



# Central Impact Area UXO Removal Update

JBCC CT Briefing April 10, 2024

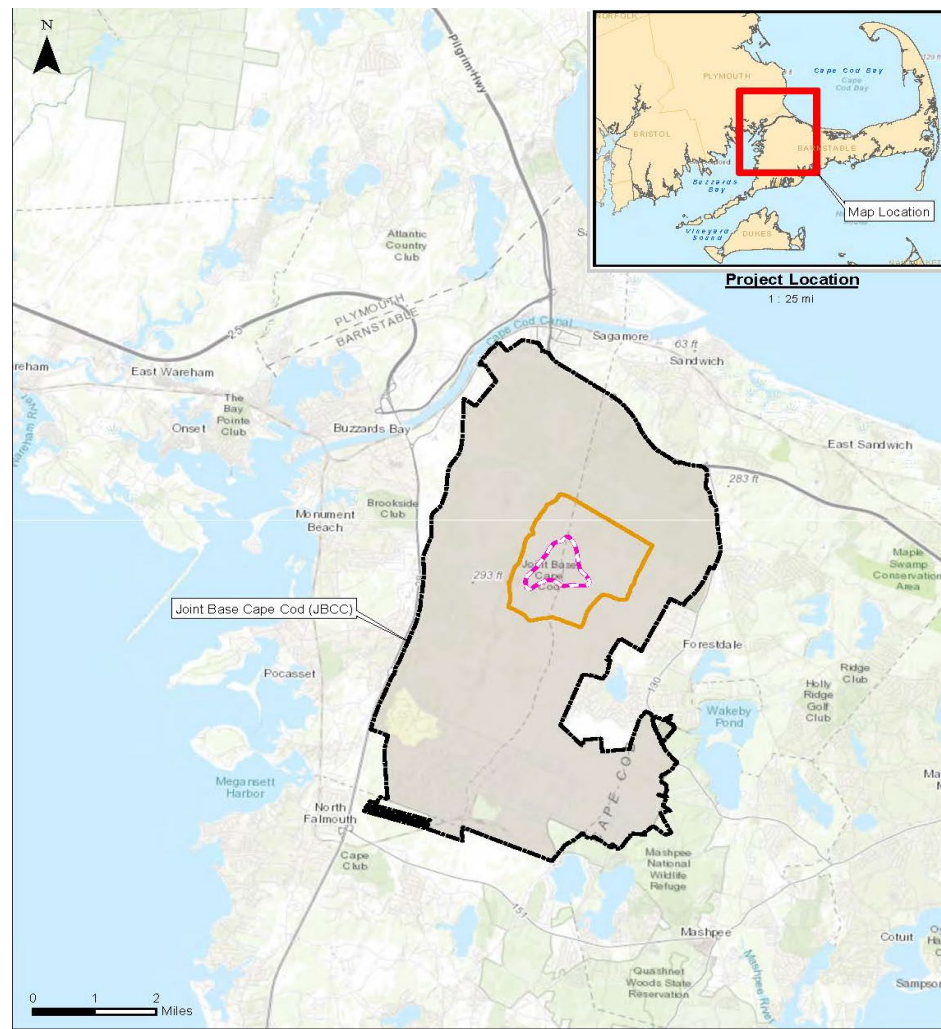
Mr. Shawn Cody

Impact Area Groundwater Study Program



# Overview

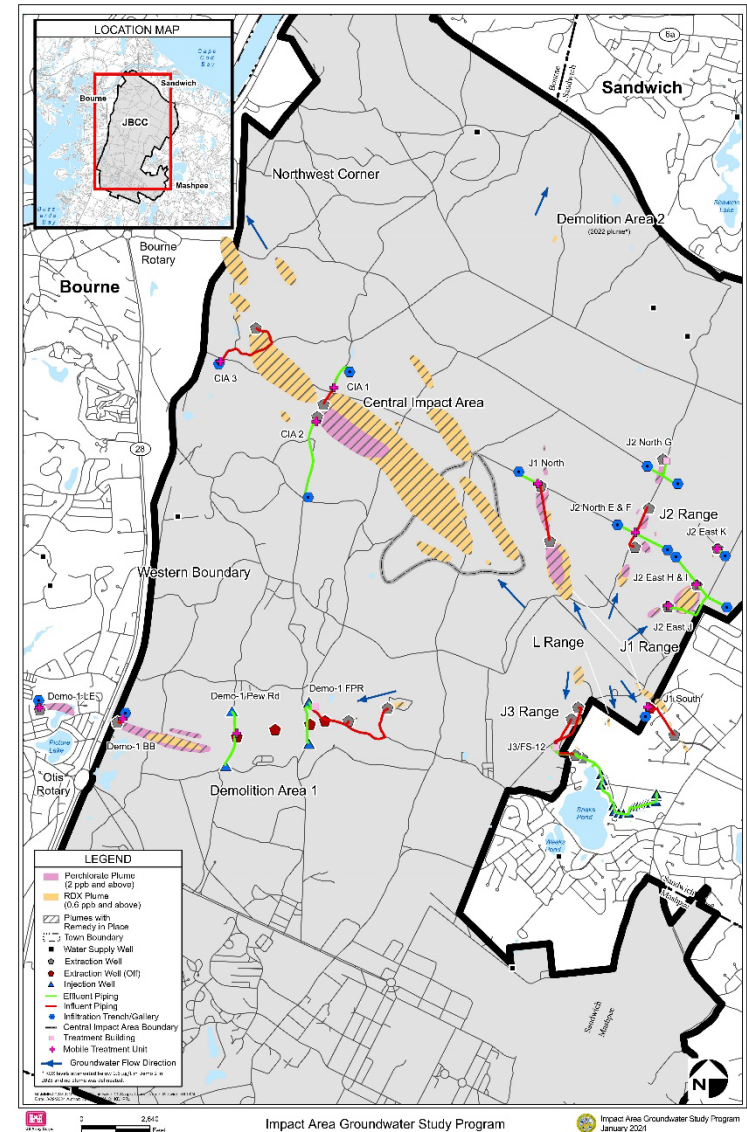
- ◆ **Decision Document (DD) finalized in 2012.**
- ◆ **Groundwater remedy in place: Three extraction wells operating at a combined 750 gallons per minute.**
  - **3.509 billion gallons of water treated and re-injected to date.**
  - **Contaminants of concern: RDX and perchlorate.**
- ◆ **Decision Document also requires source removal.**
- ◆ **Remove 75 – 95% of unexploded ordnance (UXO).**
  - ◆ **Maximize removal of net explosive weight.**
- ◆ **Approximately 133 total acres completed since 2013.**





# Groundwater Remedy

- ◆ Development and implementation of a long-term monitoring program to verify that the groundwater is being restored as predicted and to determine if additional source removal work is needed.
- ◆ Implementation of land use controls to prevent access to and use of the contaminated portions of the aquifer for drinking water and maintain the integrity of any current or future groundwater monitoring wells and treatment systems.
- ◆ Performance of five-year reviews to determine if the groundwater treatment system is still protective and achieving the goals established, if additional or more expedited source response actions are necessary to protect groundwater, and if improved technologies are available.



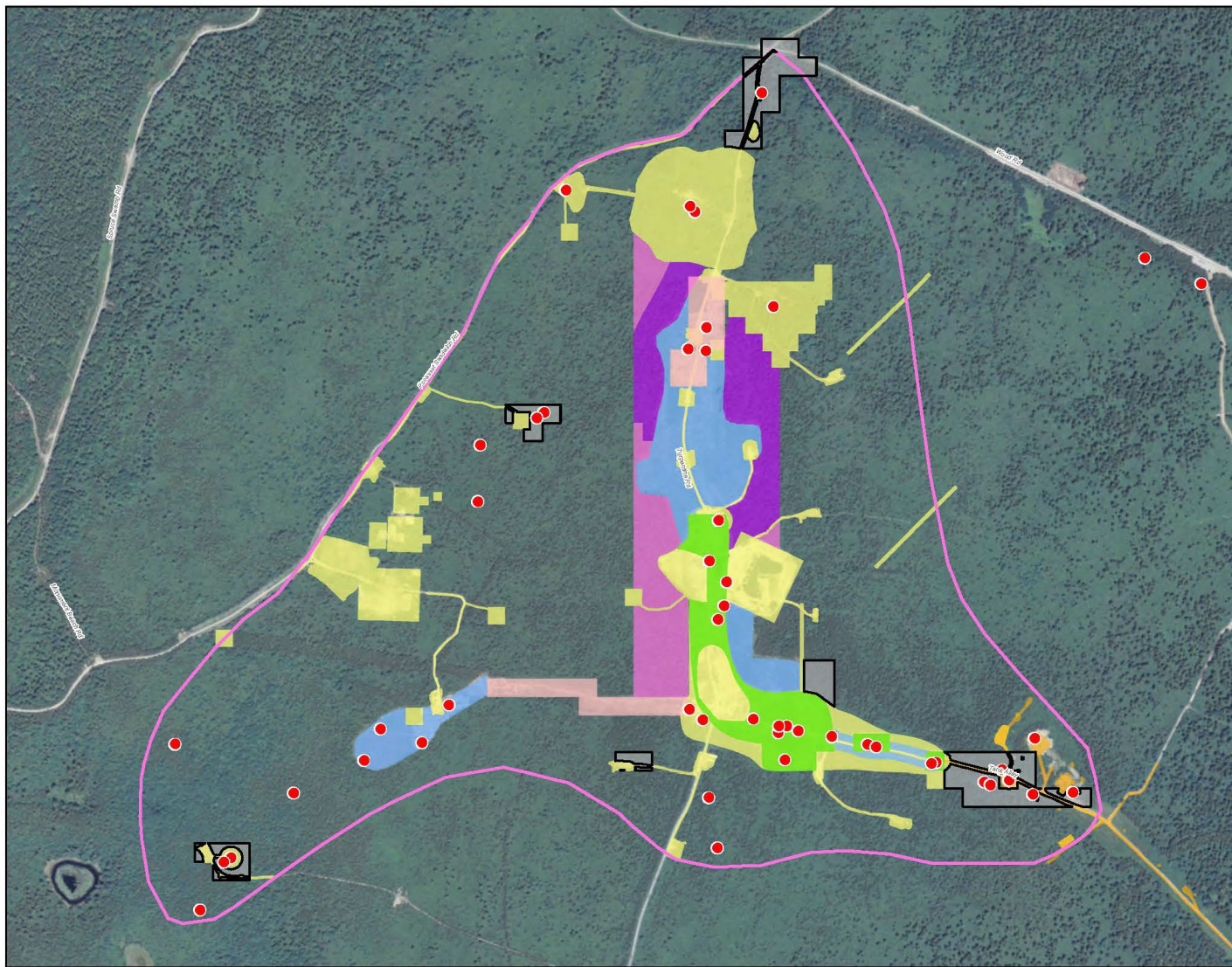


# Source Removal Project History

- ◆ **Phase I covered the first 30 acres of the project and Phase II consisted of 28 acres.**
  - **Six acres were conducted as a demonstration project with the Environmental Security Technology Certification Program (ESTCP).**
- ◆ **Because of the elevated UXO density found during Phase I and Phase II, it was determined that additional phases of work would be required.**
- ◆ **Phase III: Areas 1 (10 acres), 2 (15 acres), and 3 (10 acres) investigated during the 2018 field season.**
- ◆ **Phase IV: consisted of Areas 1 (15 acres), 2 (10 acres), and 3 (15 acres) investigated in 2021, 2022 and 2023, respectively.**
- ◆ **Phase IV Area 4 (10 acres) will be investigated during the upcoming field season.**
  - **Will include carryover of 8.25 acres not completed in 2023.**



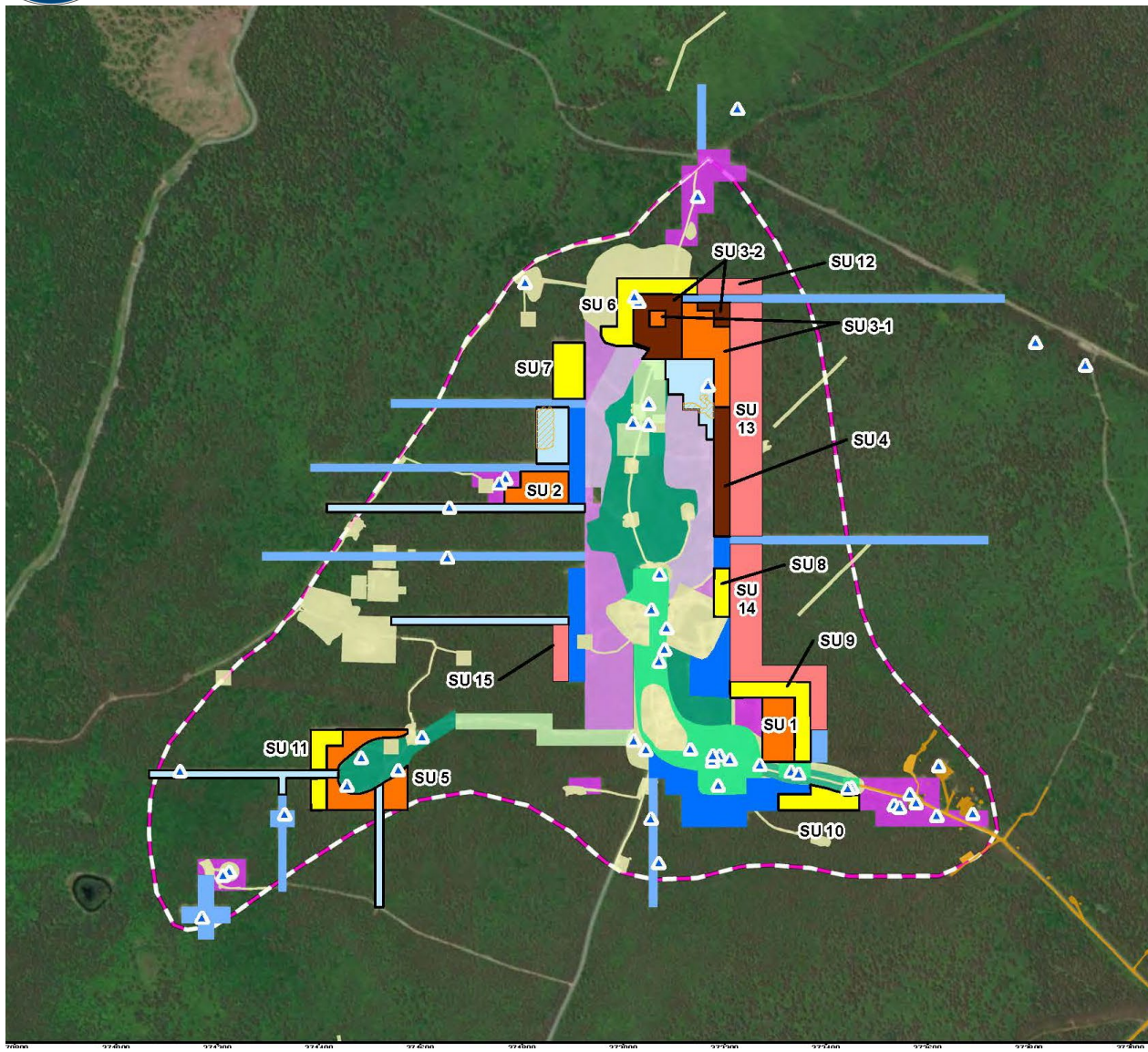
# Central Impact Area – Source Removal Phases



|  |   |
|--|---|
|  |   |
| <b>LEGEND</b>  |   |
| <span style="color: red;">●</span>   | Target  |
| <span style="background-color: purple; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span>   | Phase II - Area 1*  |
| <span style="background-color: magenta; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span>  | Phase II - Area 2*  |
| <span style="background-color: grey; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span>   | Phase II - Area 3*  |
| <span style="border: 2px solid pink; display: inline-block; width: 15px; height: 10px;"></span>  | Central Impact Area   |
| <span style="background-color: lightpink; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span>  | 6-Acre ESTCP Removal Area   |
| <span style="background-color: green; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span>  | 8-Acre Removal Area   |
| <span style="background-color: blue; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span>   | 16-Acre Removal Area  |
| <span style="background-color: orange; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span>   | J1 Range UXO Cleared Area   |
| <span style="background-color: yellow; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span>   | Previous UXO Removal Area   |
|  | Road  |
| *Phase II Areas Total 28 Acres   |   |
| <b>LOCATION MAP</b>  |   |
|  |   |
| <b>NOTES &amp; SOURCES</b>   |   |
| <small>Map Projection: NAD 83, UTM, Zone 18N, Meters<br/>         Basemap data from US Geological Survey 7 1/2 minute<br/>         Topographic Map Source: MassGIS</small> |   |
| <b>TITLE</b>   |   |
| Phase I<br>and<br>Phase II<br>Removal Areas  |   |
|  |   |
|  | <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <b>1-3</b> </div> |



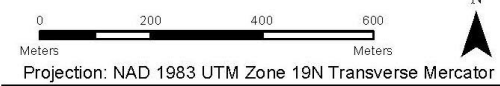
# Central Impact Area – Source Removal Phases



## Phase I, II, III and IV Removal Areas



- Legend**
- ▲ Target
  - Phase IV Area 3 15-Acre Removal Area
  - Phase IV Area 2 10-Acre Removal Area
  - Phase IV Area 1, Priority 1 10-Acre Removal Area
  - Phase IV Area 1, Priority 2 5-Acre Removal Area
  - Phase III Area 3 10-Acre Removal Area
  - Phase III Area 2 15-Acre Removal Area
  - Phase III Area 1 10-Acre Removal Area
  - Phase II Area 3 8-Acre Removal Area
  - Phase II Area 2 10-Acre Removal Area
  - Phase II Area 1 10-Acre Removal Area
  - Phase I 8-Acre Removal Area
  - Phase I 16-Acre Removal Area
  - Phase I 6-Acre ESTCP Removal Area
  - Previous UXO Removal Areas
  - J1 Range UXO Cleared Area Previous
  - Central Impact Area (CIA)
  - Phase III Area 3 work carried over to 2021

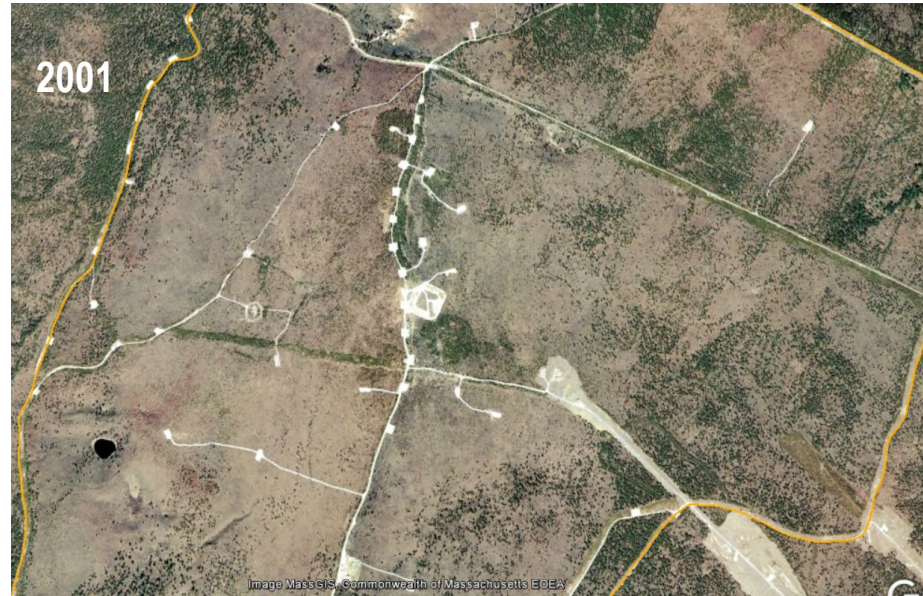


Projection: NAD 1983 UTM Zone 19N Transverse Mercator

|  |                                    |
|--|------------------------------------|
|  |                                    |
| <b>Central Impact Area<br/>Joint Base Cape Cod</b>   |                                    |
| DRAWN BY: J.Schwartz   | Project No.: 15764.002.003.0002.00 |
| CHECKED BY: S.LeFrancols   | DATE: 12/8/2023                    |
| <small>FILE: Y:\JBCCM\XD\Reporting_Formats\2023\fig1_2b_Phases_I_II_III_IV_Removal_Areas_Tschwartzj_12/8/2023_4_31:11 PM</small> |                                    |
| <small>Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community</small>                     |                                    |



# Central Impact Area – Source Removal Phases





# Central Impact Area – Source Removal Phases

2014



2016







# Central Impact Area – Source Removal Phases

2021



2023

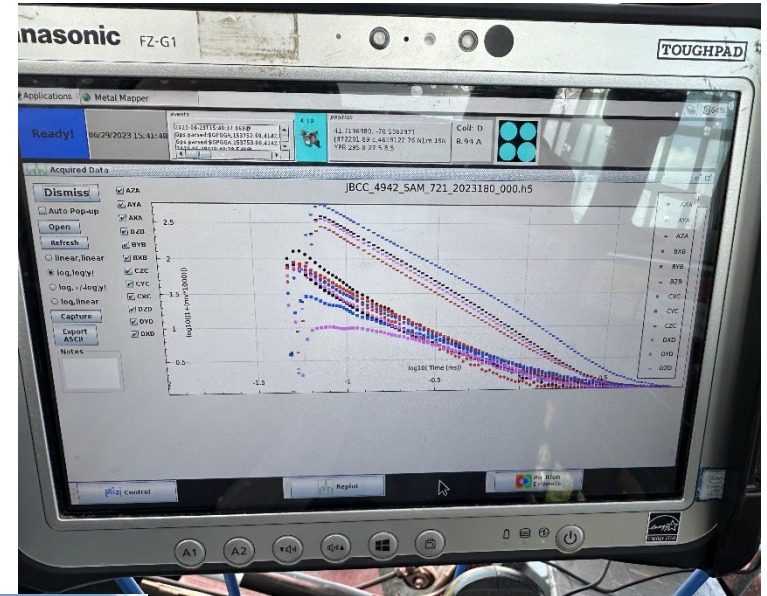




**Original “Brute Force” Approach**



# Better Approach – Metal Mapper

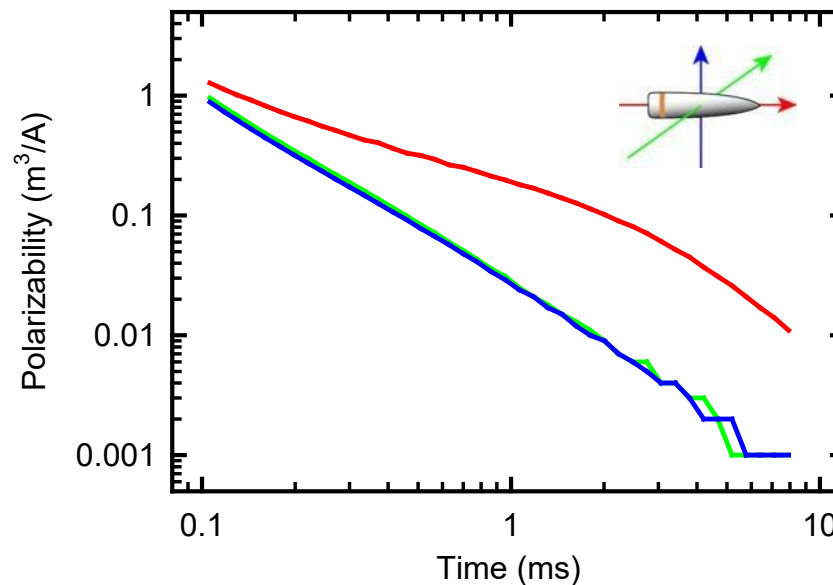
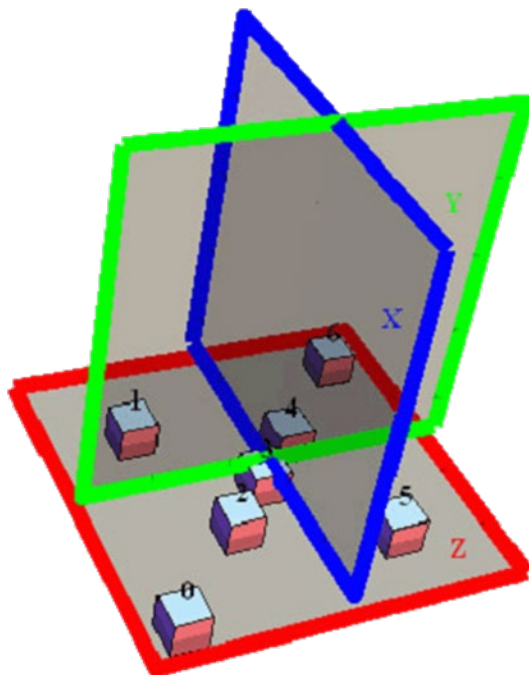






# Classification Sensors

- ◆ Same EMI Physics
- ◆ Specifically designed for munitions classification
- ◆ Now we can separate the information useful for classification





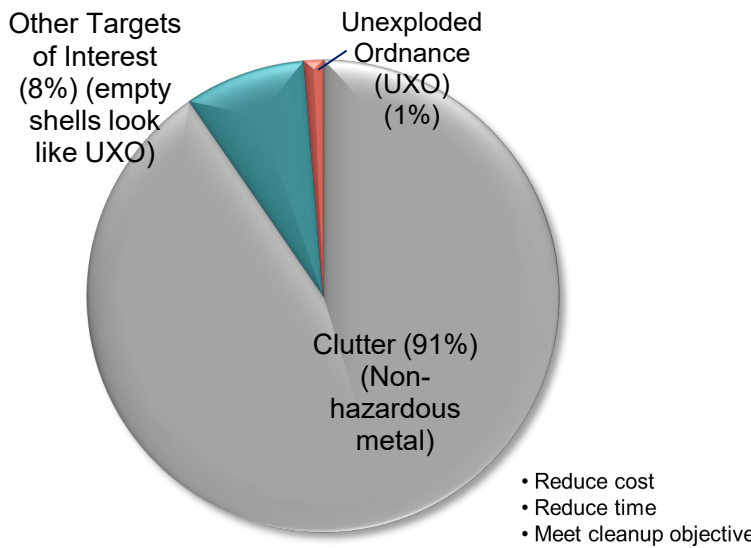
## Classification Concept



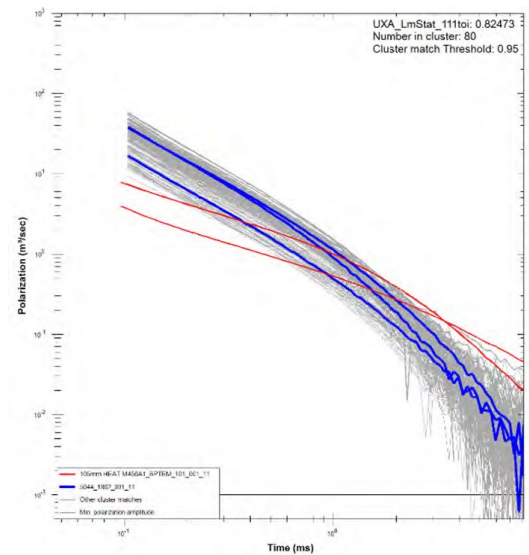
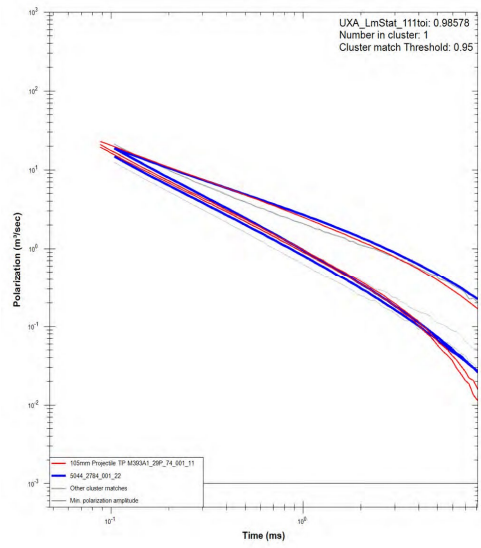
- ◆ We must rely on attributes determined from geophysical data because we cannot see buried objects.
- ◆ Anomalies meeting the 'dig' criteria are investigated. All detectable metal removed within 1-meter radius.



# Why we need Metal Mapper at JBCC

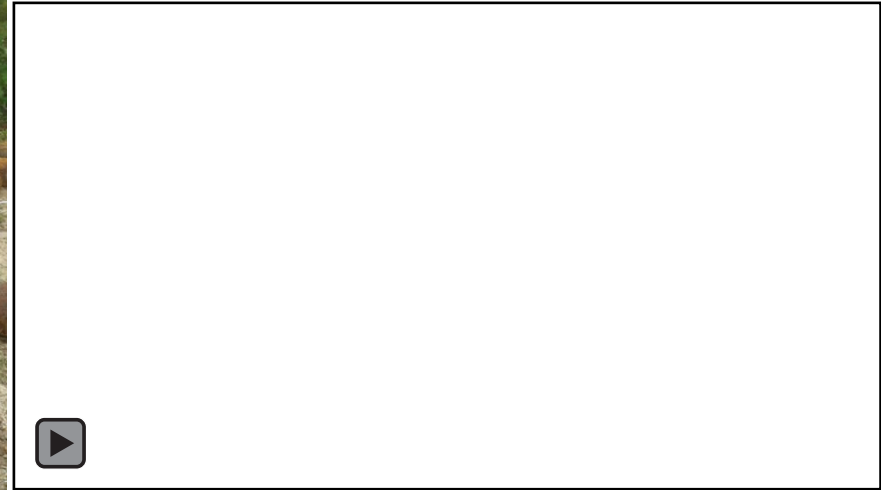


**Classification Goals: Correctly classify 95% Targets of Interest (TOI) while reducing clutter digs by >70%**

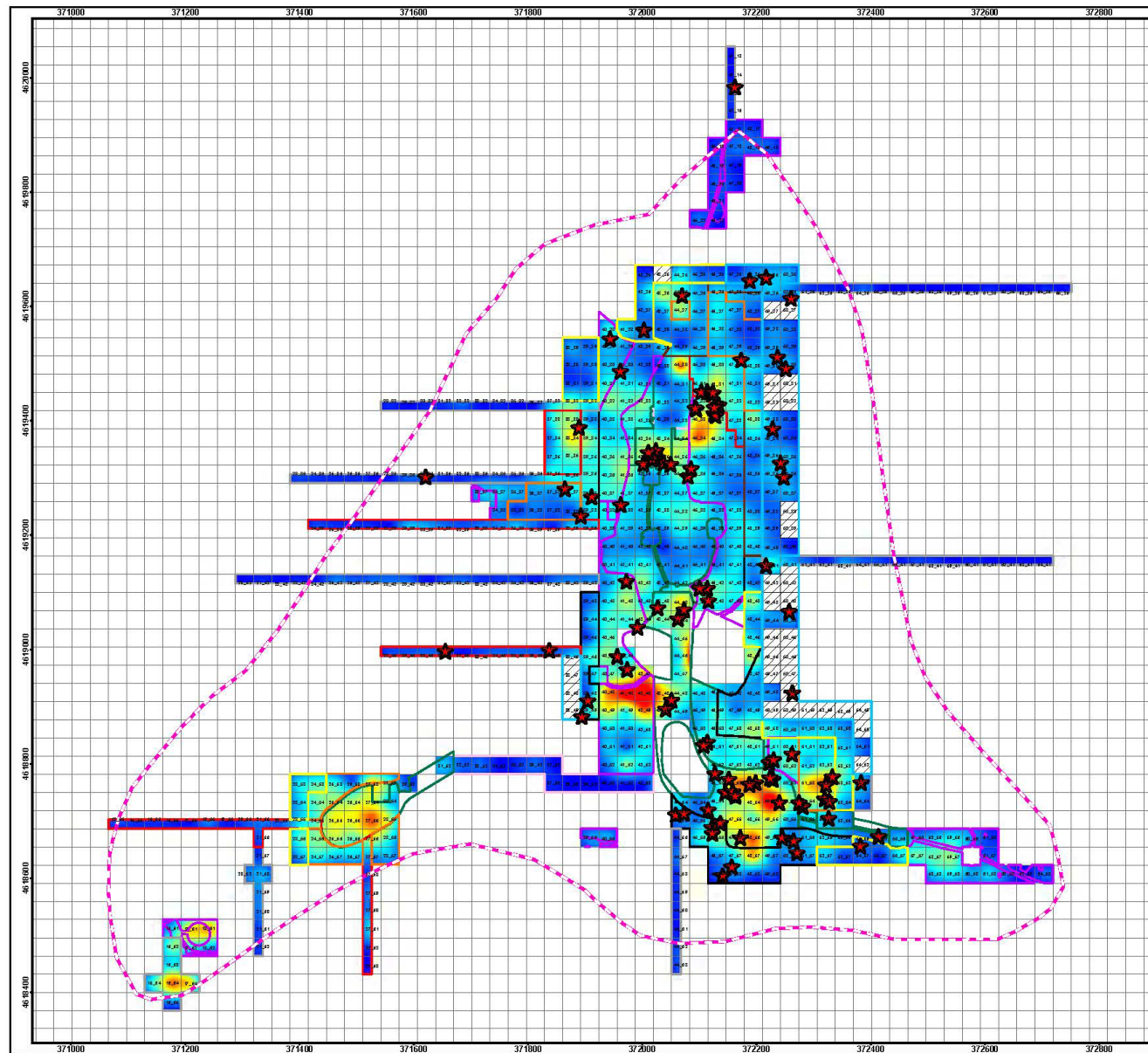




# Intrusive Investigation



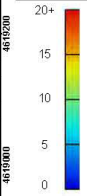




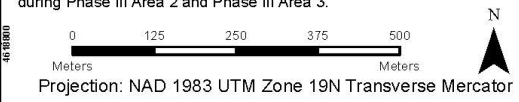
**Figure 1.5  
Actual UXO Recovered  
Per Grid**

- Legend**
- ★ 2013 – 2023 Cracked/Open/Leaking Items
  - ▨ Intrusive Investigation Ongoing
  - Phase IV Area 3 15-Acre Removal Area
  - Phase IV Area 2 10-Acre Removal Area
  - Phase IV Area 1, Priority 1 10-Acre Removal Area
  - Phase IV Area 1, Priority 2 5-Acre Removal Area
  - Phase III Area 3 10-Acre Removal Area
  - Phase III Area 2 15-Acre Removal Area
  - Phase III Area 1 10-Acre Removal Area
  - Phase II 28-Acre Removal Area
  - Phase I 24-Acre Removal Area
  - Phase I 6-Acre ESTCP Removal Area
  - Quarter Acre Grid
  - Central Impact Area (CIA)

**UXO Recovered Per Grid**



Note: Results shown for full 1/4 acre grids that are substantially complete.  
Exception: Data from half-1/4 acre grids (i.e., 1/8 acre grids) completed during Phase III Area 2 and Phase III Area 3.



|   |                                   |
|---|-----------------------------------|
| <p>Impact Area<br/>Groundwater Study Program</p>  |                                   |
| <p><b>Central Impact Area<br/>Joint Base Cape Cod</b></p>   |                                   |
| DRAWN BY: J.Schwartz  | Project No. 15764.002.001.0002.30 |
| CHECKED BY: S.LeFrancois  | DATE: 12/4/2023                   |
| FILE: Y:\JBCCMXD\Reporting_Formats\2023\fig1_5_Gridded_UXO_Actual-raster.mxd<br>schwartz_12/4/2023_5:52:42 PM |                                   |
| <small>Service Layer Credits</small>  |                                   |



## Summary of Field Operations

| Work Area                                  | Anomalies Investigated by Metal Mapper | Anomalies Excavated | UXO Items Recovered | UXO-like Items Recovered | Pounds of Explosives Recovered |
|--|--|---------------------|---------------------|--------------------------|--------------------------------|
| <b>Phase I (2013 – 2015)</b>               |  |                     |                     |                          |                                |
| 6-Acre ESTCP Area*                         | 4,716                                  | 4,716               | 79                  | 208                      | 299                            |
| 8-Acre Removal Area                        | 15,230                                 | 7,023               | 159                 | 445                      | 431                            |
| 16-Acre Removal Area                       | 27,702                                 | 11,179              | 408                 | 2,203                    | 1,098                          |
| <b>Phase I Totals (30 Acres)</b>           | <b>47,648</b>                          | <b>22,918</b>       | <b>646</b>          | <b>2,856</b>             | <b>1,828</b>                   |
| <b>Phase II (2014 – 2017)</b>              |  |                     |                     |                          |                                |
| Area 1 (10 acres)                          | 24,411                                 | 8,883               | 266                 | 1,241                    | 898                            |
| Area 2 (10 acres)                          | 20,912                                 | 10,013              | 323                 | 2,070                    | 736                            |
| Area 3 (8 acres)                           | 14,009                                 | 6,156               | 174                 | 891                      | 482                            |
| <b>Phase II Totals (28 Acres)</b>          | <b>59,332</b>                          | <b>25,002</b>       | <b>763</b>          | <b>4,202</b>             | <b>2,116</b>                   |
| <b>Phase III (2018 – 2022)</b>             |  |                     |                     |                          |                                |
| Area 1 2017 (10 acres)                     | --                                     | --                  | 13                  | 260                      | 29                             |
| Area 1 2018 (10 acres)                     | 24,208                                 | 8,167               | 197                 | 1,729                    | 533                            |
| Area 2 2019 (15 acres)                     | 26,820                                 | 9,335               | 232                 | 1,468                    | 469                            |
| Area 3 2020 (10 acres)                     | 23,239                                 | 7,848               | 218                 | 906                      | 485                            |
| Area 3 TOI and polygon digs** (0.98 acres) | NA                                     | 869                 | 18                  | 92                       | 34                             |
| <b>Phase III Totals</b>                    | <b>74,267</b>                          | <b>26,219</b>       | <b>678</b>          | <b>4,455</b>             | <b>1,550</b>                   |



## Summary of Field Operations, continued

| Work Area                        | Anomalies Investigated by Metal Mapper | Anomalies Excavated | UXO Items Recovered | UXO-like Items Recovered | Pounds of Explosives Recovered |
|----------------------------------|--|---------------------|---------------------|--------------------------|--------------------------------|
| <b>Phase IV (2021 – present)</b> |  |                     |                     |                          |                                |
| Area 1 (15 acres)                | 46,443                                 | 15,235              | 340                 | 1,341                    | 1,223                          |
| Area 2 (10 acres)                | 20,141                                 | 6,720               | 170                 | 1,507                    | 504                            |
| Area 3 (15 acres)                | 29,601                                 | 6,445               | 129                 | 627                      | 558                            |
| <b>Phase IV Totals</b>           | <b>96,185</b>                          | <b>28,400</b>       | <b>639</b>          | <b>3,475</b>             | <b>2,285</b>                   |
| <b>OVERALL TOTALS</b>            | <b>277,432</b>                         | <b>102,539</b>      | <b>2,726</b>        | <b>14,988</b>            | <b>7,779</b>                   |



## UXO Type and Quantity Recovered in the CIA Between 2000 and 2023

| UXO Type          | UXO Quantity Recorded | Weight of HE per Type (lbs.) | RDX (lbs.)   | TNT (lbs.)   | Other HE Types (lbs.) | Black Powder (lbs.) |
|-------------------|-----------------------|------------------------------|--------------|--------------|-----------------------|---------------------|
| 105mm projectile  | 497                   | 2,177                        | 1,205        | 945          | 0                     | 0                   |
| 155 mm projectile | 652                   | 4,895                        | 2,874        | 1,964        | 0                     | 75                  |
| 37mm projectile   | 285                   | 84                           | 46           | 34           | 3                     | 15                  |
| 4.2-+inch mortar  | 179                   | 1,042                        | 169          | 855          | 5                     | 1                   |
| 60mm mortar       | 230                   | 94                           | 55           | 37           | 0                     | 0                   |
| 75mm projectile   | 84                    | 8                            | 0            | 6            | 2                     | 18                  |
| 81mm mortar       | 1,288                 | 1,974                        | 1,071        | 870          | 0                     | 12                  |
| Other HE UXO      | 125                   | 232                          | 51           | 84           | 94                    | 4                   |
| <b>Total</b>      | <b>3,340</b>          | <b>10,505</b>                | <b>5,438</b> | <b>4,795</b> | <b>104</b>            | <b>124</b>          |



# Munitions Debris To Be Recycled

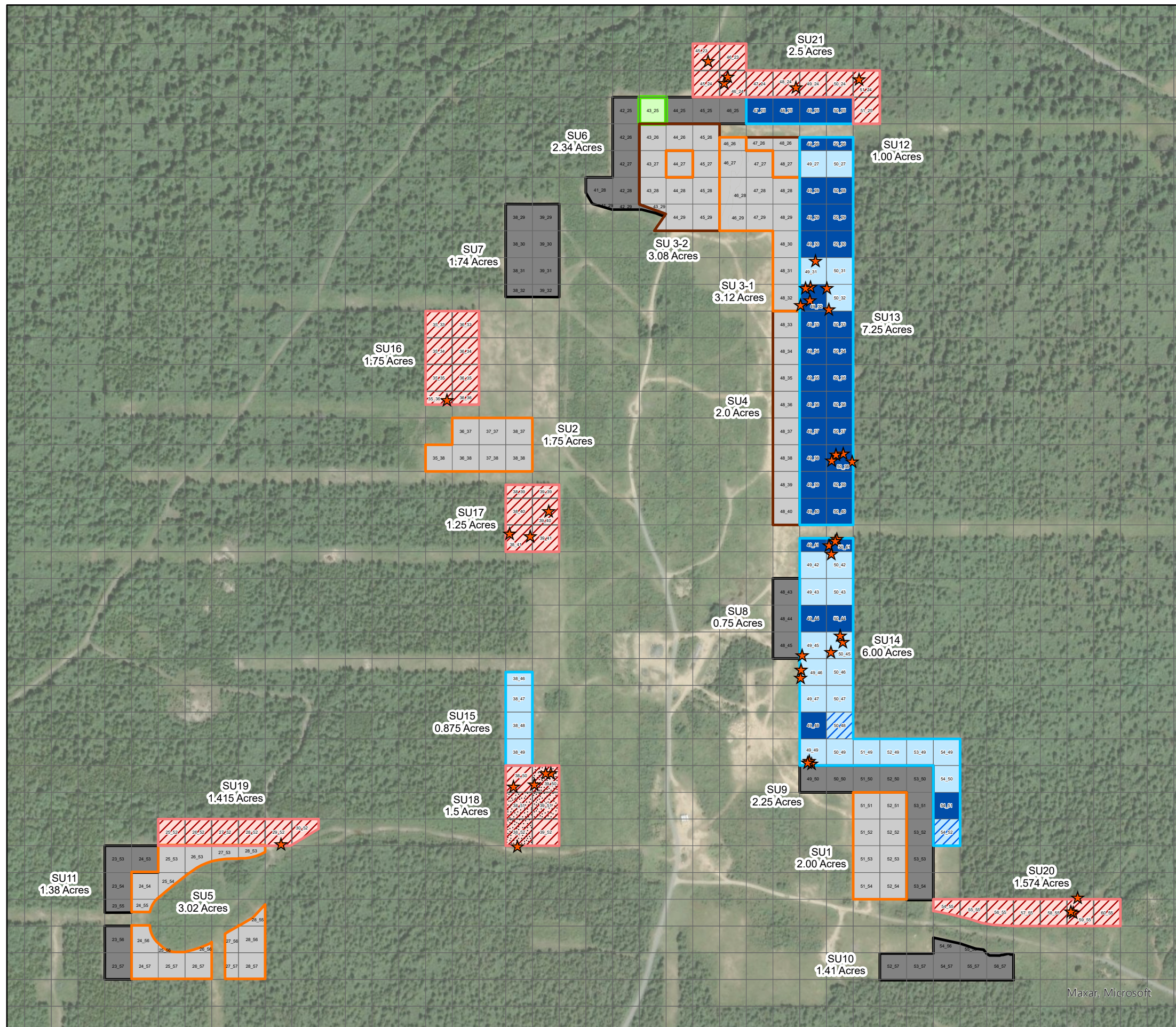
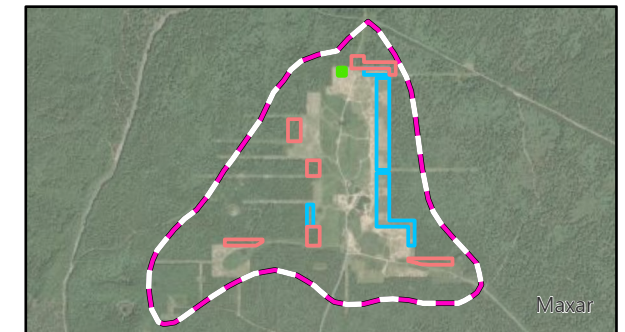




## 2024 Field Season Activities

- ◆ Complete source removal fieldwork with the remaining portions of Phase IV Area 2 and Phase IV Area 3.
  - Carryover of 8.25 acres from 2023 field season
- ◆ Begin work on new ten acres in Phase IV area 4.
- ◆ Write report summarizing findings of 2024 activities.

# Attachment 2: Source Response for UXO at the Central Impact Area 2024 Field Effort Weekly Progress Map 04/05/2024



### Legend

- ★ MEC
- Phase IV, Area 4
- Phase IV Area 4 Surface Clearance Completed
- Phase IV Area 4 Vegetation Clearance Completed
- Phase IV Area 4 DGM Completed
- Phase IV, Area 3
- Phase IV Area 3 Intrusive Investigation Ongoing
- Phase IV Area 3 TOI Intrusive Completed, Polygons Pending
- Phase IV Area 3 Intrusive Investigation Completed
- Phase IV, Area 2
- Phase IV Area 2 Polygons Pending
- Phase IV Area 2 Intrusive Investigation Ongoing
- Phase IV Area 2 Intrusive Investigation Completed
- Phase IV, Area 1, Priority 1
- Phase IV, Area 1, Priority 2
- Phase IV Area 1 Intrusive Investigation Completed

0 400 800 Feet  
Projection: NAD 1983 UTM Zone 19N



Impact Area  
Groundwater Study Program

## Central Impact Area Joint Base Cape Cod

|   |                  |  |
|---|------------------|--|
| DRAWN BY: JSchwartz   | PROJECT NO:      |  |
| CHECKED BY: SLeFrancois   | DATE: 04/05/2024 |  |
| File: Y:\JBCC\IMXD\Weekly_Reports\Weekly_Reports\Weekly_Reports_2024.aprx, 4/5/2024 12:16 PM, schwartzj |                  |  |

Service Layer Credits:  
ESRI Imagery Mapping Service, 2024.