REMEDIAL INVESTIGATION OF THE CLOSED RANGES AT F.E. WARREN AFB: A CASE STUDY

Joint Services

Environmental Management Conference

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Services to Support One Mission

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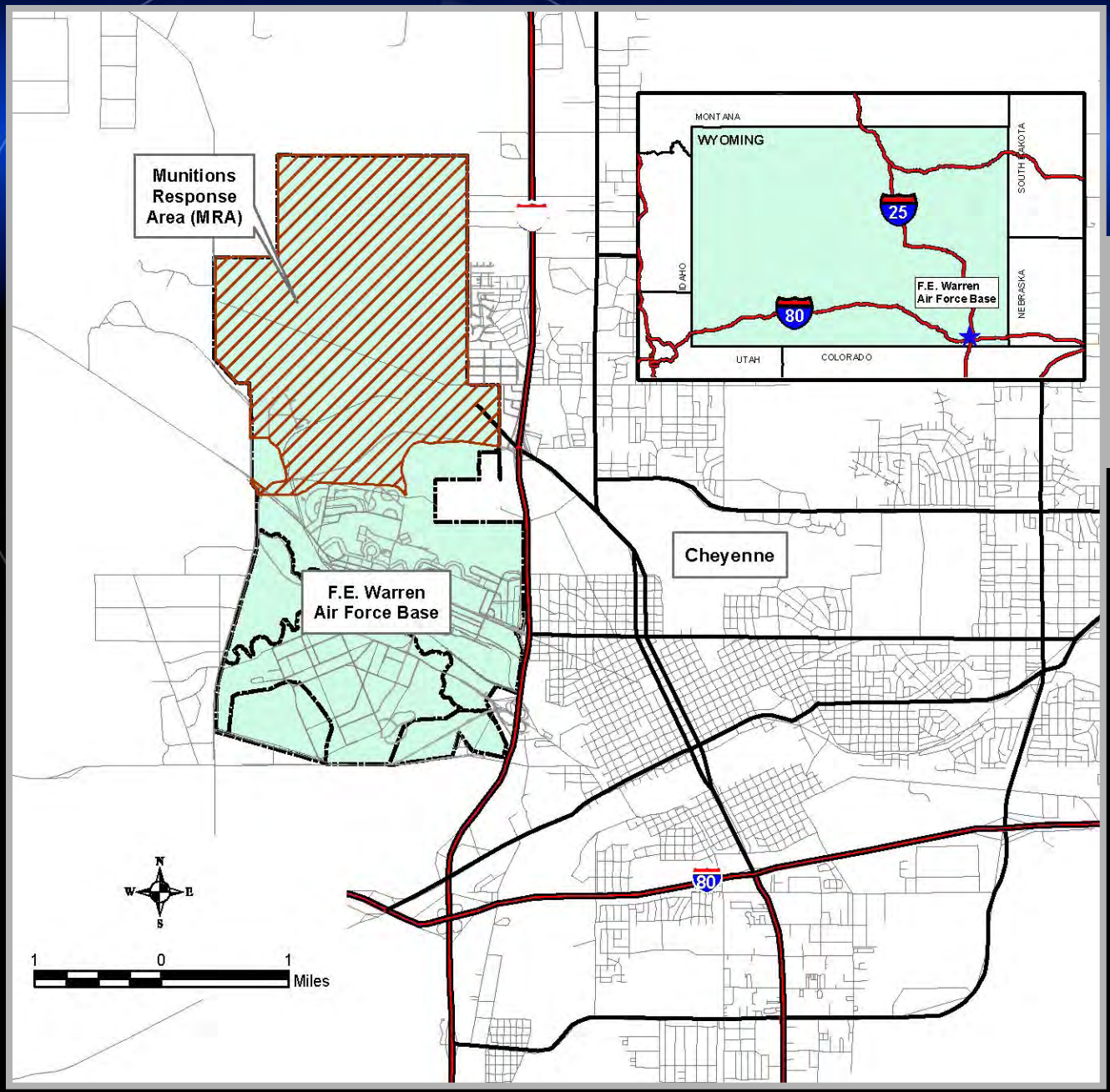
Overview

- F.E. Warren Air Force Base History
  - 1867 Fort Russell, U.S. Army Outpost
  - USAF Space Command
- Historic Ranges
- Munitions and Explosives of Concern (MEC)
- Remedial Investigation (RI)
  - Approach
  - Findings
  - Future steps

FEW Historic Range Photos

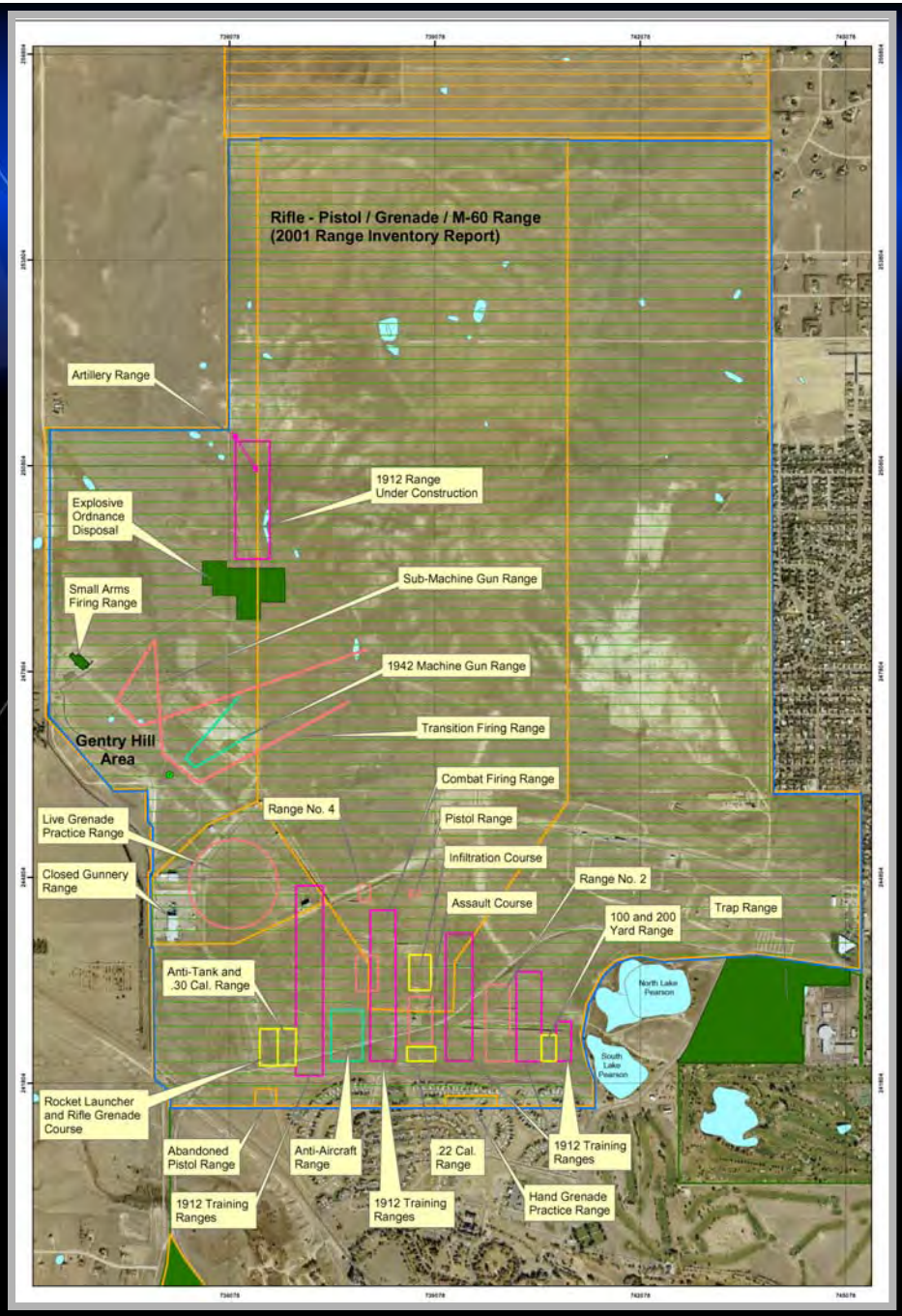


Closed Range

~ 3,000 acres

Historic Ranges

- 1912 Training Ranges
- Artillery
- Anti-Aircraft/Tank
- Machine Gun
- Rocket/Rifle Grenade
- Live Grenade
- .22 cal/.30 cal
- Pistol
- Active Ranges (x3)



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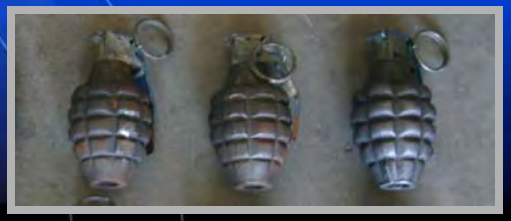
MEC Types



- 37 millimeter (mm) Projectile Rounds
- 40mm Grenades
- Hand Grenades
- M-9 Rifle Grenades
- 2.36-inch Bazooka Rocket Mortar

- 75mm Artillery Rounds [Low-explosive with Grape Shot; High Explosive (HE) with Point Detonating (PD) Fuze]
- 3-inch Stokes Mortars
- Cannonballs
- M-1 Anti-Tank Mines
- Small Arms

Land Use

Current

- Open Space
- Limited Industrial
- Perimeter Fence & Signs

Future

- Mission Support
- Development?

Remedial Investigation

- USAF Environmental Restoration Program (ERP)
  - Air Force Center for Environmental Excellence
- CERCLA (Superfund)
  - Process: RI – Feasibility Study (FS) – ROD – RD/RA
- Investigate and delineate extent of:
  - MEC - Partial “clearance” of range through investigation
  - Munitions Constituents (MC) - Explosive residues, Lead
- Assess human and ecological risk
- Support for FS and future Remedial Action (formal clearance)
  - Optimize approach for future land use

General RI Approach

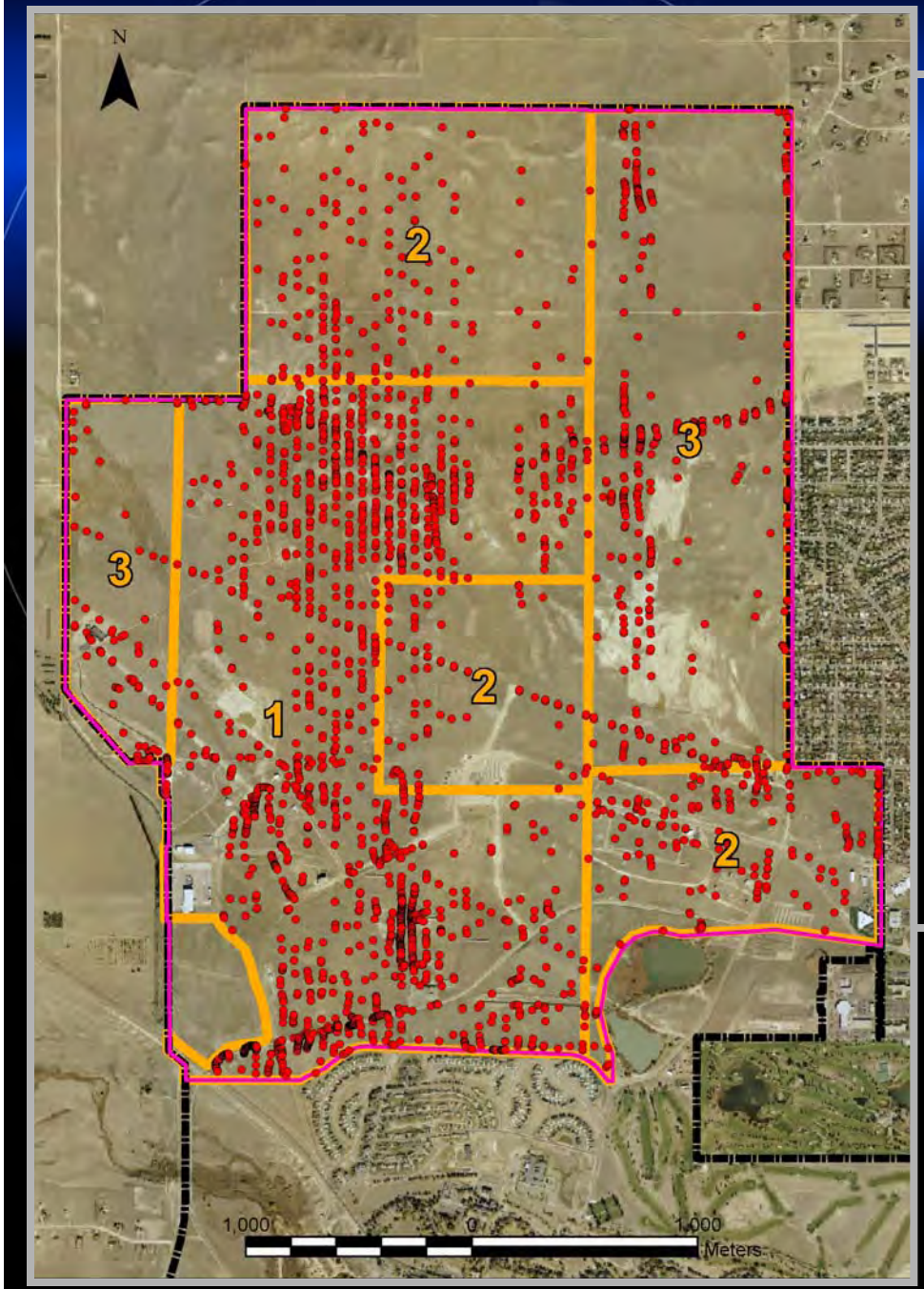
- **Dynamic**
  - Continuous spatial analysis
    - Boundary delineation
    - Correlation of target anomaly density to investigated MEC
  - Dataflow (digital tools)
  - Evolving Conceptual Site Model (CSM)
- **Strategic**
  - Collect data to optimize resources & estimate resources for remaining investigation and future remedy
  - Strategic redeployment of resources
    - Information vs. production & acres cleared

RI Approach (Cont.)

- Range Reconnaissance (2003)
- Initial CSM
- Intrusive investigation & MEC response
- Analyze MEC distribution
- Define Munitions Response Sites (MRS)
- Strategic MC soil sampling
- Risk assessment (MEC & MC)
- Reporting

Range Reconnaissance

- Records Review
  - 2001 Range Inventory
  - Historic range maps
  - EOD clearance reports
- Geophysical (Geo) Investigation
  - Geo Prove-Out (GPO)
  - Transect survey – 58m
  - Target anomalies
- RI Work Plan
  - CSM
  - Investigation approach
  - Data/risk evaluation



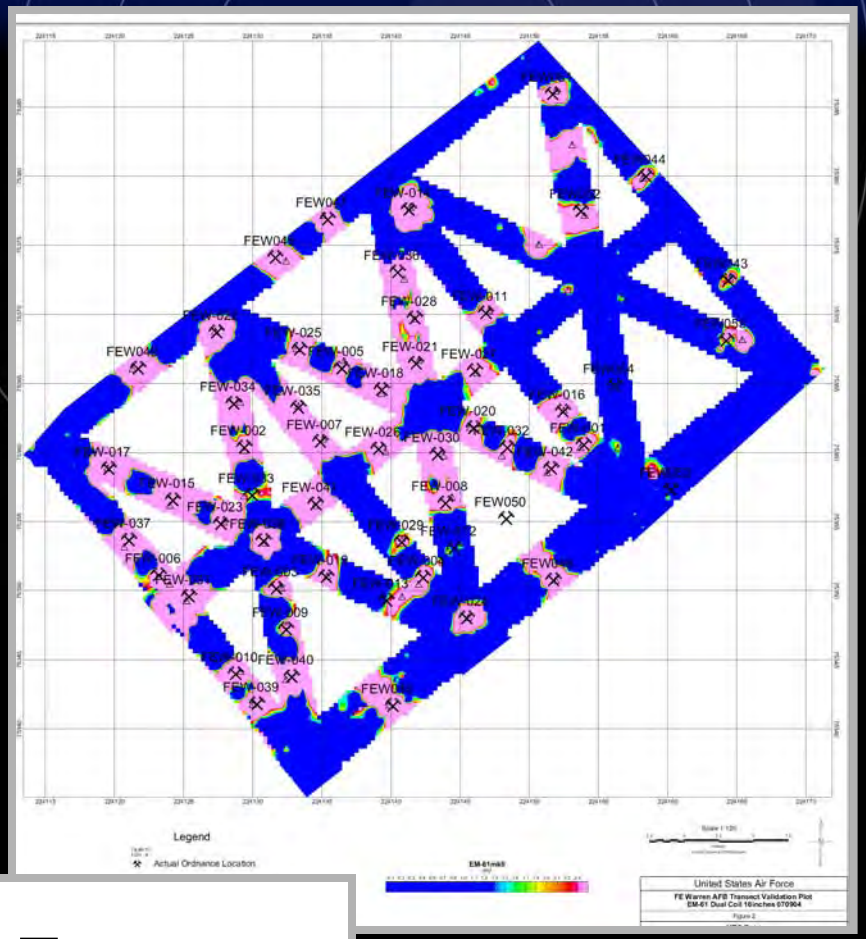
General CSM

- Zone 1 – Probable MEC
  - Full coverage
- Zone 2 – Possible MEC
  - Transects & stepouts
- Zone 3 – Outlying Area
  - Transects & stepouts

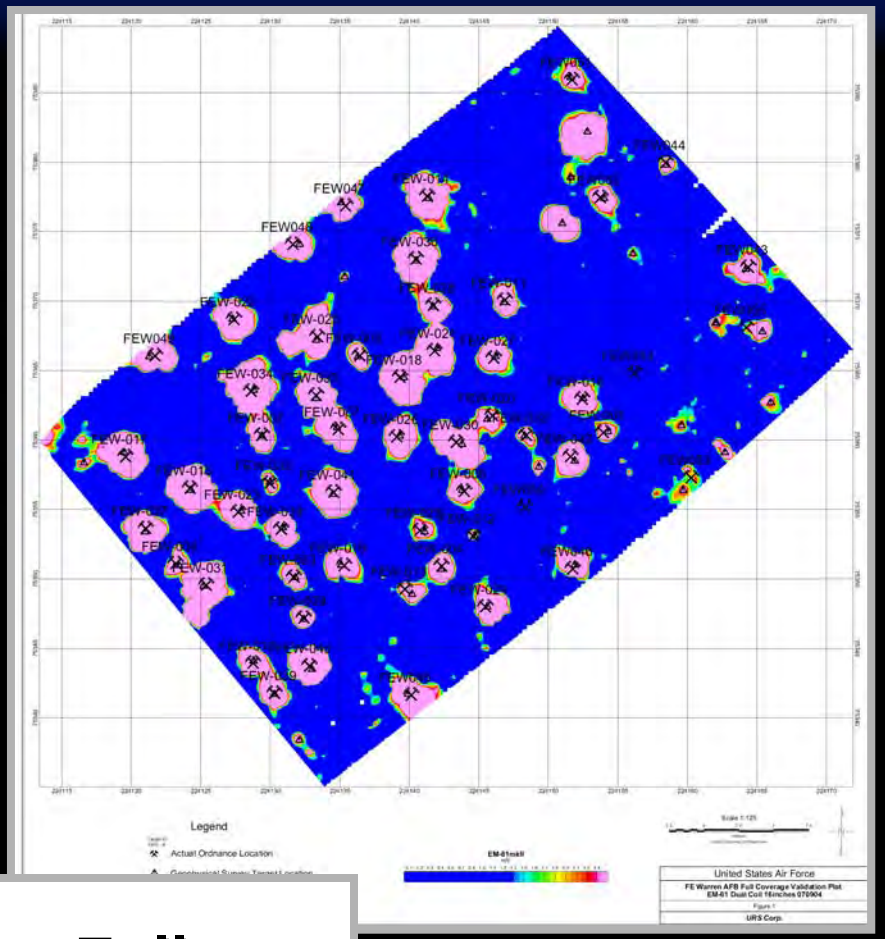
Geophysical Prove-Out

- Demonstrate capabilities
  - Instrument validation
  - Site-specific capabilities
- Seed items
  - Historic MEC items
  - Various depths and orientations
- Geo Survey
  - Response values
  - Threshold value for target anomaly

GPO Plot



Transect



Full

Site-Specific Remediation Depths

- How clear is clear?
- SSRDs recommended for unrestricted use by DoD Explosives Safety Board (DDESB)
- Determining SSRDs – DoD 6055.9-STD
  - GPO
    - Site-specific data – MEC, depths and response values
  - UXO Recovery Database (USACE & CTC)
    - MEC/UXO data from multiple sites
    - Recovery Depths – mean, median, maximum
  - Comparison of site GPO data to UXO database
    - **Can we "see" deep enough to recover all MEC?**
    - Recommend SSRDs for "unrestricted" use
  - Comparison of RI data to database and SSRDs

Field Investigation

General Strategy

- Mission support
  - Wind Farm, Storm water, JFHQ
- Evaluate target densities in suspected range areas & strategically deploy UXO teams
- Delineate hotspots & boundaries
  - Optimize resources
- Refine CSM
- MEC Response

Field Investigation

- Explosives Safety Submission (ESS)
  - Approved by DDESB
- Mobilized March 21, 2005

Personnel

- SUXOS, SSO, QC
- 4 Dig Teams (7 each)
- 3 Geo Teams (2 each)

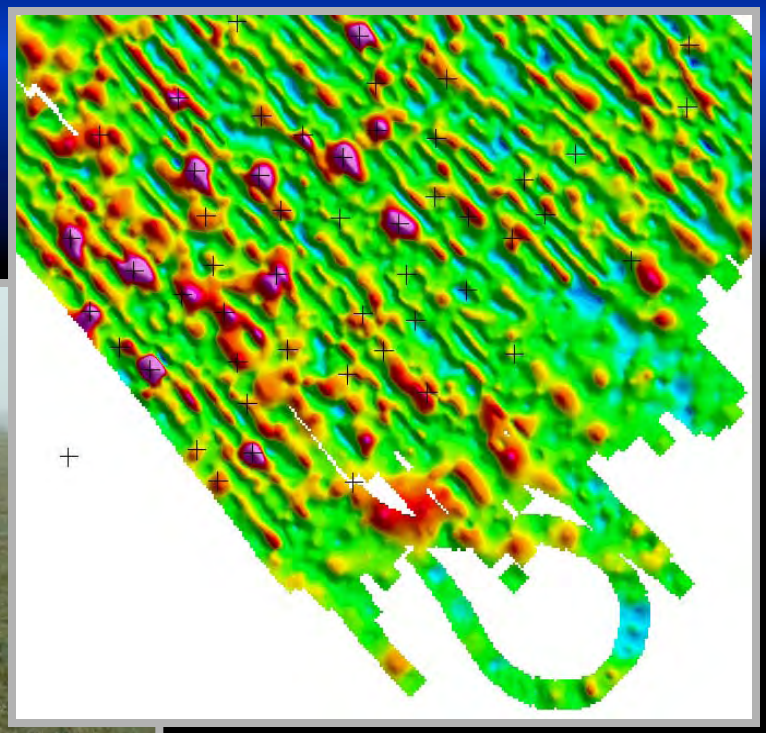
Equipment

- EM-61, Schonstedt, Fisher
- ATVs & Hand Tools
- E-Tools
  - GPS Receivers
  - Hand-held PDAs
  - Website
  - GIS

Geo Teams

- EM-61
  - Towed Array: tri-coils
  - Hand-held
- Data Flow
  - Collected
  - Upload/download Daily
  - Processed & targets picked
  - Target density maps
  - Upload/download to PDAs for investigation

Geo Teams



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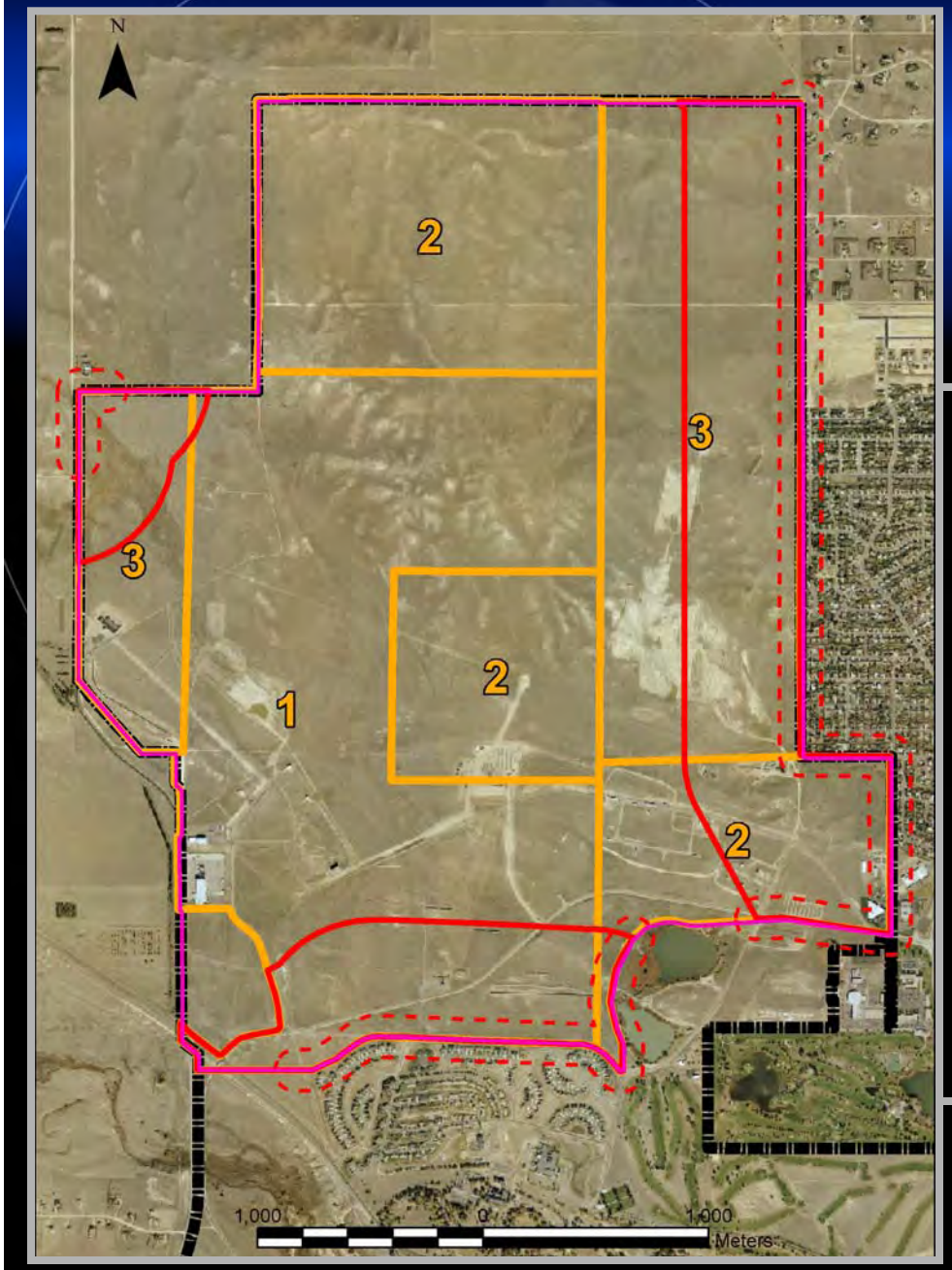
Dig Teams Reacquiring Anomalies

Digging Anomalies



Safety Zones

- Buffer (1701 ft) - MGFD
- Potential Evacuation (300 ft)

Investigating Safety Buffer Zones

‘Bud Light’

MEC Discoveries at F.E. Warren AFB

75mm Fuzed

75mm HE Fuzed

37mm HE Fuzed

Stokes Mortar, Unfuzed

75mm HE with MKIII PD Fuze

X-Ray MEC – EOD Support

Chemical Agent Identification Set

- K955 Sniffer Kit
- 1988 finds, burn pits
- Relatively harmless, but classified as CWM
- Coordinating with:
  - Wing Safety
  - HQ AFSPC Safety
  - AFSC
  - USATCES
  - DDESB
- Exclusion Zone
- Chemical Safety Submission (3/2/06)

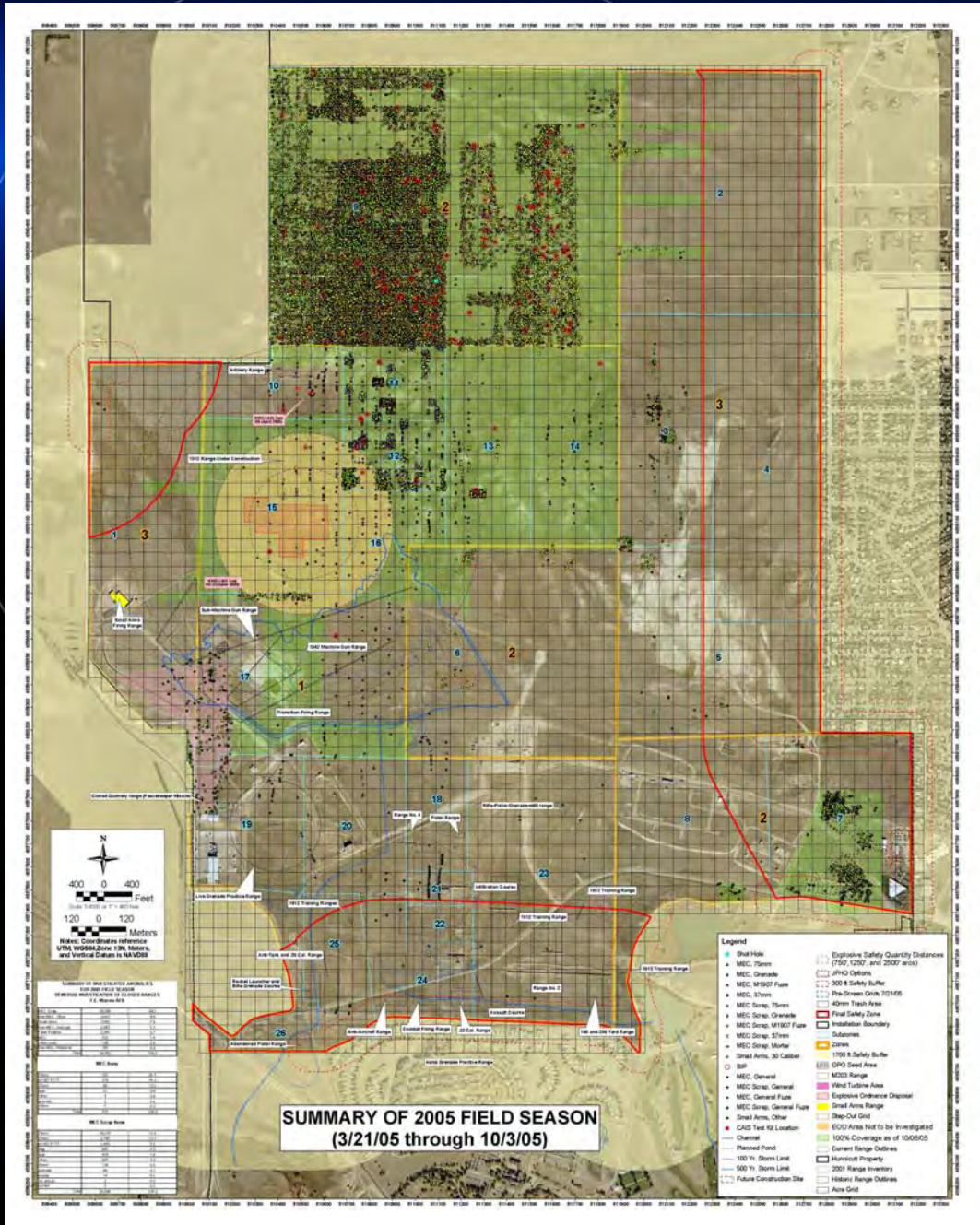
Investigated Anomalies as of 10/3/05

Investigated Items

Classification	Count	Percentage
MEC Scrap	26,996	69.3
Non-MEC: Other	3,843	9.9
Small Arms	2,893	7.4
Non-MEC: Geologic	2,083	5.3
False Positive	2,206	5.7
MEC	532	1.4
Utility Lines	196	0.5
Non-MEC: Historical	203	0.5
Total	38,952	100.0

MEC Items

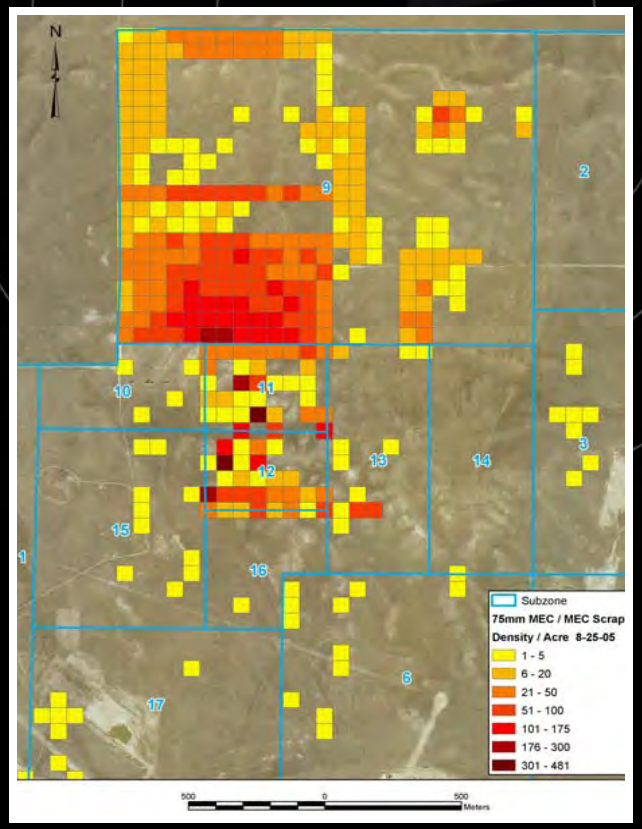
Item Description	Count	Percentage
75mm	221	41.5
m1907 PTTF	219	41.2
37mm	65	12.2
fuze	21	3.9
Other	3	0.6
grenade	2	0.4
40mm	1	0.2
Total	532	100.0



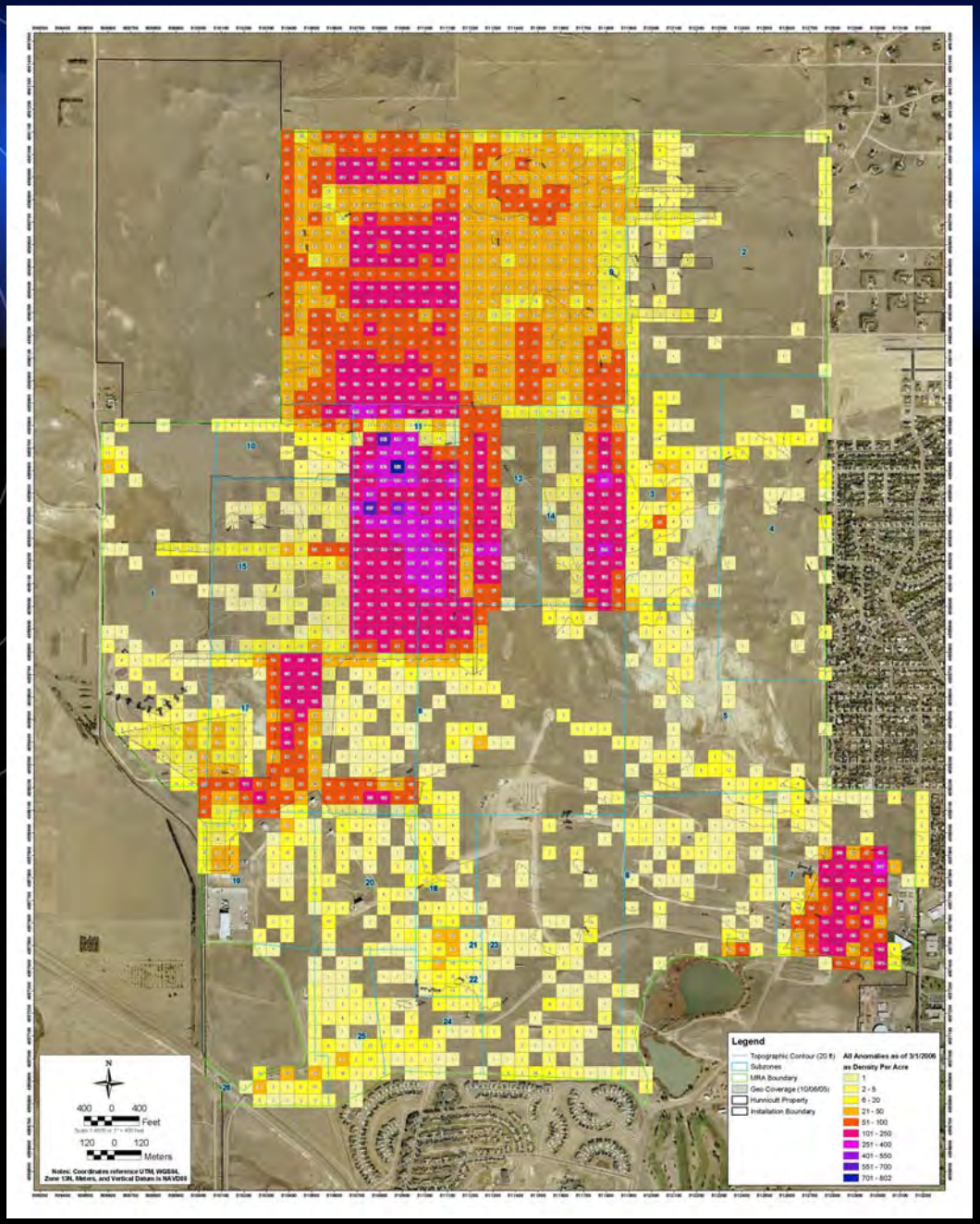
Findings

- As of 03 October 2005, 38,952 investigations
- Majority of items MEC scrap and Non-MEC
- MEC Scrap
  - Frag, frag and more frag, expended fuzes
- Non-MEC
  - Rocks, wire, nails, horseshoes, bolts, cans
  - Small arms

Target Anomaly Density



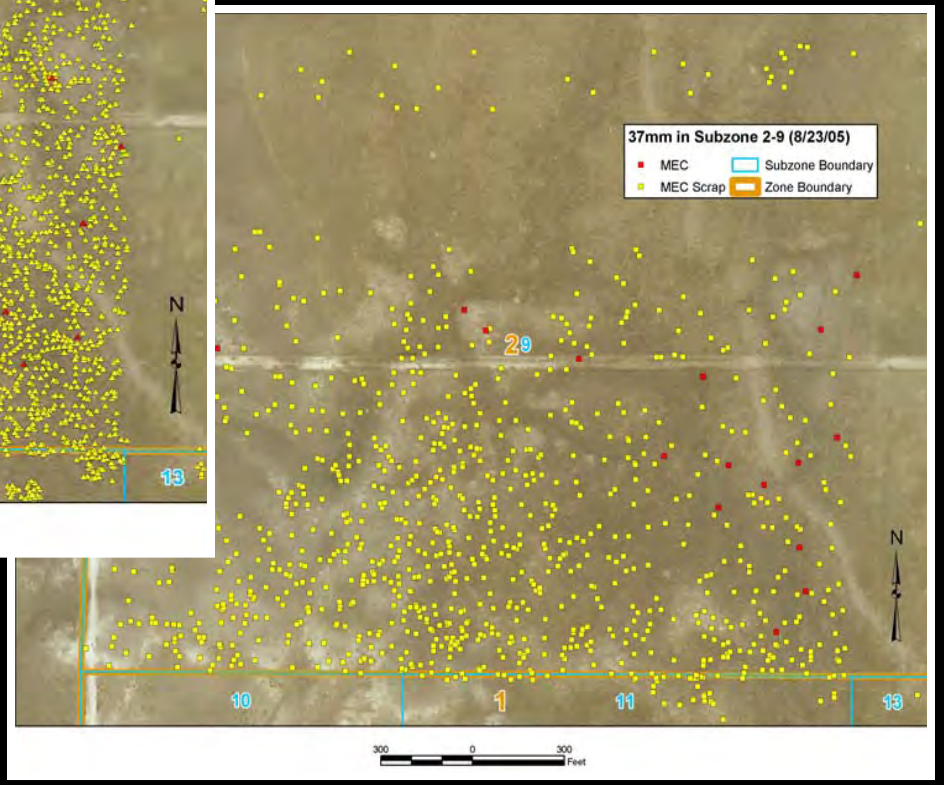
75mm MEC/Scrap



GIS Spatial Analysis

75mm MEC/Scrap

37mm MEC/Scrap



Services to Support One Mission

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Quality Control

- Geo-processing
- Hole Clearance
- Seed Item
- Confirmation Survey and Investigation Verification (CSIV) – Limited

- Adapted to RI vs. Clearance

MEC Storage

Demilitarization Operations

Explosive Ordnance Disposal (EOD)

- Successful partnering
- Blow In Place (BIP)
  - Fuzed items (per USACE guidance)
  - Provide GPS coordinates
  - Blast and frag mitigation (sand bags)
  - EOD places charges and detonates

BIP – May 24, 2005

Where Next?

- Complete MEC investigation (2nd field season)
  - Increased optimization
    - UXO Discrimination – Linear Genetic Programming
  - Delineate MRSs for:
    - FS/future RA (mechanized removal? Small arms – lead?)
    - Focused MC investigation
- MC Sampling Plans & Sampling
  - Surface & Subsurface soil sampling
  - Delineate extent of soil contamination
- RI Report
  - Risk evaluation – MEC & MC
  - Document process & findings

FEW Lessons Learning

- Integrate ERP (RI/FS) & UXO expertise
- Strategic approach
  - Optimize resources
  - Predictive geophysical evaluation
  - Spatial analysis
  - Delineate boundaries
  - Dynamic planning & CSM
    - Rapidly shift and deploy dig teams
- E-Tools & Data Management
  - PDAs, website, database, GIS, GPS
- Updated Projections: Level of effort & costs

FEW Lessons Learning (Cont.)

- Partnering
  - Mission Support: Wind Farm, Joint Forces Headquarters, Stormwater;
  - EOD
- Triad Approach (manage decision uncertainty)
  - Systematic project planning (“strategic planning”)
  - Dynamic work strategies
  - Real-time measurement strategies

ITRC: Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management. December 2004

QUESTIONS