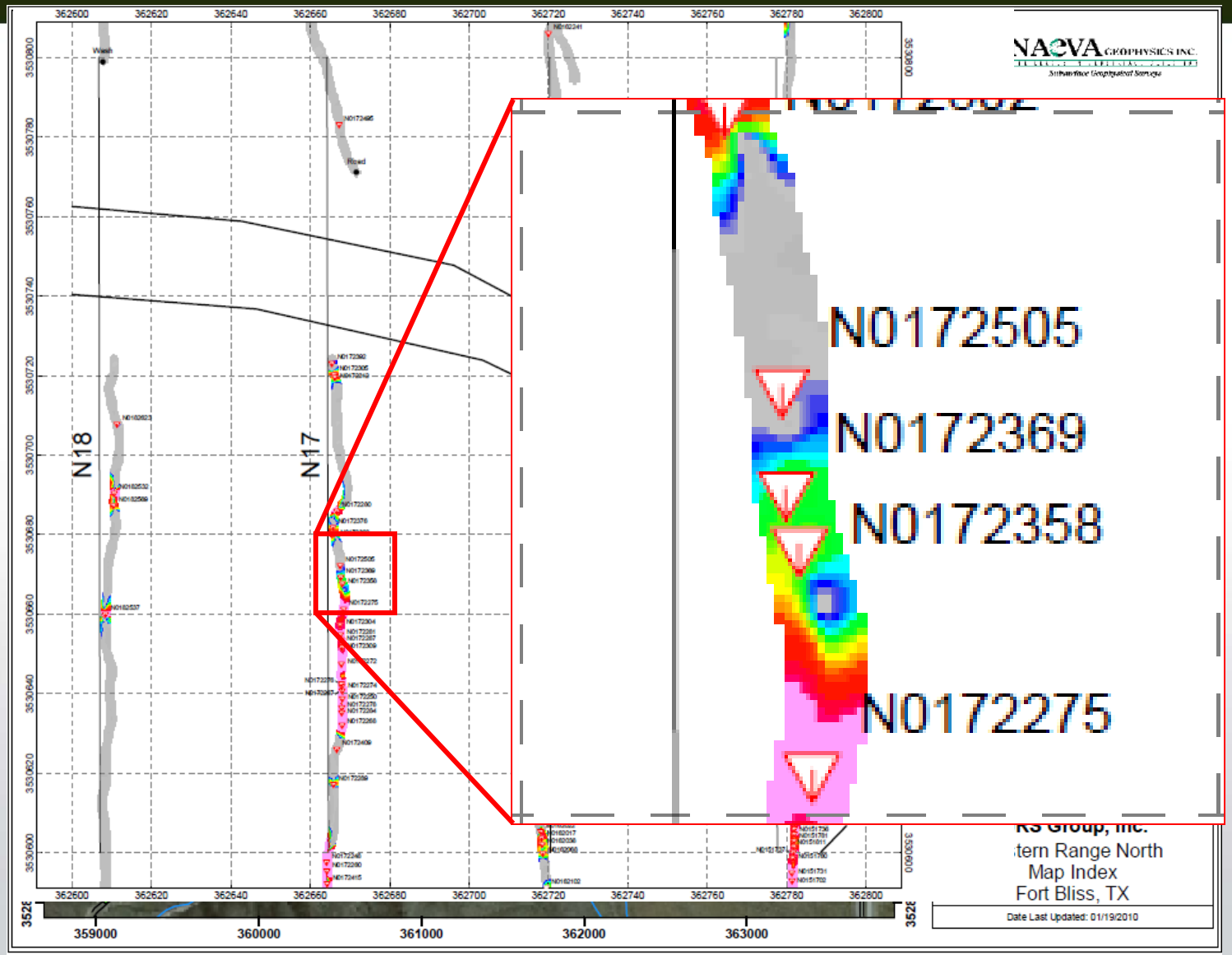
# Instrument Response and Anomalies



# Analog MEC Reconnaissance

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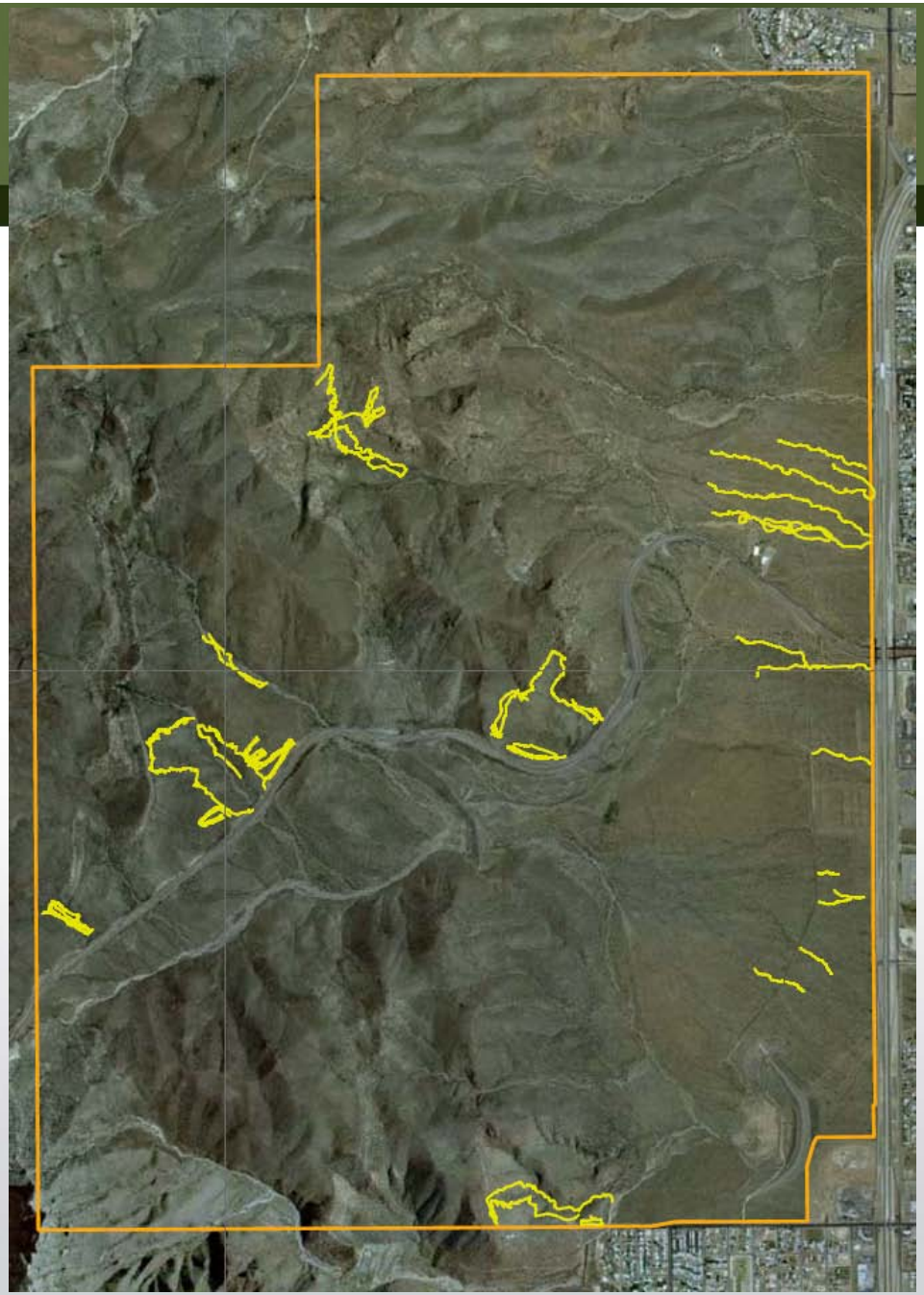
- Based on USACE, Huntsville Center, Programmatic Work Plan for MEC Reconnaissance Surveys
- Use hand-held EMI sensors (MineLab 2) and GPS/PDAs to map anomalies
- Acquire data in areas inaccessible by DGM teams due to terrain:
  - In the arroyos, to test hypothesis that relative anomaly densities are higher inside the arroyos than across the remainder of the site
  - Along the unofficial hiking trails within the mountainous terrain of the site
  - Collected data along approx 22 miles of terrain

Video

# Course of Analog Data Collection

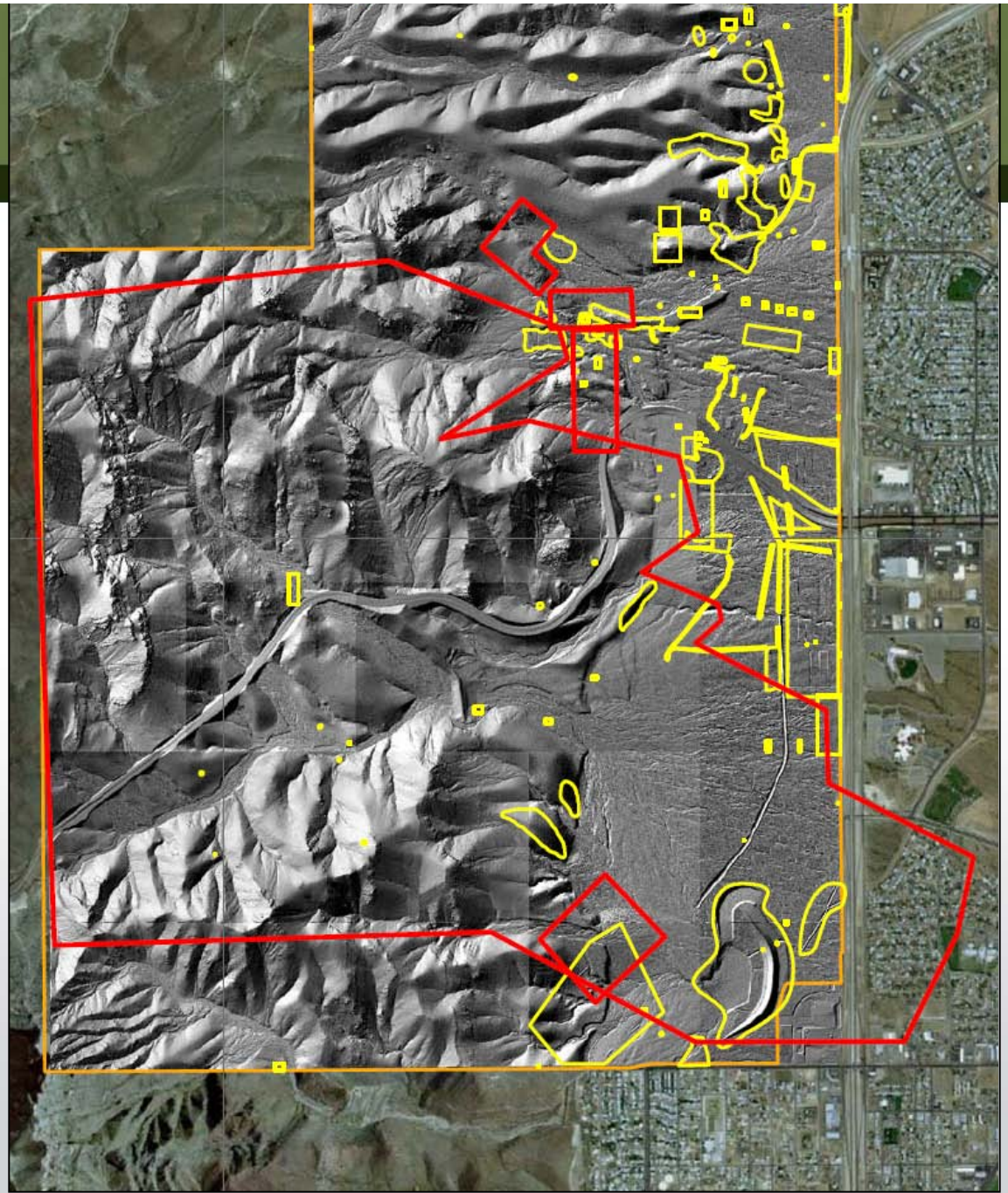


# Data Overlays

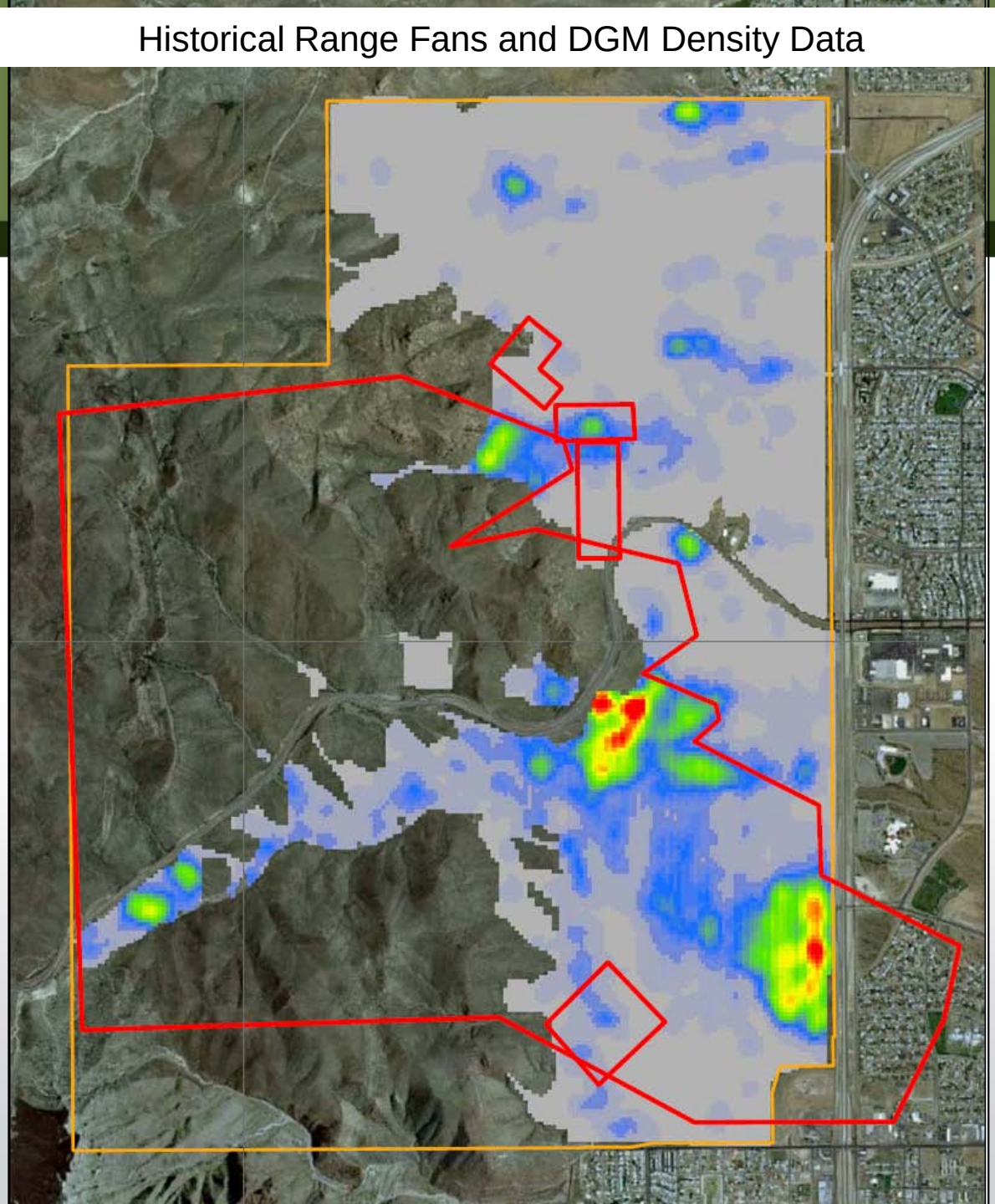
# Weight of Evidence

- Individually, data layers can be compelling
- Used together, multiple data layers corroborate, refute, expand on conclusions and increase level of confidence.
- Overlays:
  - Historical data
  - Recon/observational data
  - Optical sensor (lidar) data
  - Geophysical sensor data

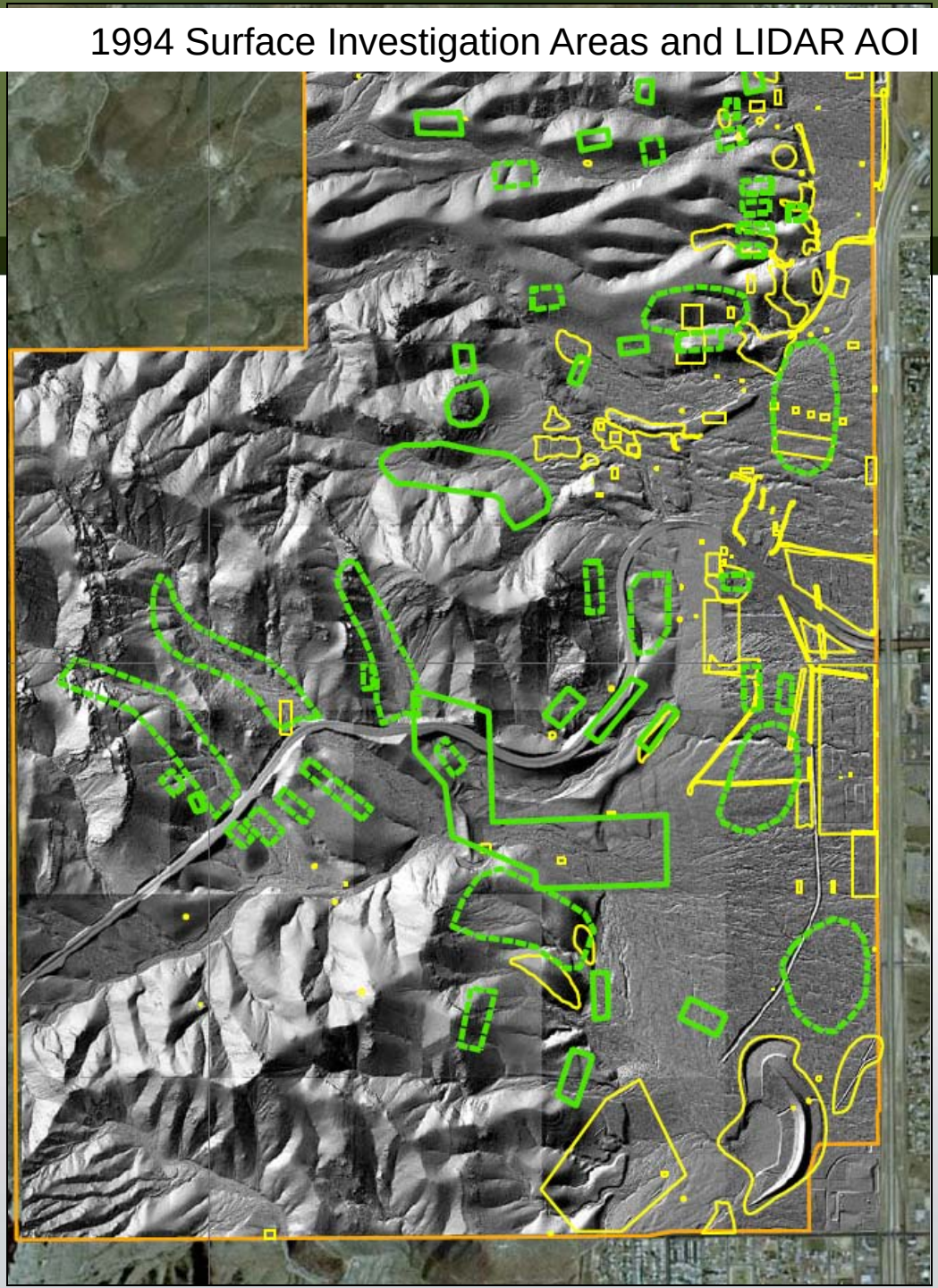
# Historical Range Fans and LIDAR Areas of Interest



# Historical Range Fans and DGM Density Data



# 1994 Surface Investigation Areas and LIDAR AOI



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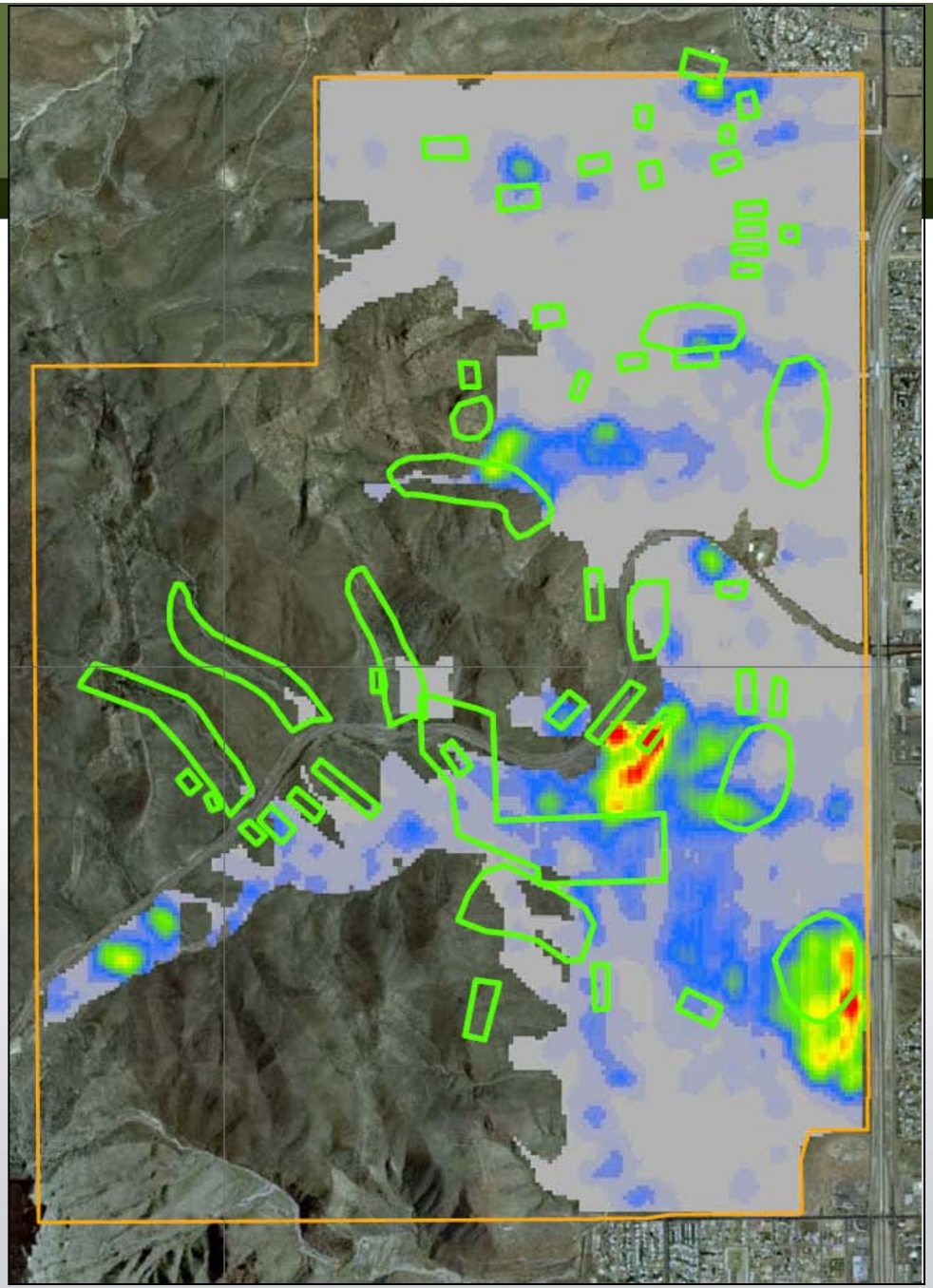
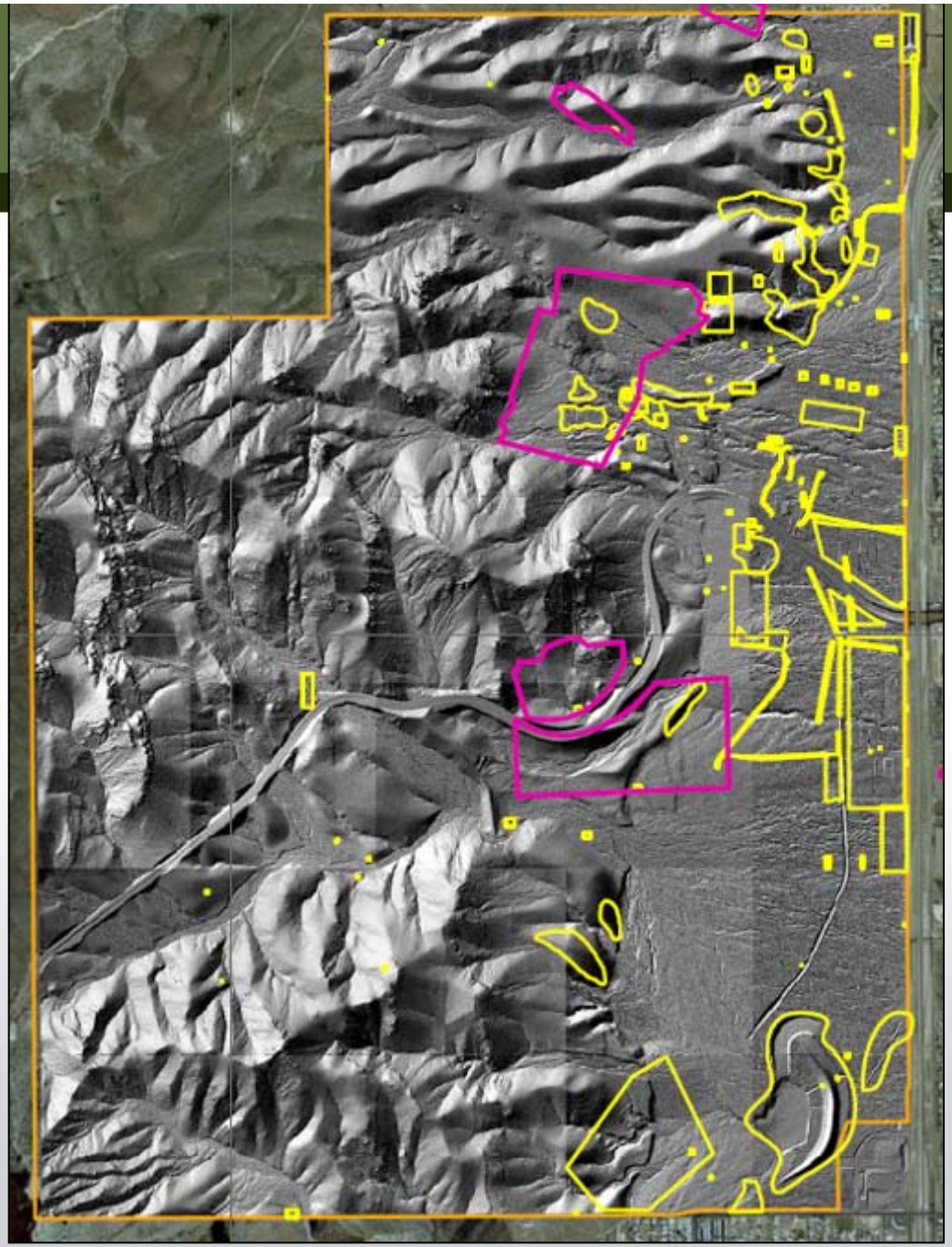
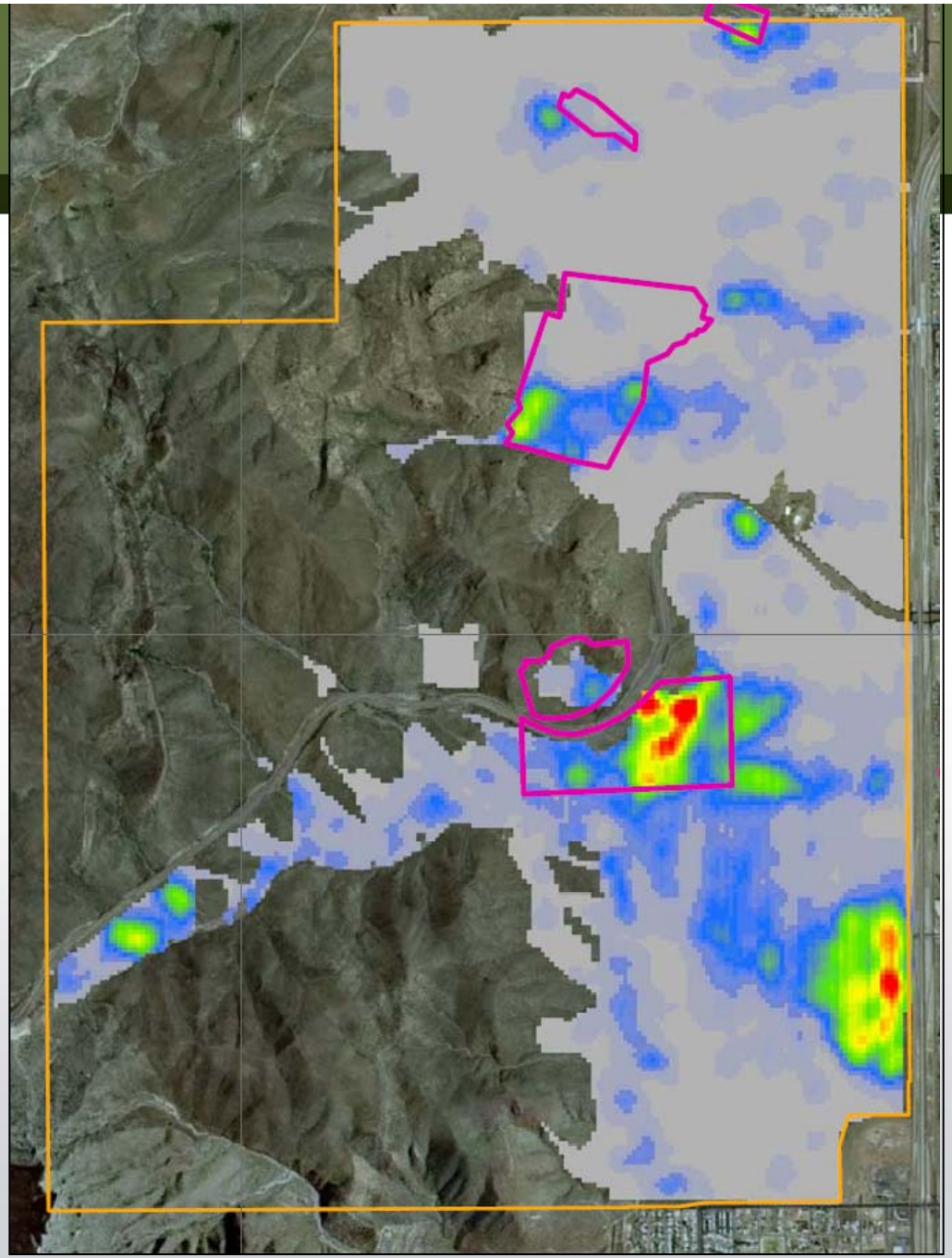


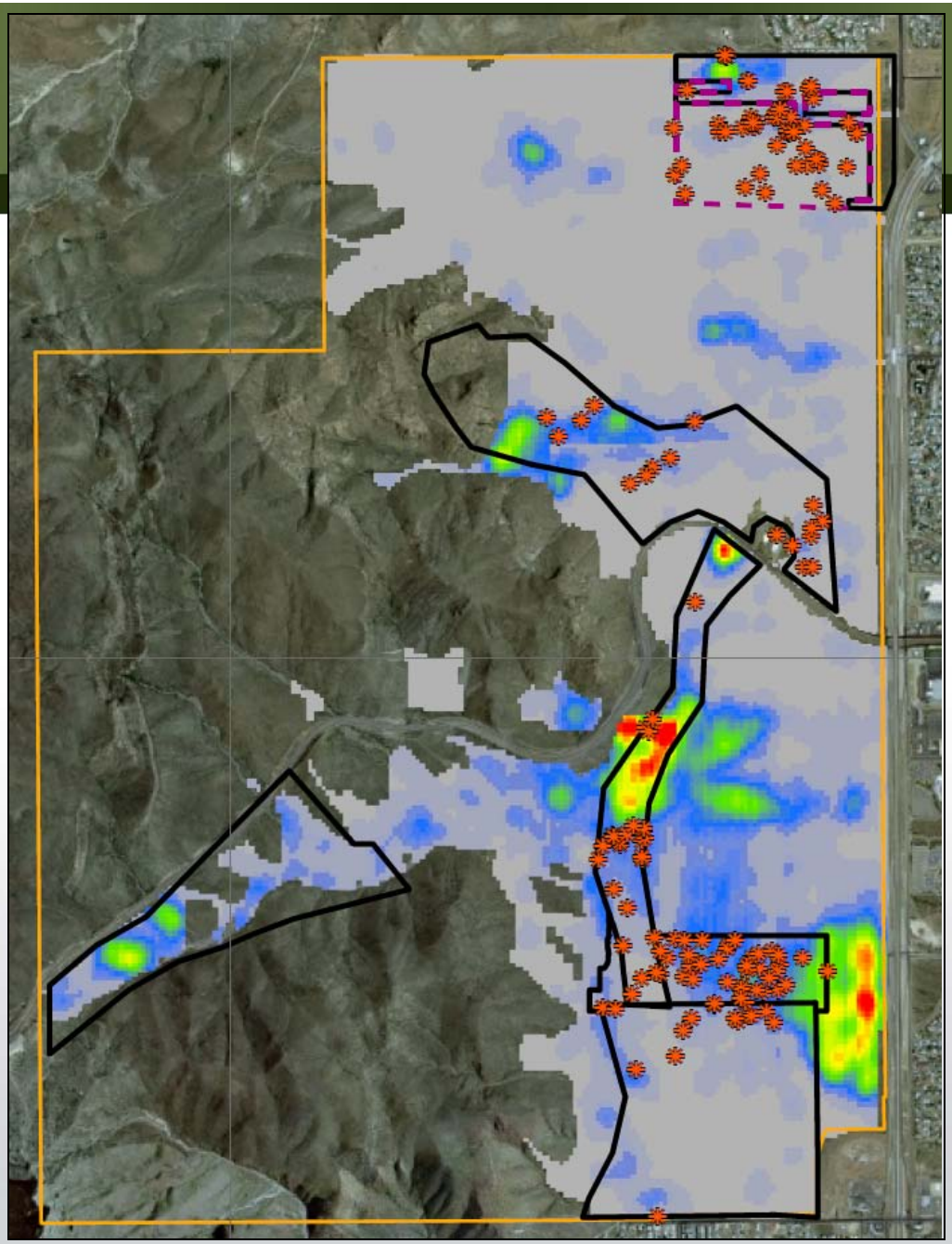
# 1997 Surface Clearance and LIDAR AOI



# 1997 Surface Clearance and DGM Density Data

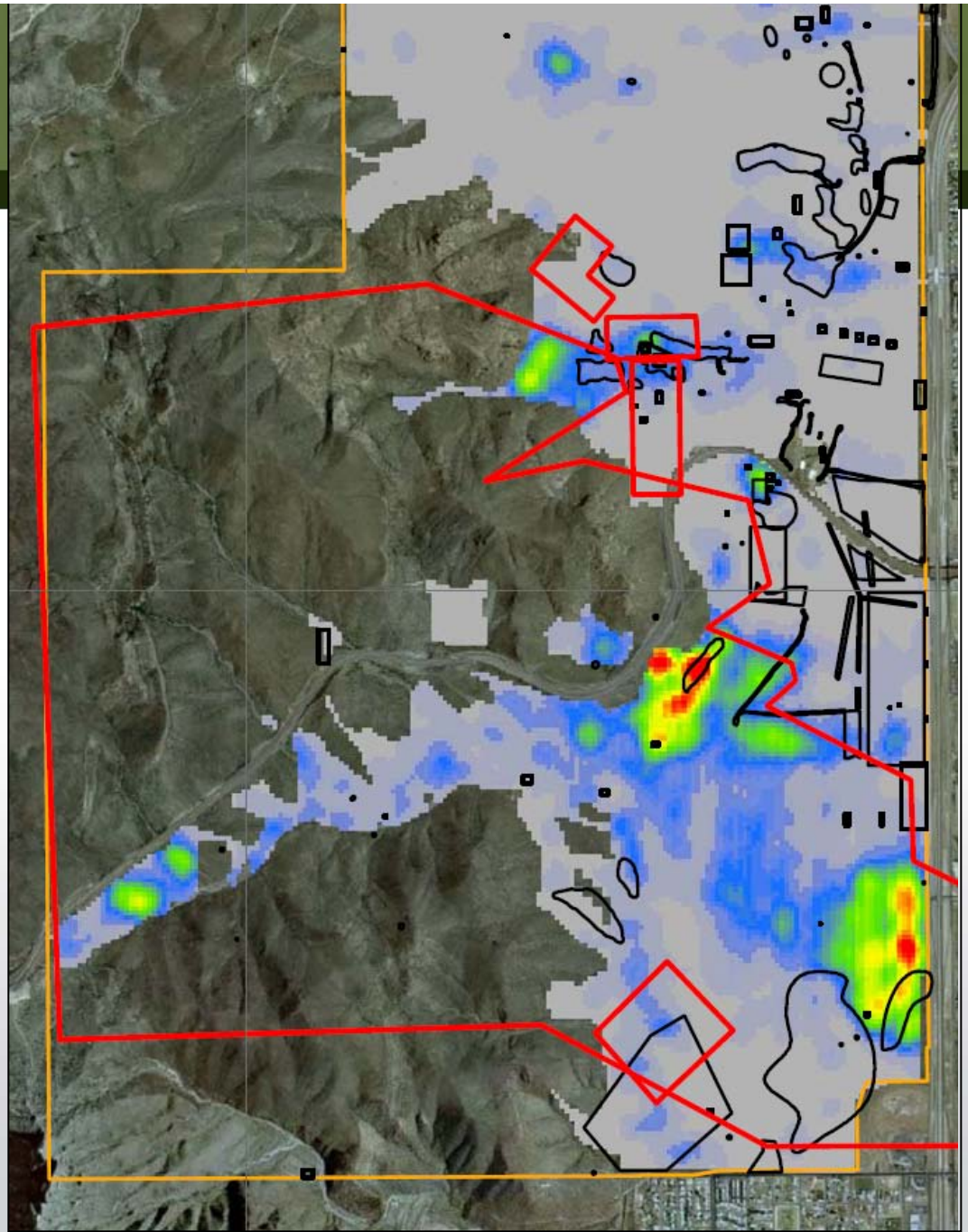


# 2004 Surface and Subsurface Clearance and DGM Density Data

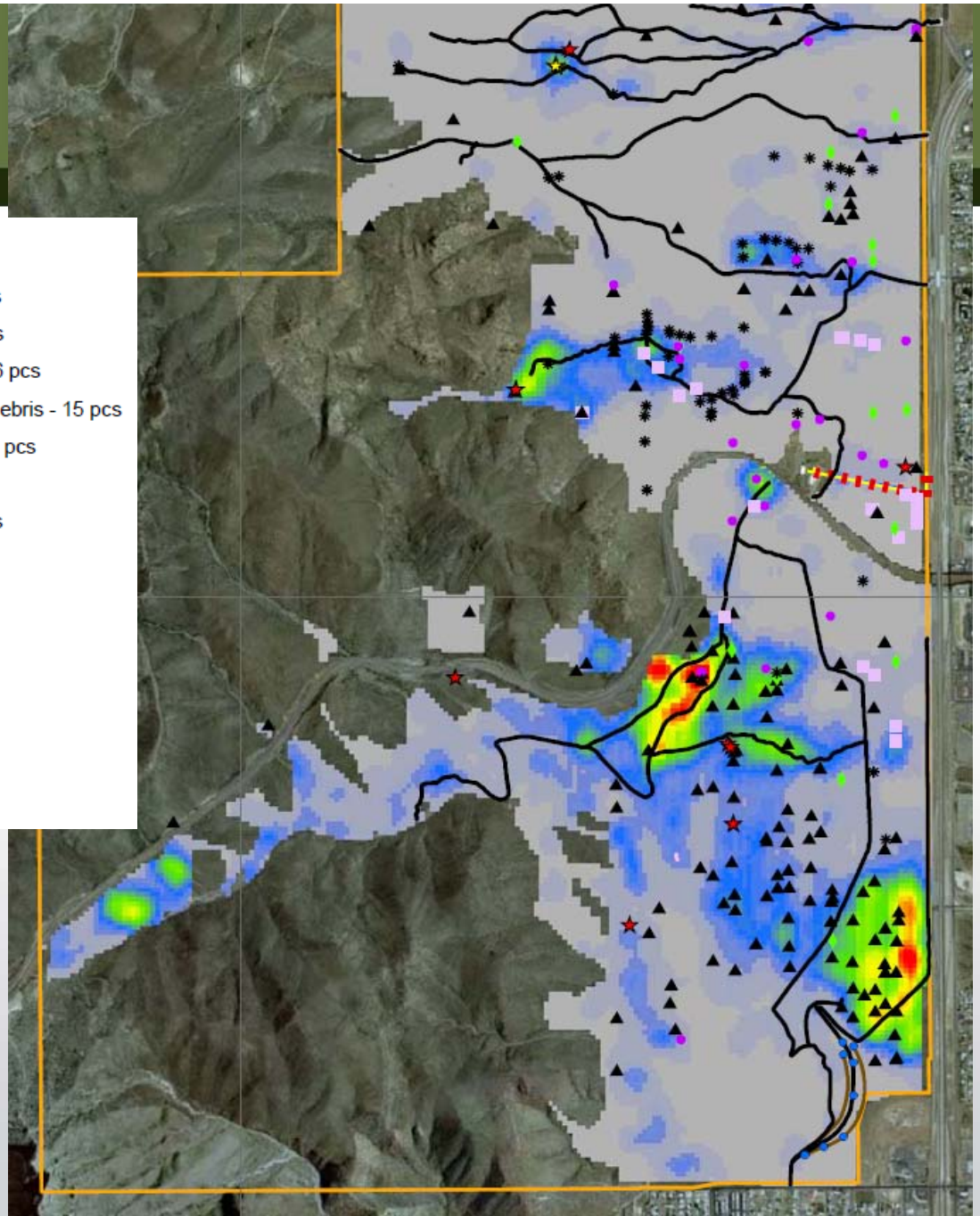


= munitions

# Historical Range Fans, LIDAR AOI, and DGM Density Data



# Analog Range Reconnaissance and DGM Density Data



**Legend**

- Demolition Pit - 2 sites
- MEC Location - 11 pcs
- Munitions Debris - 156 pcs
- Range Residue and Debris - 15 pcs
- Concrete Feature - 24 pcs
- Dike - 8 pts
- Surface Metal - 27 pcs
- Wire Fencing - 56 pcs
- Dike
- Water Line
- Building Outline
- Road
- Power/Tel Line (Live)
- Castner Range MRS

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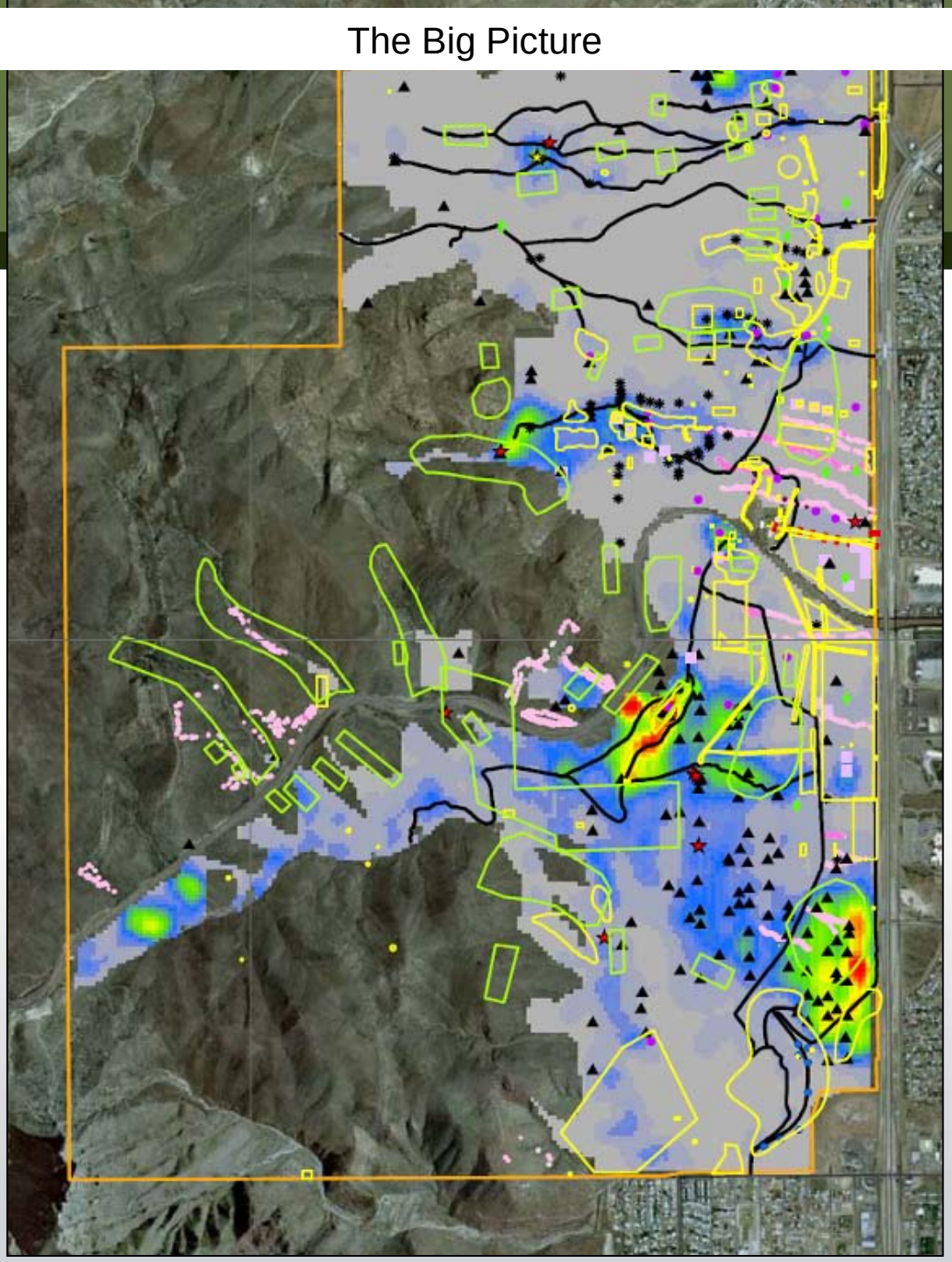
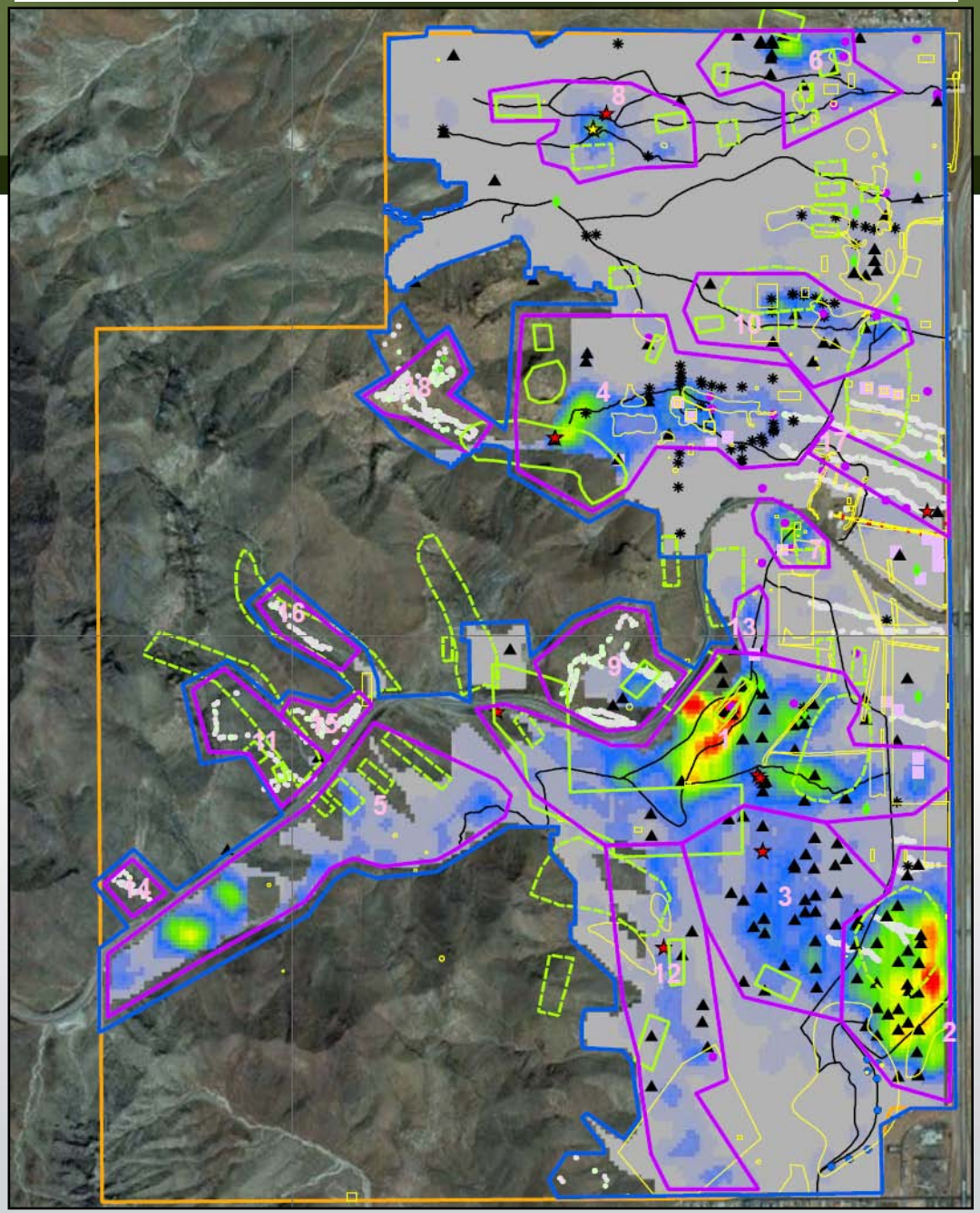
# The Big Picture



# Proposed Target Area Delineation

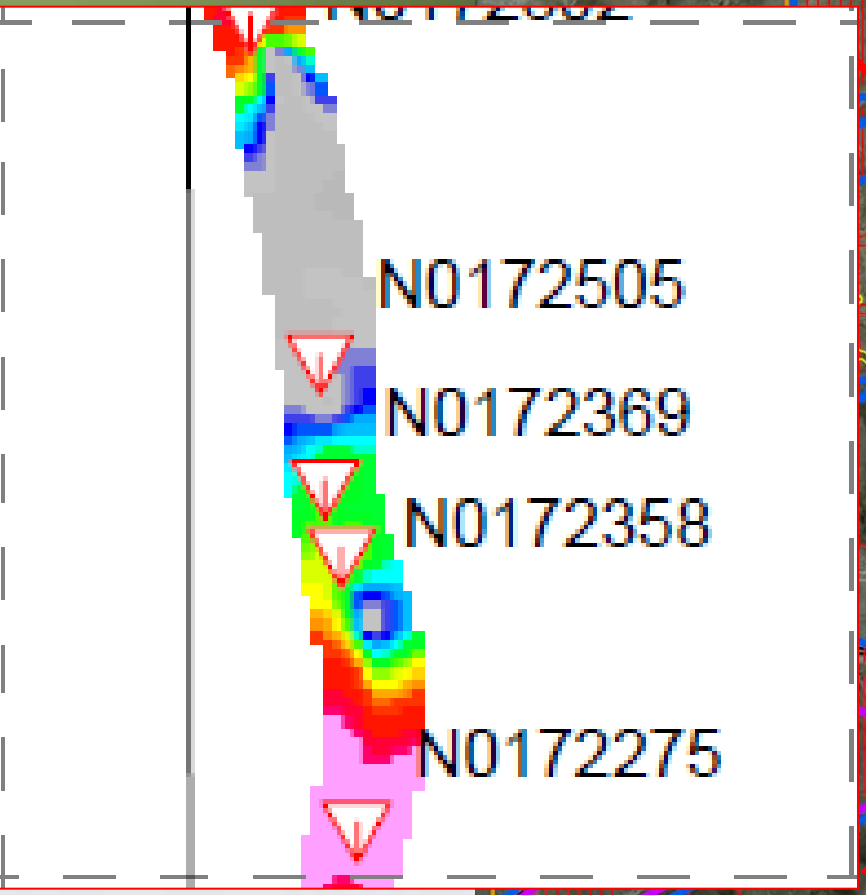


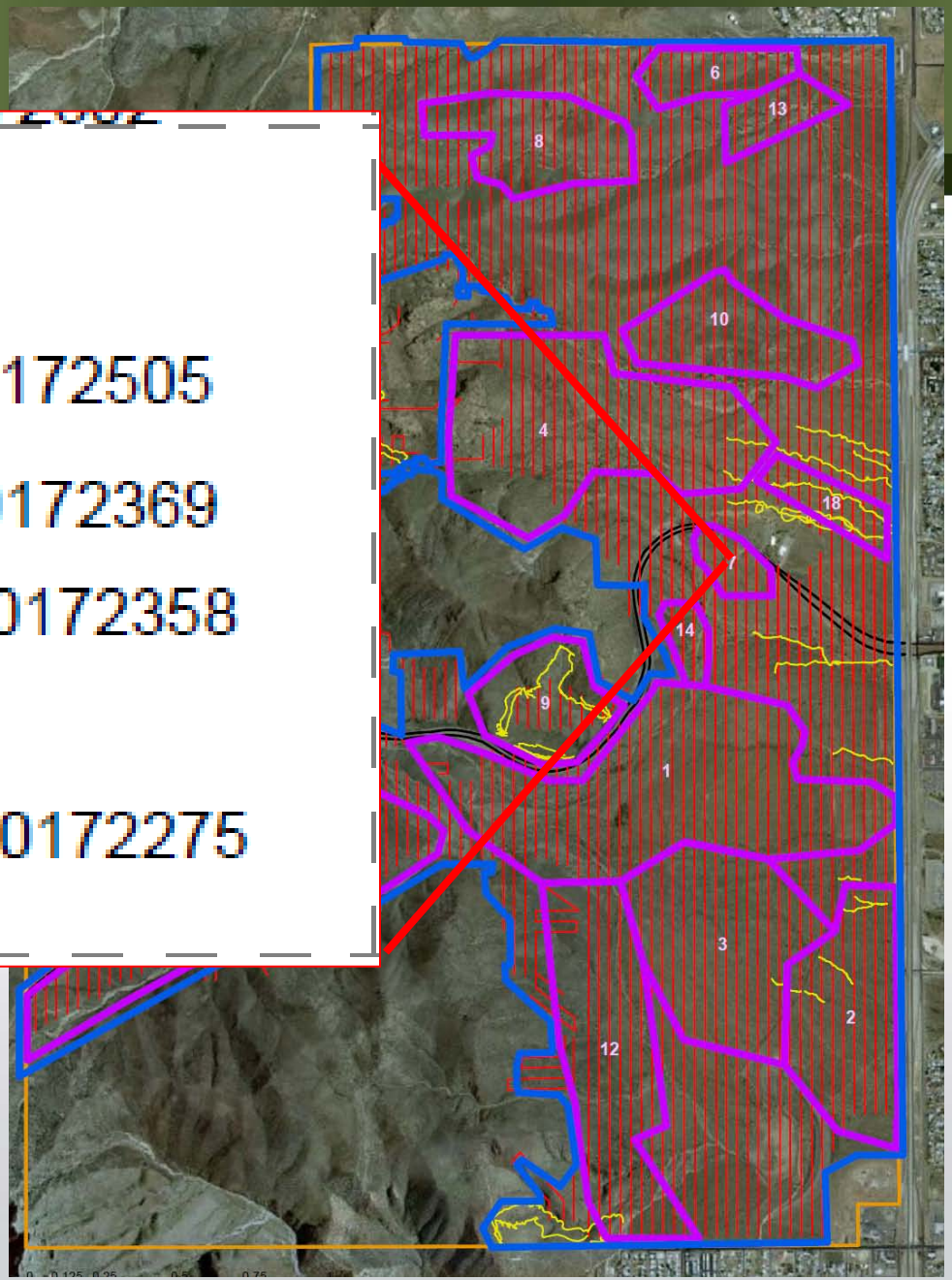
# Intrusive Investigation (Future Work)

# Intrusive Investigation

- Verify target and non-target areas:
  - Target areas:
    - Develop hypotheses about density of High Explosive (HE) frag and Munitions and Explosives of Concern (MEC) items per acre (e.g., ≥ 50 pieces per acre)
    - Test hypotheses through intrusive investigation of detected anomalies on transects to confirm areas as targets (to 90% confidence level)
  - Non-target areas:
    - Develop hypotheses about MEC densities (e.g., ≤ 0.5 MEC items per acre)
    - Test hypotheses through intrusive investigation detected anomalies on transects to confirm non-target areas (90% confidence level)
- Characterize nature and extent of anomalies within target areas
  - Size
  - Nomenclature
  - Condition
  - Depth
  - Orientation
  - Coordinates
  - Photographs

# Notional Sampling Areas for Intrusive Investigation



# Intrusive Procedures

- UXO Tech teams pinpoint anomaly locations using EM-61
- Use hand-tools to excavate all anomalies in sampling area
- Classify items
  - MEC
  - Munitions debris
  - Range related debris
  - Cultural debris
- Record data about each item

# Project Schedule

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- September 2010 –February 2011: Anomaly identification and intrusive investigation
- February – May 2011: WAA Report writing

# Questions?