Appendix N

DGM QA Approval and Discussion

FORMER FORT ORD, CALIFORNIA
MRS 16
QUALITY ASSURANCE REPORT:
DIGITAL GEOPHYSICAL OPPERATIONS

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1.0 INTRODUCTION

MRS-16 (formerly Site OE-16) occupies 80-acres adjacent to and just north of the Multi-Range Area (MRA) (Harding 2002). The site is sandwiched between Parker Flats Road to the north, Eucalyptus Road to the south and Watkins Gate Road to the east (Figure 1). At the time of the survey, MRS-16 was surrounded by a 6-ft high chain link fence. The nearest residential community is that of Fitch Park, located on the former Fort Ord about a mile to the west. The roads surrounding the range as well as BLM property to the north, east and west are open to recreational use. According to the Installation-Wide Multispecies Habitat Management Plan (HMP) for Fort Ord (USACE 1997) the site will be transferred to BLM to be used as an undeveloped habitat reserve. The site is mostly covered by maritime chaparral and its terrain is dominated by rolling hills with elevations ranging from 420–450 ft. These hills are composed of sand associated with Pleistocene aged sand dunes that may be as thick as 250 ft.

Clean-up operations pertinent to DGM activities were initiated with a prescribed burn in October 2006. The burn was followed by surface and analog removal activities. DGM investigations were conducted between January 2007 and July 2008. The purpose of the investigation was for:

1) mapping geophysical anomalies;
2) picking and reacquiring those anomalies that met the criteria to represent the smallest munitions and explosive of concern (MEC), a 37 mm HE projectile for the project, or any larger item

This report covers the Quality Assurance (QA) processes conducted by the U.S. Army Corps of Engineers (USACE) with respect to the collection, processing and evaluation of digital geophysical data collected by Shaw Environmental, Inc. (hereafter referred to as Shaw). The field protocols, database management and quality assurance reviews were based on the protocols previously developed for MRS 43-48 (Parsons 2006, USACE 2006).

2.0 QA ACTIVITES

2.1 Field oversight

Field oversight was conducted on a random basis according to the procedures described in Appendix A.

Production geophysical data was collected using Geonics EM-61MKII electromagnetic sensors either as single sensors (man portable) or multiple-sensors (towed array)(Figure 2). These sensors generate a magnetic field that reacts with the ground and materials on or within it. Secondary fields induced in the ground are then measured by receiving coils on the sensor and can be used to locate ferrous and non-ferrous metals in the soil. Data were collected either as individual grids or in grid blocks of variable size consisting of multiple grids. Each grid consisted of an area 100 x 100 ft. A total of 323 full or partial grids out of 406 possible grids were surveyed using DGM methods[1]. The remaining 83 grids were surveyed in real-time using either a Schonstedt or EM61-MKII (no digital data recorded). The majority of these grids contained significant tree canopy that prevented the GPS units from receiving adequate signal to acquire a useable position fix. The analog operations using the Schonstedt fluxgate magnetometers were tracked by the USACE UXO Safety Specialist and are outside the scope of this report except where seeds were missed.

For MRS-16 the digital surveys were designed to acquire 100% coverage of each grid. The thick maritime chaparral cover characteristic of the area had been removed via a prescribed burn so that only scattered small oak trees remained. Vegetation coverage locally impacted DGM access, such as around trees where the canopy was thick and in areas with protected Sand Gilia. Local topography (primarily man made) also eliminated some areas from DGM coverage. According to the last DGM QC report received on 5 February 2008, the average DGM production rate was 12.2 grids per day or about 2.81 acres per day. Shaw had picked 12,258 anomalies and reacquired 12,013 anomalies. Based on previous QC reports, the reacquisition rate was 162.5 anomaly reacquisitions per day.

2.1.1 Specific conditions

Data collection over the majority of MRS-16 was conducted according to the site specific work plan (Shaw 2006). There were however 3 primary exceptions, these being a high concentration area, a "noisy" area and areas below thick tree cover where high-quality GPS signals could not be acquired.

2.1.2 Primary high concentration area:

Early in the process of surveying MRS-16, a series of high-concentration areas were identified in the western portion of the MRS. This area was characterized by very large, overlapping anomalies. This area also coincided with the 2 areas selected for a cost-comparison where 23 grids were assigned to analog and DGM clean-up and 23 grids were assigned to repeat DGM surveys. The intent was to take similarly sized areas in MRS-16 to execute a cost-comparison between the standard removal process as used on Ranges 43-48 and a multiple pass DGM approach that had been recommended by Parsons as a cost effective alternative (e.g., Murray et al. 2006). However, during the analog process several large burial pits filled with practice 2.36-in rockets were discovered and an estimated 48,971 pounds of MD were subsequently removed[2]. The area identified as the high-concentration area is shown on Figure 3 and due to its size the comparison studies were abandoned in order to better characterize the burial pits.

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[1] Preliminary data reported in *Preliminary Draft, Remedial Action Report, MRS-16 Munitions and Explosives of Concern Removal, Former Fort Ord, California* by Shaw dated 30 October 2008 and are subject to change.
[2] Ibid

2.1.3 Noisy area

The "Noisy Area" is located along the north and west portion of MRS-16. Data in this area was characterized by a high anomaly density but yielded little MD, MEC or RRD. The Shaw lead geophysicist and USACE QA geophysicist performed a site walk to try to determine what the cause of the high anomaly rate was but nothing was apparent. The best estimate is that erosional debris from Santa Margarita Formation, which is known to have magnetic concretions (precipitated deposits). It was inferred that these concretions were naturally deposited in a high abundance in this strip creating a zone of high magnetic background. To address the problem the Shaw geophysicists developed a modified processing and picking protocol that is described in FWV TII-0021 and Appendix B(a). This approach was more restrictive in the anomaly selection process and provided additional QC protocols for picks near the pick threshold.

2.1.4 Real-time digital survey areas

A significant portion of the 83 grids not included as digital grids were surveyed using EM61-MKII in a real-time mode. The procedures used were documented by FWV TII-0020 and were demonstrated in May 2008. The field procedure required establishing 2-ft wide lanes delineated with ropes and walking transects with the EM61-MKII. The audio signal on these tools were set on high as an auditory alarm, but the system operator used the visual display to track signal response while walking along the lane. When an anomaly was encountered the operator ran the instrument back and forth in multiple directions until the peak response location was identified. At this point a pin flag was placed in the ground and a UXO technician inspected the area shortly thereafter. These surveys were required in areas where tree canopy was too thick to allow for a good GPS signal to be received and the same tool was used to try to keep consistency in the surveys. Since no digital data was recorded these surveys were treated by the QA program similarly to the Schonstedt analog surveys. The only difference being that the USACE QA geophysicist reviewed the work plan and observed the field demonstration. All QA seeds within the areas covered by the real-time digital surveys were collected.

2.2 Digital data review

A review of digital data by the USACE was performed to monitor the effectiveness of data processing and consistency of data delivery. Issues that were looked at in these data included:

1) Missing survey lines within a grid (interline gaps).
2) Data "gaps" along survey lines.
3) Bowing out of survey lines beyond 50% of survey line spacing.
4) Unreasonable data "spikes."
5) Data incongruity across survey grids (data levels in one grid are not reasonably compatible with data levels in neighboring grids).
6) Inadequate data density along survey traverse.

7) Lack of accurate, precise locations; survey line orientation.
8) Inadequate/incomplete site survey coverage.
9) Missing, incomplete, or noncompliant instrument standardization checks.
10) Completeness of file header information and supporting documentation
11) Adequacy of anomaly picks

To accomplish this all raw and processed data files were checked by the USACE to ensure that Shaw followed an appropriate and informative naming convention reflecting the grids surveyed as outlined in the DID MR-005-05. The USACE checked that Shaw managed the field and processed data in a professional manner, including organization, daily maintenance, and complete documentation. The transfer and delivery of data was achieved via an ftp site where raw (pre-processed) data was delivered in 3 business days after collection and processed data (including pick files) were delivered in 5 business days. The USACE performed 100% verification of the accompanying documentation for completeness and accuracy. This focused on a review of header files on the pre-processed data (data that has merged into a single file and synchronized with the GPS data) and processed data to verify that dates were consistent, systems and system sampling parameters were identified, project name and contractor was listed, and all column headers were included and defined. Shaw also delivered supporting summary sheets that further documented field parameters and processing. 100% of the summery sheets were reviewed for completeness, verification of calibration data and consistency to the electronic data file headers.

The process for reprocessing and projecting the psueo-color maps of the DGM data was revised from that used at MRS 43 to 48. Instead of starting with a 100% review of the data in Geosoft Oasis Montaj and scaling down the review to about 20% as was done previously, the new procedure resulted in 100% review throughout the project. The difference being that these digital data were imported into Geosoft only for the generation of psuedo-color maps that were then exported as a georeferenced geotif. The geotifs were then imported into ESRI ArcGIS and anomaly pick data were superimposed on top of the maps. The ArcGIS environment allowed for a more rapid and interactive analysis of these data as well as providing a living archive of these data that could be easily manipulated and queried. Despite the full review of data, the revised process allowed for a more complete review of the digital data in an easier and faster means than before because grids only had to be generated once and then once in the GIS plots could be toggled on and off for analysis. As with the MRS Ranges 43-48 data, the data review focused on plotting a sum channel modified from that proposed by EarthTech (2005) for the Camp Beale SI according to:

$$\text{Sum Channel} = 0.16*\text{Ch1} + 0.21*\text{Ch2} + 0.26*\text{Ch3} + 0.31*\text{Ch4}$$

where Ch1 to Ch4 refer to the data collected in time-gates 1-4 on the bottom coil of the EM61-MKII. These data allow for plotting using the same scale range (-3 to 7 mV) that has been used for Channel 3 alone on many previous projects at Fort Ord. Another reason for calculating and plotting this channel in this manner is that it calculates the data differently than the contractor (who was plotting using the straight arithmetic sum of the channels and results could be compared more effectively to previous surveys. Overall, the general QA digital data remapping and review consisted at a minimum of:

1) creating a process data database
2) importing processed XYZ data
3) calculation of sum channel
4) generating a grid (0.25 cell size and blanking distance of 2-ft) of sum channel
5) plotting the sum channel
6) plotting a symbol cover for the track lines (view coverage)
7) exporting the plots to geotifs
8) importing the geotifs into a GIS
9) importing the pick files into MS Access that was live linked to the GIS
10) inspecting the anomaly picks
11) generate QA picks for any unpicked anomalies that warranted further evaluation

Overall the data was of high quality; however, several data quality issues were encountered that are described under the corrective action requests (CARs) and in Appendixes B and C. DQOs were met on a consistent basis and the delivery of raw and processed data was generally according to the 3-day and 5-day schedule. Probably the single most apparent issue was that the contractor was not able to establish a fully functioning database during the execution of the project and a full database migration did not occur until after DGM field work had concluded. The likely cause was that the contractor was instructed to use the existing database inherited from Parsons instead of using their own and then use a conversion utility to export their data into the format of the existing database for archival purposes. Database issues had been brought to the attention of the management as early as January 2006 and ultimately resulted in the Corps instructing Shaw to purchase a dedicated server to house the data on the onset of field data collection. A significant ramification of the database management issue was that as field operations were ending no grids had been turned over to QA for review and acceptance. The digital files had been reviewed periodically and sequentially as the project progressed but no grids had been released to QA to allow for QA digital and analog surveys to commence. The initial slug of grids was released to QA on 16 and 23 July 2007 and errors led to the release of some grids that were not ready which QA subsequently investigated and failed. Root-cause analysis of the failures identified that some grids had been erroneously released to the government for acceptance.

2.3 QA Seeding

Twenty three seeds were emplaced by QA in the MRS-16 area (Figure 4; Table 1). Seeding was initiated after the initial surface removal and prior to DGM surveys. Seeding locations and depths were selected to test:

1) grid coverage
2) excavation procedures
3) anomaly picking procedures

The 23 seeds included projectiles (30mm(1), 37mm (12)), hand grenades (4), rockets (2.36-in (4)) and mortars (81mm (1)). To meet the testing objectives seeds were placed near corner stakes and along grid boundaries, near vegetation or smaller topographic features that are obstructions to straight line paths, and randomly within grids, and one seed was placed in a gopher hole. There were two sets of double seeds that consisted of a larger seed being buried typically 0.5 feet above a smaller seed. The smaller seed was generally below the maximum depth of detection from the surface, but easily detectable from the base of the hole once the upper seed was removed. These double seeds were intended to verify that UXO technicians swept the hole with a magnetometer after removing an item to verify that the hole was clean. Seeds were buried at depths ranging from 4 to 30-inches. Eighteen of the 23 seeds were recovered. Those not recovered include:

ORD-QA08: 30mm projectile buried 24-inches below the ground surface in a horizontal position and 6-in below seed ORD-QA29 (Table 1). Failure to detect this seed resulted in the issuance of the corrective action request CESPK-ED-GG-FY07-001 (Appendix C). Root-cause analysis by Shaw indicated that the seed was missed because it was Shaw's protocol not to sweep completed holes with a Schonstedt upon completion of the excavation. FWV TII-019 was generated following PDT debate with a resolution that holes will be post-surveyed using an EM61-MKII (same tool used to detect) and not a Schonstedt due to increases in time and cost to use the Schonstedt down each hole, and the ubiquitous occurrence of metal fragments in the soil. As a result, Seeds ORD-QA08 and ORD-QA16 become non-detectable from the surface.

ORD-QA14: 37mm projectile buried 16-inches below the ground surface in a vertical position. The corrective action request CESPK-ED-GG-FY07-002 identified that anomaly pick C3A2G5-0023 was located 1.3-ft from the seed and that seed recovery should have been in the dig radius of that pick. QA personnel reacquired the seed and found that it was detectable with both a Schonstedt and EM61-MKII (6.0 mV on channel 3). The most likely cause of the miss was either malfunctioning EM61-MKII or the seed anomaly was masked by anomalies C3A2C5-0023 and -0024 and field procedures did not adequately clear site. Shaw addressed problem by acquiring new EM61-MKII and testing the old and new systems, and retaining of field teams (Appendixes B and C).

ORD-QA15: a 37mm projectile buried 15-in below the ground surface in a vertical orientation. The seed was placed near a rock to test coverage around an obstacle. Failure to recover this seed resulted in the issuance of corrective action request CESPK-ED-GG-FY07-003. QA investigations of the seed after the miss yielded non-detects using both the Schonstedt and EM61-MKII. After the field QA investigation it was discovered that the seed had been excavated by Shaw but notification protocols had not been followed. As a result reporting procedures were clarified between Shaw and the USACE and added reporting requirements were incorporated.

ORD-QA16: this was a 37mm projectile buried at 30-inches and 6-inches below seed ORD-QA-30. Need to detect this seed was superseded by acceptance of FWV TII-019 generated following the miss of seed ORD-QA08.

ORD-QA20: 37mm projectile buried at 12-inches and oriented horizontally. This seed was planted at the onset of the project by C. Huckins and coincidentally was located directly on top of a former water line. Review of the data indicates that detection was not possible due to the elevated background.

Thus, based on these results it is determined that 1 of the 5 missed seeds were detectable and should have been found. Of the remaining seeds two are removed from the calculation of detection rate due to WVN-019 that altered the reacquisition process. This resulted in the lowest of the double seeds non-detectable. The remaining seed was buried directly on top of a steel water main and was rendered non-detectable due to the locally elevated background. Thus, 19 of 20 detectable seeds were recovered for a recovery rate of 95%. ORD-QA14 should have been removed by field crews excavating nearby anomalies (seed was located within the dig radius). Performance is deemed acceptable in accordance to the work plan and sufficient to meet the intent of the DQOs.

2.4 QA Digital Re-Surveys

The USACE conducted independent digital QA surveys scattered about the site. In total, 6 grid blocks consisting of 13 grids were surveyed (Figure 5). The individual grid block maps are presented in Appendix D. The overall goal of 1.5 to 2% stated in the QA work plan was exceeded with approximately 4% of the grids having been resurveyed. Several anomalies were identified and placed in the QA anomaly dig list (Table 2). The results from the grids are discussed in the next section.

2.5 QA Anomaly Excavations

As part of the digital resurveys by QA anomalies exceeding a pick threshold of 3 mV on either the EM61-MKII channel 3 or the calculated sum channel described earlier were picked for QA evaluation. Table 2 lists 26 anomalies that were selected for reinvestigation. Specific items of concern are described below:

QA-C3A1G0-001: This was a large piece of cultural debris located on the western boundary of MRS-16. The anomaly was the focus of the corrective action request CESPK-ED-GG-FY08-007. Shaw's response stated that this was not a failure because it is located just outside of the MRS. Previous MMRP actions on Ft Ord required documentation of complete grids, thus would have been a failure; however, this project is allowing partial grids so the end result was to pass the partial grid (FWV TII-0024).

Several anomalies were located in grid C3A2D9. Investigation of these anomalies found the nose cone and warhead of a 2.36-in rocket (C3A2D9-004) and a complete 2.36-in rocket (C3A2D9-005). Once those 2 items were uncovered the field determination was to fail the grid and no further excavations were conducted. A corrective action request was not generated for these finds because shortly after the discovery of these items (< 1 day) it was determined that the grids in that grid block had been erroneously released to QA due to a database merge error. This also coincided with temporary cessation of field activities and Shaw was instructed to rectify their database issues (Appendix C).

Five anomalies were identified in grid C3A3H2 that yielded 3 horseshoes and 1 2.36-in rocket. These finds resulted in the generation of corrective action request CESPK-ED-GG-FY07-006. See the following section for discussion of Shaw's response.

2.6 Corrective Action Request

During the clean-up operations of MRS-16 issues were identified that resulted in the issuance of corrective action requests (CARs). Five CAR's were issued as a results of DGM activities (Appendix C). The documents contained in Appendix B were generated by Shaw to document their response to the first four CARs issued and the steps implemented to prevent recurrence. Note that the fourth CAR of the project was issued by the USACE safety officer and is not included in Appendix C or the review of DGM related CARs. These DGM CARs are briefly described here:

CESPK-ED-GG-FY07-001: The issue resulting in the generation of this CAR centered on Shaw not recovering the lower seed in a double seeded hole. Following previous practice on Ft Ord, QA had placed 2 seeds in a single hole consisting of a "large" item within the limits of DGM detection and a second item 6-in lower but typically out of the detection range from the ground surface. This seeding configuration was done twice on MRS-16. The intent being to verify that a Schonstedt fluxgate magnetometer was used to sweep the hole for other metallic items prior to filling the hole in. The root cause analysis revealed that such sweeps were not part of Shaw's standard practice and that verification of a clean hole was being performed with an EM61-MKII that was run across the hole in multiple directions prior to filling in the hole. Issuance of the CAR resulted in a PDT conference call where it was determined that a field variance would be generated to document Shaw's field procedure and that sweeping the holes with a Schonstedt would not be a standard part of the process. As a result of this, seeds ORD-QA08 and ORD-QA16 become classified as non-detectable because they were placed at depths known to be undetectable from the surface.

CESPK-ED-GG-FY07-002: This CAR was generated because seed ORD-QA14 was not recovered. This seed was a 37mm projectile buried 16-inches below the ground surface in a vertical position. Shaw's production data showed that anomaly C3A2G5-0023 was located 1.3-ft from the seed. Thus, the seed was within the dig radius of this pick and should have been recovered. QA personnel reacquired the seed and found that it was detectable with both a Schonstedt and EM61-MKII (6.0 mV on channel 3). Shaw stated in their root cause analysis that the most likely cause of the miss was either a malfunctioning EM61-MKII or the seed anomaly was masked by anomalies C3A2C5-0023 and -0024 and field procedures did not adequately clear site. Shaw addressed problem by acquiring new EM61-MKII, testing the old and new systems, and conducted training with the UXO dig teams.

CESPK-ED-GG-FY07-003: The third CAR was also generated because of a missed seed. Seed ORD-QA15, a 37mm projectile buried 15-in below the ground surface in a vertical orientation near a rock to test coverage around an obstacle had been missed. QA investigations of the seed after the miss yielded non-detects using both the Schonstedt and EM61-MKII. Subsequent to the QA search the seed was found in the pool of seeds returned to the USACE safety officer. Proper notification of QA via email protocols had not been followed so those protocols were revisited and additional notification requirements were emplaced.

CESPK-ED-GG-FY08-006: This CAR was generated on 19 June 2008 after QA investigated 5 anomalies identified in QA DGM data and found 3 horseshoes and a 2.36-in rocket. The root cause analysis by Shaw revealed that the QA anomalies were systematically offset from production data anomalies by about 10.5-ft indicating a systematic error. Detailed review of the data found that GPS signal lock had been lost in the area of those items resulting in the apparent shift. Shaw's response was to review all of their production data for recurrence of the issue and found 1 additional occurrence. The areas impacted by the poor GPS signal quality were resurveyed and Shaw imposed additional screening criteria to flag recurrence in subsequent data.

CESPK-ED-GG-FY08-007: Also generated on 19 June 2008 was this CAR to address a 307 mV anomaly identified in QA DGM data. When excavated the area contained large cultural debris buried about 6-in below the surface. Root cause analysis revealed that this area was not covered by production DGM surveys because it was located just outside of the former fence for MRS-16. Although on previous projects where full grids were surveyed if any portion of the grid was located within the project area, this project focused only within the former fence boundary as defined in FWV 0024.

3.0 CONCLUSIONS

QA activities by the Government verified that Shaw had an adequate QC program in place and that data collected at MRS-16 are sufficient and in accordance with the project DQOs outside of the high concentration area.

4.0 LESSONS LEARNED

Several quality related issues were observed during the execution of the MRS-16 clean-up activities. A primary perception by USACE QA is that many of the issues were driven by a management perception that focused almost solely on cost and schedule and did not account for the reporting requirements and staffing needs associated with a geophysically based clean-up program. This was realized early on in the program when database issues arose yet field teams were sent into the field to collect data prior to the establishment of a fully-functional database. These issues led to an early list of lessons learned that was presented at a project team meeting in the timeframe of August/October 2007 (Appendix E). Staffing issues and re-prioritizing of geophysical team tasks in order to provide work areas for idol UXO teams resulted in inefficient data collection and animosity between

UXO and geophysical teams. QA feels that many of the quality issues ultimately tie back to the database problem that remained even after DGM field activities had ceases as is exemplified by the release of the first grids for QA review after geophysical activities had ended 17 and 23 July 2007). QA feels that it is critical that the USACE requires proof of proper management of DGM based MMRP projects prior to the initiation of new projects on site. As is demonstrated by new developments coming out of the SERDP and ESTCP programs, as well as the Huntsville MMRP CX training, modern ordnance clean-up projects are largely driven by digital geophysical surveys that have become the core of the projects. As such, project geophysical team members need to be included in every step of the project design, planning and execution. These themes stated in Appendix E were recurrent through the project and must be avoided in future projects as much as possible.

A list of issues observed or suggestions for future projects is presented below:

a. USACE should reinstate the use of Schonstedt sweeps through cleared holes. At least 2 of the CARs described above should have been prevented if the holes were swept with Schonstedt's prior to filling them in and moving to the next excavation as has be the practice on Ft Ord previously.
b. New contractors coming on site should not be required to drop their existing database formats and convert to the Ft Ord database. Contractors need to be informed of the fields that are required in the database and were appropriate their database will need to be modified to accept required fields. At the end of the project, the contractor will need to export data from their database into the Ft Ord database so that all the appropriate fields are populated.
c. A new seeding configuration should be added to the suit currently used. This is to add a small seed near a much larger seed. If this had been implemented by this study instead of the vertical doubles all of those seeds would have remained valid. However, a combination of vertical and close-proximity doubles would provide a more comprehensive evaluation of the excavation clearance procedures.
d. QA seeding should not only evaluate contractor performance but can be used to monitor detector performance throughout the surveyed area. A proposed "triple-seed" configuration, where 3 seeds are placed at ranging from Pds of 100% to ~25%, could be used selectively around a range to measure site-specific performance and variability in detection depth. These data would then be useful during the risk analysis phase. However, it must be noted that such a procedure would mean that a percentage of seeds would be missed and these would not be considered a failure on the part of the contractor. Those seeds planted with Pds at or near 100% from the GPO would still be considered failures if missed. Although this approach would slightly increase seeding costs and tracking of these seeds, the benefits would be realized during risk analyses where these data would provide more site specific data on system performance and maximum depths of detection, thus increasing confidence in the clean-up and a better understanding of ordnance detection capabilities.

e. USACE QA recommends that future project return to the process of working only with "full grids" wherever possible.
f. Higher confidence in grid clearance under thick tree canopy would be achieved if DGM maps could be produced and pictures of the anomaly distribution and picking provided. QA recommends that real-time digital surveys not be performed in future and that these surveys be replaced either by fiducial surveys or surveys within roped lanes with survey points at both ends. The EM61-MKII's tachometer would then be used to measure distance. Or, survey grade systems can be performed using Shaw's robotic total station that tracks a survey prism that is placed on the array/sensor in the location of the GPS antenna. Either method would allow for 100% digital maps to be produced.
g. The Range Support Center needs to establish QA standards for all MMRP projects and assure that during the development of Scopes of Work that funding is allocated at the end of projects to allow QA to review the DIDs and incorporate any lessons learned for subsequent projects.

5.0 REFERENCES

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6.0 TABLES

Table 1. QA seed tracking list.

Number	SeedID	Northing	Easting	Nomenclature	Depth (in)	Orientation	Depth Recover (in)	Notes	Status	Date Seeded	Seeded By	Surveyed	Date Found	CAR	gridID
MRS16-003	QA06	2122858	5746733	2.36" Rocket	10	Hor	4	Reported as QA05 (C3A2I3-O4)	Found	12/19/2006	Huckins	TRUE	4/26/2007	--	C3A2I3
MRS16-004	QA07	2122415	5746706	2.36" Rocket	12	Hor			Found	12/19/2006	Huckins	FALSE	5/8/2028	NA	C3A2E3
MRS16-005	QA08	2121771	5748441	30mm	24	Hor	24	double, buried 6" below QA29	Double	1/17/2007	Hunter	TRUE		CAR_07_001	B3J3H0
MRS16-006	QA09	2123218	5747097	37mm	6	Hor			Found	1/18/2007	Hunter	TRUE	4/17/2008		C3B2C6
MRS16-007	QA10	2121209	5749016	37mm	19	Vert		in gopher hole	Found	1/17/2007	Hunter	FALSE	7/10/2008		B3J4C6
MRS16-008	QA11	2122375	5747474	37mm	7	Hor		east wall of trench	NA	1/18/2007	Hunter	FALSE		Huck Released	C3A2H0
MRS16-009	QA12	2122777	5746682	37mm	13	Hor	13		Found	1/17/2007	Hunter	TRUE	4/23/2007	--	C3A2H2
MRS16-002	QA13	2122953	5746686	37mm	10	Hor		near a small tree	Found	12/19/2006	Huckins	FALSE	3/31/2008	--	C3A2J2
MRS16-010	QA14	2122618	5746969	37mm	16	Vert			Missed	1/17/2007	Hunter	TRUE		CAR_07_002	C3A2G5
MRS16-011	QA15	2121854	5747128	37mm	15	Vert		near rock	Missed	1/17/2007	Hunter	FALSE		CAR_07_003	B3J2I7
MRS16-012	QA16	2122489	5747084	37mm	23	Hor	30	double, buried 6" below QA30	Double	1/17/2007	Hunter	TRUE	4/20/2007	NA_per CAR 07-001	C3A2E6
MRS16-013	QA17	2121876	5746784	37mm	12	Hor			Found	1/17/2007	Hunter	FALSE	5/2/2008	--	B3J2I3
MRS16-014	QA18	2122000	5747798	37mm	6	Hor	6		Found	1/17/2007	Hunter	TRUE	4/16/2007	--	B3J3J3
MRS16-015	QA19	2121200	5749001	37mm	8	Hor			Found	1/17/2007	Hunter	FALSE	6/18/2008	--	B3J4C6
MRS16-001	QA20	2122423	5746699	37mm	12	Hor			Masked	12/19/2006	Huckins	FALSE		NA	C3A2E2
MRS16-016	QA21	2122033	5746450	MKII Grenade	6	Hor		Near tree	Found	1/17/2007	Hunter	FALSE	4/11/2008	--	C3A1A0
MRS16-017	QA22	2121948	5748761	MK II Grenade	9	Vert	12		Found	1/17/2007	Hunter	TRUE	4/25/2007	--	B3J4J3
MRS16-018	QA23	2122232	5747783	MK II Grenade	5	Vert	3		Found	1/17/2007	Hunter	TRUE	5/2/2007	--	C3A3C3
MRS16-019	QA24	2122336	5748115	M30 Grenade	6	NA	3		Found	1/17/2007	Hunter	TRUE	5/30/2007	--	C3A3D7
MRS16-020	QA27	2121422	5748617	81MM mortar	12	Hor	11		Found	1/17/2007	Hunter	TRUE	5/8/2007	--	B3J4E2
MRS16-021	QA28	2122147	5747192	Rifle flare (signal)	8	sub-Hor			NA	1/17/2007	Hunter	FALSE		Huck Released	C3A2B7
MRS16-022	QA29	2121771	5748441	2.36in rocket	18	Hor	18	double, 6" above QA08	Found	1/17/2007	Hunter	TRUE	3/21/2007	CAR_07_001	B3J3H0
MRS16-023	QA30	2122489	5747084	2.36in rocket	17	Hor	6	double, 6" above QA16	Found	1/17/2007	Hunter	TRUE	4/20/2007	--	C3A2E6

Table 2. QA dig results

ID	X	Y	Response (mV)	Dig result
QA_B3J3I7-001	5748108.9	2121838.2	6.2	Rusty hinge (RRD)
QA_B3J3I7-002	5748112.0	2121834.9	5.3	RRD < 1-in depth
QA_B3J3I7-003	5748126.6	2121841.3	4.3	RRD < 1-in depth
QA_C3A1GO-001	5746440.0	2122704.0	307.0	Large metal cultural debris embedded in ground at 6-in depth
QA_C3A2D9_001	5747480.4	2122330.7	26.9	RRD < 1-in depth
QA_C3A2D9_002	5747459.6	2122339.0	16.6	Rusty soil at 9-in
QA_C3A2D9_003	5747428.7	2122368.9	20.9	Rusty soil
QA_C3A2D9_004	5747386.2	2122341.1	14.1	Nose cone and 2.36-in rocket warhead (MD)
QA_C3A2D9_005	5747383.8	2122335.9	70.6	2.36-in rocket (MD)
QA_C3A2D9_006	5747378.3	2122338.7	54.8	Grid failed - digs stopped
QA_C3A2D9_007	5747377.0	2122332.8	33.6	Grid failed - digs stopped
QA_C3A2D9_008	5747372.4	2122334.7	28.2	Grid failed - digs stopped
QA_C3A2D9_009	5747374.6	2122320.6	35.0	Grid failed - digs stopped
QA_C3A2D9_010	5747373.4	2122315.7	21.7	Grid failed - digs stopped
QA_C3A2D9_011	5747368.8	2122318.5	50.6	Grid failed - digs stopped
QA_C3A2D9_012	5747360.5	2122321.8	27.6	Grid failed - digs stopped
QA_C3A2D9_013	5747361.7	2122325.5	20.5	Grid failed - digs stopped
QA_C3A2D9_014	5747339.4	2122302.3	47.1	Grid failed - digs stopped
QA_C3A2D9_015	5747344.3	2122304.7	14.7	Grid failed - digs stopped
QA_C3A2D9_016	5747355.0	2122306.5	6.8	Grid failed - digs stopped
QA_C3A2D9_017	5747360.5	2122304.1	7.6	Grid failed - digs stopped
QA_C3A3H2-001	5747727.9	2122726.0	18.4	Rust @ 10-in
QA_C3A3H2-002	5747751.0	2122753.5	16.6	Horseshoe @ 6-in
QA_C3A3H2-003	5747724.3	2122763.2	19.5	Horseshoe @ 8-in
QA_C3A3H2-004	5747753.5	2122764.6	27.0	2.36-in rocket at 4-in (MD)
QA_C3A3H2-005	5747728.2	2122772.7	14.6	Horseshoe @ 8-in

7.0 FIGURES

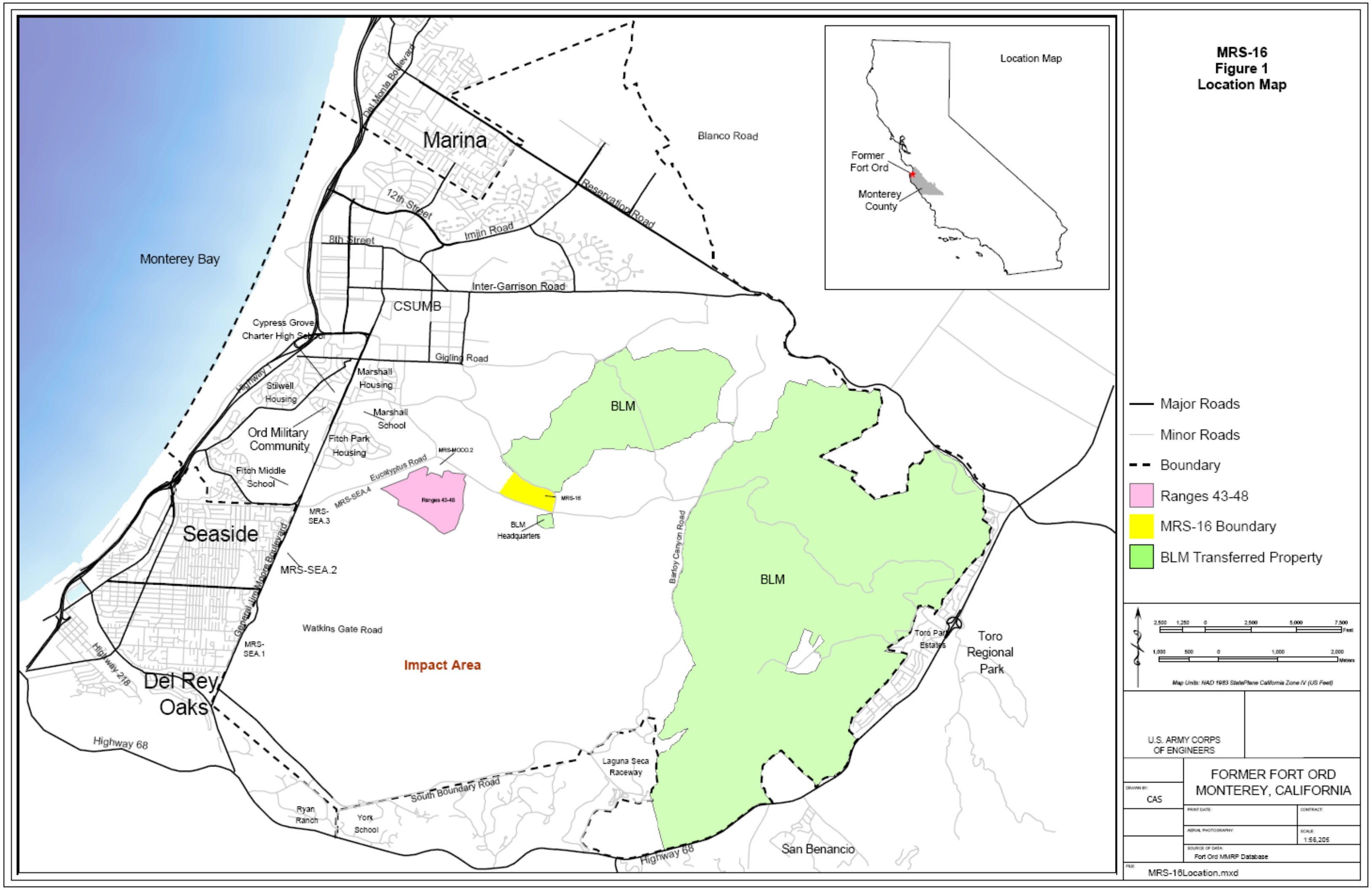

Figure 1. Location of MRS-16 and the former Fort Ord.

a. Towed-array with three EM-61 MKII sensors.

b. Single man-portable sensor.

Figure 2. Geonics EM-61 MKII configurations.

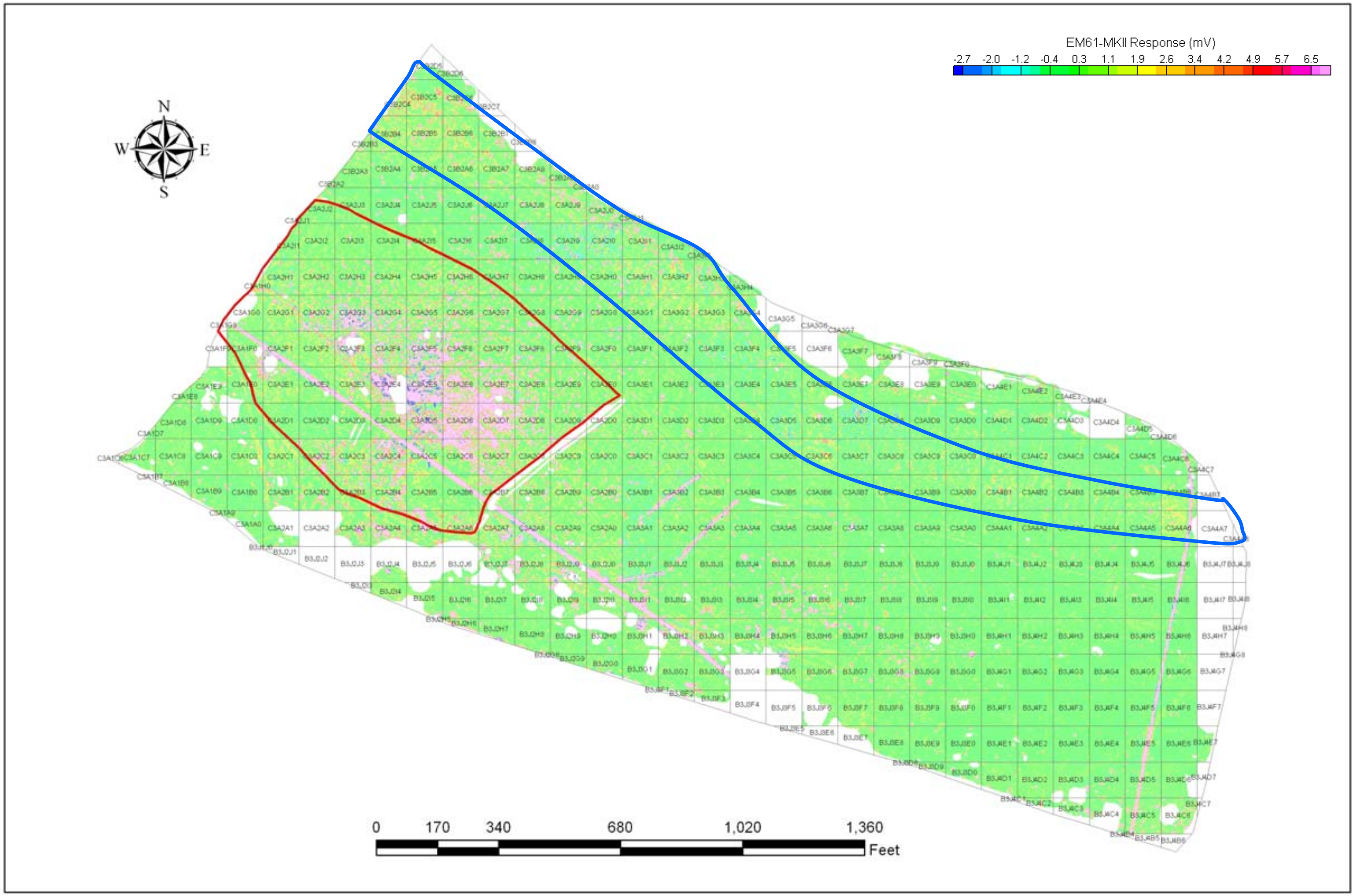

Figure 3. Composite map showing the extend of digital geophysical data, the outlined high-concentration area (red line) and "noisy area" (blue line).

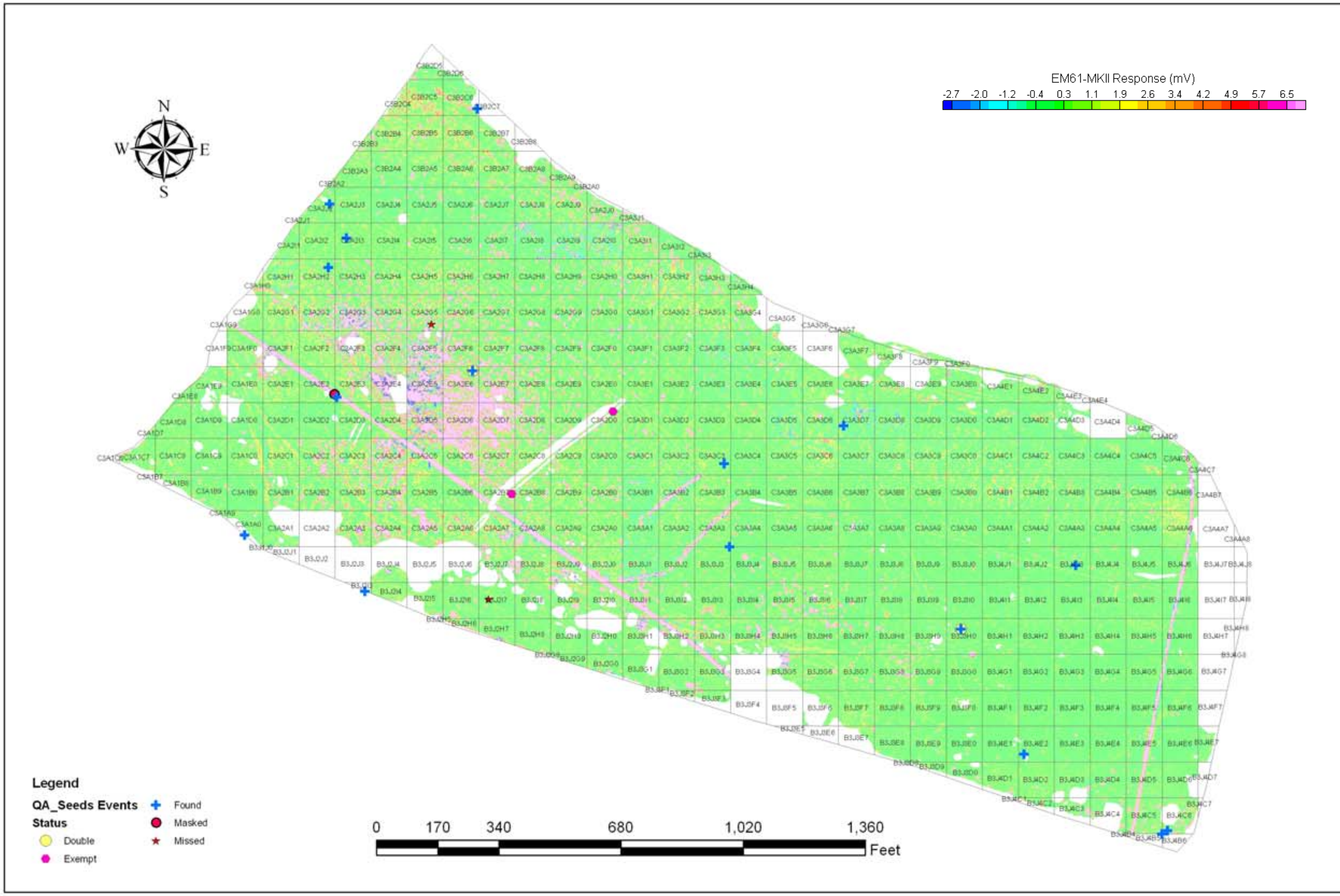

Figure 4. Final disposition of QA seeds superimposed on final DGM data plot.

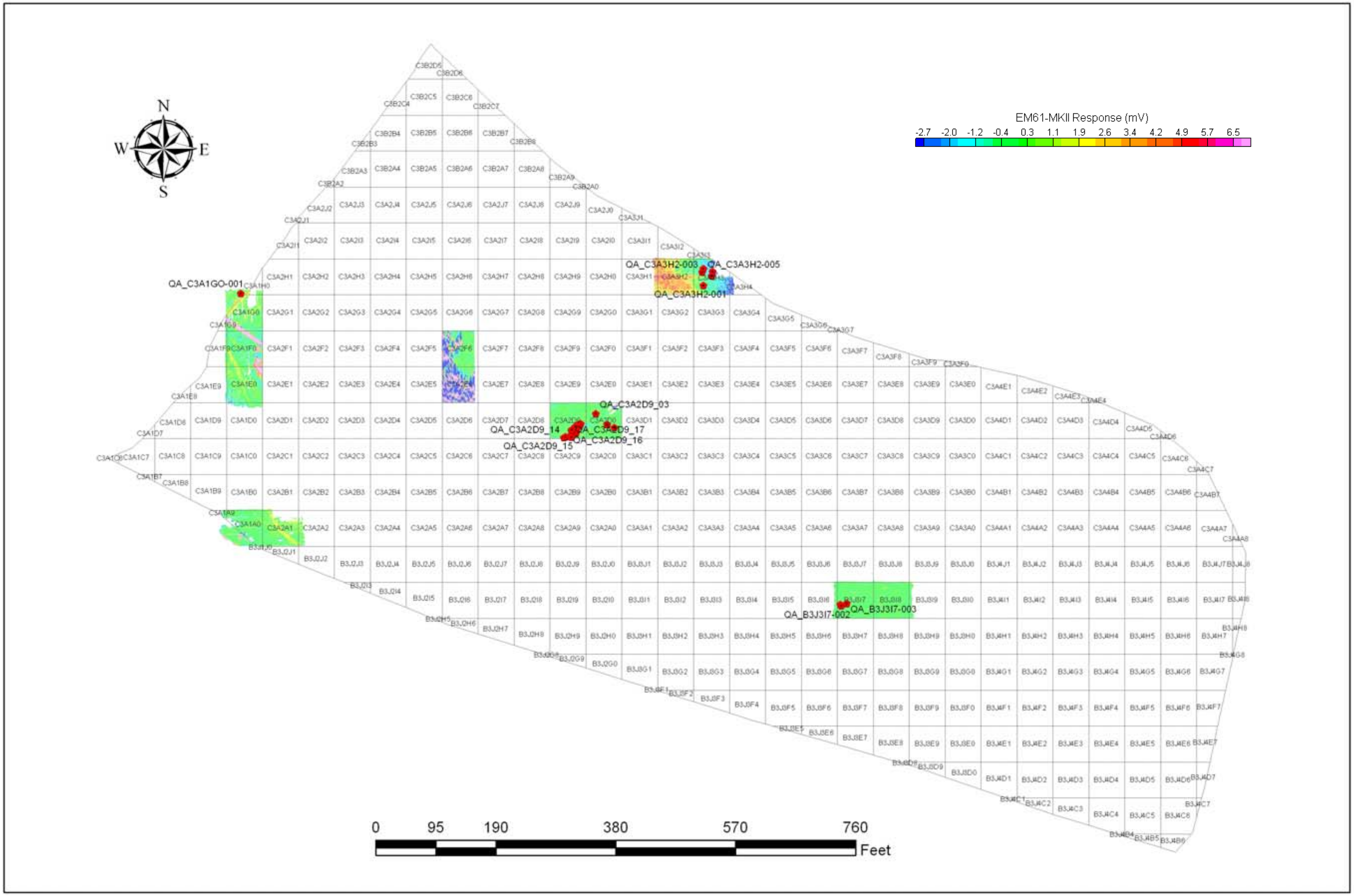

Figure 4. QA DGM survey grids and location of QA anomaly picks. See Appendix D for details.

Appendix A

QA Procedures for Digital Geophysics

MRS-16 QA WORKPLAN FOR GEOPHYSICAL ACTIVITIES

1.0 OVERVIEW OF USACE QA

A quality management program includes defining specific processes for ensuring that program and project objectives are properly delineated and attained. The general objective of geophysical investigations is to efficiently locate OE for proper evaluation, recovery, and disposition. The project team defines a project's specific geophysical investigation objectives, which must be risk-based, measurable, and attainable.

QC is an evaluation performed by the contractor to ensure that the work performed meets prescribed requirements and complies with applicable laws, regulations, and sound technical practices.

QA is a review by the USACE of the overall effectiveness of the contractor's QC program, processes, and compliance of work by others. The QA procedures are the process by which the Government fulfills its responsibility of being certain that QC is functioning and that site operations were performed in accordance with (IAW) a Site-Specific Work Plan (SSWP).

2.0 DIGITAL QA PROCEDURES

A QA program to evaluate and monitor digital geophysical activities will be implemented during the Contractor's field activities and corresponding processing of geophysical data and reacquisition of digital anomalies. Specific details on the QA steps are provided in Appendix A. The QA plan is designed to monitor:

(1) Operator performance
(2) Equipment performance
(3) Operator/Equipment procedures
(4) UXO detection to depths of concern
(5) Removal of UXO of concern

Digital QA procedures include the observation of field QC procedures and activities by the contractor, conducting and collecting site-specific data to comprehensively analyze the entire digital geophysical survey—from data acquisition to processing and interpretation. A seeding program will be implemented to provide the Government with quantitative abilities to monitor the Contractor's performance. This oversight will include field observations of the Contractor, detailed analysis of a subset of the contractor's field data, independent evaluation of 2 to 5% of the survey grids and quantitative analysis of the seed detection data. The collected data from the contractor will be used to evaluate:

(1) Signal levels and repeatability (compared to QC and QA surveying)
(2) Precision and accuracy of locations
(3) Adequacy of site coverage from survey track plots
(4) Detection capabilities of the instruments (from signal response levels in the site-specific soil and vegetation conditions).
(5) Performance of personnel.

Geophysical instrument operators will be evaluated by observing their instrument operation, data acquisition, and reacquisition procedures. Geophysical data processors will be evaluated by analyzing the quality of the data processing, as shown in the initial and final processed data files and the target selection/interpretation results listed in the dig sheets. The digital QA process will entail five other major components that are described in subsections 2.1–2.5.

2.1 MONITORING CLEARANCE OF SURFACE CLUTTER

The USACE OE Safety Specialist (OESS) will monitor the clearance of metallic objects from the surface, which will be performed before the digital geophysical survey begins to reduce surficial noise and increase the probability that deeper OE targets are detected.

2.2 MONITORING DIGITAL FIELD DATA ACQUISITION

USACE geophysicists will monitor and evaluate the acquired and processed data, consisting of about 90% verification review and 10% raw data review. Any data that indicates one the following problems will be noted and then reacquired and/or reprocessed by the Contractor:

(1) Missing survey lines within a grid.
(2) Data "gaps" along survey lines.
(3) Bowing out of survey lines beyond 50% of survey line spacing.
(4) Unreasonable data (e.g., systematic "spikes" or noise)
(5) Data incongruity across survey grids (data levels in one grid are not reasonably compatible with data levels in neighboring grids).
(6) Inadequate data density along survey traverse.
(7) Lack of accurate, precise locations; survey line orientation.
(8) Inadequate/incomplete site survey coverage.
(9) Missing, incomplete, or noncompliant instrument standardization checks.

2.3 MONITORING THE MANAGEMENT OF DIGITAL DATA

All raw and processed data files will be checked to ensure that they follow an appropriate and informative naming convention reflecting the grids surveyed as outlined in the DID's. The USACE geophysicists will check that the Contractor manages the field and processed data in a professional manner, including organization, daily maintenance, and complete documentation. The transfer and delivery of data will be monitored for meeting the agreed-upon deadlines. The accompanying documentation will be checked for completeness and accuracy. The USACE geophysicists will evaluate digital planimetric maps of the processed data, survey transects, and Contractor QC survey results. QC dig sheets and post-excavation information will also be evaluated. The USACE geophysicists will ensure that the Contractor geophysicists give full and careful consideration to all target responses.

2.4 INDEPENDENT SURVEYING

USACE geophysicists will conduct independent digital QA surveys of the investigation area with the same digital equipment used by the Contractor. The number of grids and the amount of each grid subject to a digital QA survey is determined on a project-specific basis. In the beginning of the project, 5 – 10% of the grids will be QA surveyed until the Government is satisfied that the contractor is meeting their DQOs. The independent surveys will then be incrementally reduced as long as satisfactory results are achieved. The goal is to achieve a 1.5 to 2% overall QA survey rate; however, if discrepancies in the Contractor's results are observed then the QA survey rate will be increased back to the initial level until the Government is satisfied that DQOs are again being met. A minimal amount of QA field surveying is necessary to record signal levels, instrument responses, and effects of vegetation and topography. This data will be used to check that the Contractor's data is correct, consistent, and accurately represents the surveyed area. The overall goal of achieving a 1.5 to 2% digital QA survey is deemed appropriate to meet the needs of the QA program in combination with the other components described in section 2, and it meets the recommended minimum acreages listed in Table 7.4 of EM 1110-1-4009. The Shaw QCM will track the digital QC survey.

2.5 QA SEEDING PROGRAM

The two most important, and distinct, design components of the QA OE seeding program are 1) an evaluation of the Contractor's detection capabilities of the specific munitions of concern and 2) an evaluation of the spatial survey coverage of the area under investigation. The first design component is necessary in order to determine that the munitions of concern are detected to the best degree and at the highest levels of quality of the Exploration Geophysics industry. Previously recovered, site-specific munitions debris (MD) items must be utilized to meet the needs of this QA program requirement. The second design component is necessary to ensure that the investigation area is completely and thoroughly surveyed. Simulants consisting of 6-inch pieces of iron rebar will be used to satisfy this design component. In addition to the primary design components, the results of previous OE investigations will be evaluated to identify patterns in past errors of detection and in survey comprehensiveness.

Data on ordnance occurrence and geophysical detection are presented in Table 1. The calculated worst-case depths are from EM-1110-1-4009 and assume vertical penetration at muzzle velocities of a non-deforming projectile, thus represent maximum theoretical boundaries. Similarly, the static test results from the Ordnance Discrimination and Detection Study (ODDS) represent system limitations of a particular geophysical system (EM61) in a free-air test, thus indicate upper bounds on a systems ability to detect a target in an ideal situation. Depths presented are for best and worst case scenarios for detection based on target orientation. The data from the Field Trial Sites (FTS) from the ODDS report as well as those from the OE-15DRO.1-2 and MOCO2 After Action Reports (AAR) list the maximum depth at which select ordnance items were found. Seeding criteria for inert OE items will utilize these theoretical and field based data such that munitions specific burial depths will reflect the detection capabilities demonstrated in the ODDS report and field encountered maximum depths. The final column represents data extracted from the Fort Ord Master Military Munitions Database compiled by Parsons. It should be noted that some of these depths approach or exceed the worst case scenarios and may represent buried targets.

As a validation step, a few munitions may be placed between the calculated depths of maximum penetration and the theoretical maximum depths of detection; however, a majority of the seeds will be placed in the vicinity of the maximum occurrence depth (based on most up to date information at time of seeding) and within the limits of the ODDS static test results for maximum depth of detection.

Table 1. Typical maximum observed and maximum depths of detection.

Munitions	Calculated* Depth of Penetration in sand (inches)	ODDS Static tests - EM61 (best/worse) (inches)	ODDS Field Trial Site Data (FTS 1, 2, 4, & 6) Max depths (inches)	Parsons OE-15DRO.1-2 AAR Max Depths (inches)	Parsons MOCO2 AAR Max depths (inches)	Fort Ord MM Master Database**
22 mm subcal	16.8	12/12	--	--	10	36
20 mm projectile	46.8	--	2	--	--	6
37 mm projectile	46.8	18/12	24	24	4	48
57 mm projectile	32.4	--	16	8	3	18
75 mm projectile	46.8	24/24	12	8	18	48
105 mm projectile	92.4	48/48	--	--	42	--
155 mm projectile	168	72/72	28	--	--	24
40 mm granade (e.g., Mk19/M203)	2.4	--	3	--	2	48
Rifle granades (e.g., M9)	1.2	24/24	30	12	3	48
2.36-in rocket	4.8	24/24	24	28	6	24
3.5-in rocket	9.6	48/36	10	4	--	72
4.2 in mortar	49.2	--	25	--	--	--
60 mm mortar	13.2	36/24	12	8	30	30
81 mm mortar	32.4	36/24	30	4	10	39
Stokes 3-in mortar	39.6	48/36	--	--	--	48
Hand granade	1.2	12/12	3	4	20	48
Hand granade fuzes	--	--	6	--	12	36***

*From Table 7.3 in EM-1110-1-4009
** See appended sheets
***Buried

The suite of inert targets (simulants) used will reflect:

(1) most frequently recovered items
(2) “High risk” items
(3) “Hard” to detect items

Each simulant will be clearly marked (painted orange), and inventoried with a serial number for easy identification after recovery. USACE will seed at least 1 target per 4 acres.

The target simulants (rebar) will also be placed in random grids throughout the area of investigation in locations to assess spatial survey coverage. Grid focus areas include:

(1) Changes in gradient
(2) Near obstacles (including areas where the GPS drops out)
(3) Grid boundaries
(4) Site boundaries

The rebar simulants will be placed either vertically or horizontally in the soil so their tops lie just below the ground surface.

The locations of the QA –seeds will be recorded with a Leica RTK GPS with approximately 1 cm horizontal accuracy. These locations will be held confidential from the contractor until the pertinent grids have been digitally surveyed.

Appendix A. QA Procedures for Digital Geophysics

This memo was drafted to establish procedural guidelines that will be used by the U.S. Army Corps of Engineers, Sacramento District (CESPK) in their QA role at Fort Ord.. The intent is to define a series of procedures by which the Corps will observe and validate the military munitions response (MMR). Also included are metrics that CESPK will use during their validation.

Field Geophysical Surveys

QA oversight will include random, unannounced visits to observe the Shaw digital geophysics teams. Oversight will include verification of proper set up and calibration checks. These procedures are those associated with the use of an EM61-Mk2. These include:

1. System set up: It is assumed that once production surveys begin, either as single system (man portable) or towed array, the configuration of the system will not very and the system will not be broken down and re-assembled each day. Thus, daily operations will include checking all of the cable attachments, assuring that all fittings and fasteners are tight, and that the EM61 cables are attached to the GPS.
2. System warm-up: System should be turned on and allowed to warm up for a minimum of 5-minutes.
3. Turn of GPS: Turn system on and verify RTK fix. Throughout day, especially during production survey the operator needs to periodically verify RTK fix. RTK fix also needs to be verified during position check.
4. Cable shake: With system running all of the cables should be shaken and "wiggled" at each end while also visually monitoring the data screen as it updates on the Juniper hand-held (man-portable) or computer screen (towed array). Acceptance criteria will be fluctuations below 2 mV on Channel 3. Test is to be performed at least once a day, or when erratic data is observed that cannot be adequately defined by other alternatives.
5. Static test: Data will be collected over a period of 3 minutes. During that time the coils are not to be moved nor will personnel walk within 1 m of the coils to eliminate potential noise. Man-portable unit will be laid against an object or leaned so that handle rests on ground so that system does not move. Acceptance will occur if background noise is below 2 mV. Test must be performed at least once per day.
   a. File nomenclature: mmddyyX where mm = month, dd = day, yy = year and X is designator for "Static Test"
6. Spike test: A 2-in ball hitch will be used as a spike centered on a plywood jig. Prior to test a new file should be started. The system will be run a minimum of 10 seconds to document background then the spike will be placed below the center of the bottom coil (coils are to be aligned parallel to ground surface) and data will be collected for at least another 10 seconds. Prior test indicate the spike should be around 105 mV; however,

acceptance criteria is that repeat spike tests should be within 20%. Test is to be run at the beginning and end of each survey.

a. File nomenclature: A#A#A#S where A#A#A# = grid block ID and S = "Start Spike"

b. File nomenclature: A#A#A#E where A#A#A# = grid block ID and S = "End Spike"

7. Lag test: The spike will be placed on the ground in an area near the grid block to be surveyed but away from any known anomalies (thus, Schonstedt or EM61 sweep should be done first to evaluate background acceptance). A new file will be started and 4-transects will be run in an east-west or north-south direction. Direction is to be same as those to be run in accompanying grid block. Data will be collected as a single file. Transects are to run along a single line that starts 3 m to one side of spike and extends 3 m beyond spike. Transects are to be run back and forth, 2-times in each direction. There are no acceptance criteria for data is to be used during processing phase to determine lag/latency correction. Test is to be run for each grid block.

   a. File nomenclature: A#A#A#? where A#A#A# ?= grid block ID and ? = "Lag Test"

8. Position test: GPS antenna will be set up directly above a corner stake. The GPS reading will be read directly off of GPS handheld unit and the data recorded in the PDA. For acceptance the recorded position must be within 0.5 ft of the previously defined stake coordinate.

9. Logging:

   a. Is RTK fix maintained throughout? If lost, how long and what was team response. Short drops (<0.5 min) in RTK fix acceptable and can be extrapolated during post processing.

   b. Walking speed: N/A

   c. Towed array speed: must be below 2.5 mph

   d. Battery voltage must remain above 11.8 V. Batteries should be swapped about every 2 hr 15 min.

   e. Line must be straight

   f. Line spacing ~every 2 ft

   g. System bounce should be within "reasonable range" – this will be professional judgment; if bouncing looks too bad topic should be discussed with team geophysicist. Bouncing will create noise be creating high frequency changes in sensor separation from ground and creating cable shake. These will combine to create random noise that may lead to subsequent data rejection during processing, QC and or QA review.

Digital Geophysics Data Management and Processing

1. Dat61
2. Import data to Geosoft
3. Evaluate "Spike" data
4. Lag Test
5. Data leveling
6. Grid generation
7. Plot map
8. raw data delivery
9. graph all channels
10. low pass filter
11. anomaly selection
12. dig/target list generation
13. export processed data and target list

Concurrence:

____
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____
John Esparza
USACE QA Officer, SPD Range Support Center

____
Cynthia Burris
USACE Fort Ord Project Manager

Appendix B

Miscellaneous QA Quality Tracking Documents

a. “Noisy area” documentation memorandum (3/21/07)
b. Email on DGM QA issues to QC Geophysicists
    i. Response to QA review (3/26/07)
    ii. Grid C3A1E0 (4/11/07)
    iii. Grid C3A3A5 (4/11/07)
c. Resolution on MRS-16 Geophysical issues (7/19/07)
d. Memorandum on QA Seed issues (4/17/07)
e. Database modifications (11/21/07)
f. Response by P. Kelsall to QC issue email from C. Burris (11/21/07)
g. Summary of responses to corrective action requests 1-4 (11/21/07)

Appendix B

Miscellaneous QA Quality Tracking Documents

a. “Noisy area” documentation memorandum (3/21/07)

Assessment, Data Processing and Remedy for "Noisy Area" Grids Within MRS-16, Former Ft Ord

During the DGM of MRS 16 we noticed a stretch of noisy data that runs East West parallel to Parker Flats Rd.. It is constrained to the northern portion of the site just north of the ridge that runs East West. This affects several grids. We have not surveyed the northernmost grids. However, a large portion of that area has trees. There are no visible power lines or anything that looks like it could cause interference.

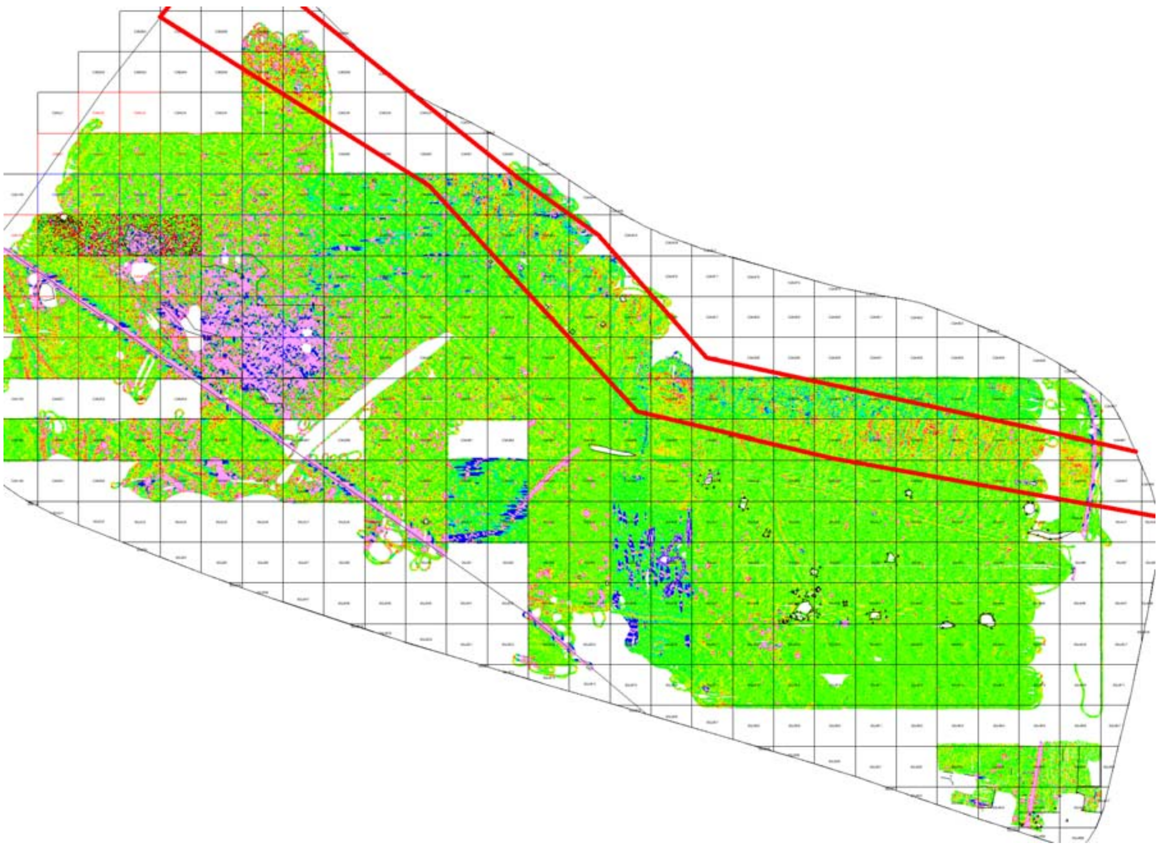


Figure 1. Outline of noisy area present in the data we've obtained to date.

- At first we believed it to be an equipment issue. Therefore we decided to resurvey one of the noisy areas. The resulting data showed the same pattern in the data. Because of this and because it is localized, it was determined that outside factors are causing the higher readings.

- We also tested a single unit in gridblock C3A3A6. We noticed the high background when we were reacquiring targets in grid C3A3C6 and had a hard time nulling the EM61 because the background was changing so rapidly. We only reacquired the first 9 targets and they were all false positives. At this point we decided to survey a few lines to demonstrate the background issue. The results of the survey were the same and showed EM61 readings increasing as you go north on C6.

- We ran a static test inside the noisy area. We set an EM61 within the noisy area and let it run for a couple of hours in the morning and a couple of hours in the afternoon. The purpose was to determine if there is any outside interference. There was no spiking (or unusual readings) evident in the data, however the drift was high for channels' one and two.

- Because the background is higher in these areas, we tried leveling the data using different parameters within Geosoft's UX-Drift correction. Basically, we accounted for the higher readings by including a larger percentage of high readings for the average background. This helped dramatically. However, there are still signals that are probably false targets. We've tested this on gridblock C3A3A6. The first 9 in C6 (done previously and mentioned above) that were false positives and our changing the leveling eliminated 6 of these. With this and careful target picking we believe we can eliminate most of the bad targets.

Below is a profile showing the differences in background we are referring to.

Looking at the raw and leveled data for gridblock C3A3A6 (which contains grids C3A3A6, C3A3B6, and C3A3C6) you can see the changes in EM61 readings. The profile in figure 2 is from a towed array survey traversing grids C3A3A6, C3A3B6, and C3A3C6. C6 is in the 'noisy area' and each of the peaks in the data below is within C6 (it was traversed back and forth several times). There is both an increase in long wavelength readings and short wavelength readings (of which we are interested). There is a sharp drop in C6 at the last 4 peaks (marked with M) and that is due to a mound in the grid. During reacquisition Chuck noticed that the background jumped from 20mV to 0mV on channel 1 on top of the mound. This is evidenced in the data below. Note that this general pattern exists in all grids that cross over into the 'noisy area'. This "Effect" affects about 20 to 30 grids.

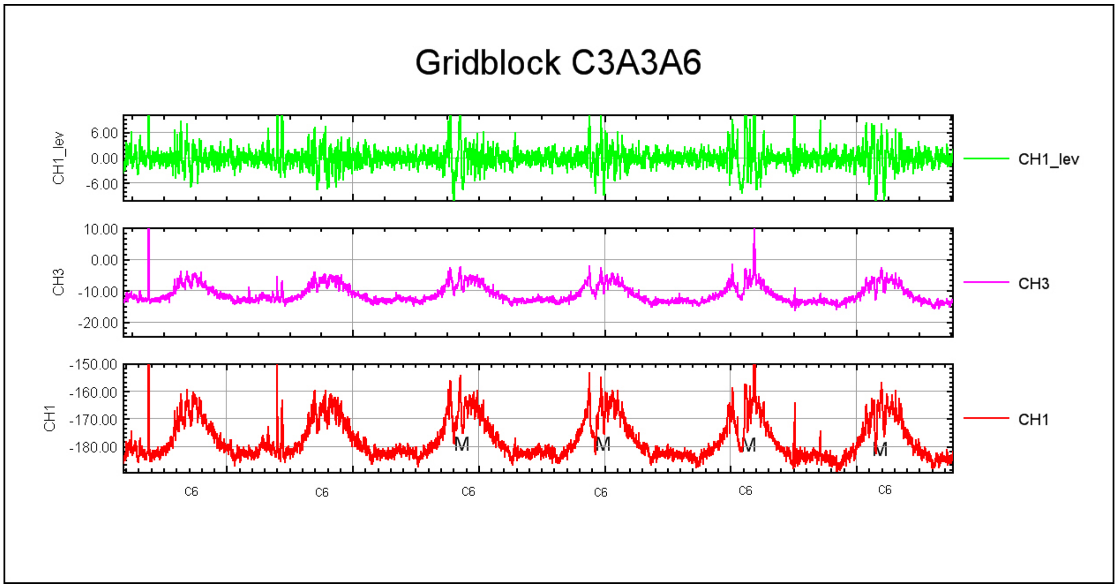


Figure 2. Profile going North-South in Gridblock C3A3A6. The higher readings occur inside grid C3A3C6. C6 = inside noisy area in grid C3A3C6. M = Mound.

Processing and Testing

Shaw conducted a comparison in processing routines for Grid C3A3C6 (noisy grid). Channel 3 was the least affected channel on the EM 61 Mk2 data (Figure 2). Therefore, we processed the channel 3 data with the improved fore-mentioned leveling routine and processed the channel 3 data very similar to the Parsons approach. We chose to do this because our "normal" processing routines for the MRS 16 data generated too many false positives. It was thought that using channel 3 data (least affected by the noise and background phenomena) would generate less false positives. Shaw also reprocessed the same grid using Sum 4 data and the improved leveling routine. As it turns out both methods generated approximately the same number of "false positives". The Channel 3 processed data actually exhibited more false positives because we had to lower the threshold value to gain maximum detection.

It should be noted that there is a low false positive percentage across MRS-16 outside of the noisy area (approximately 8 percent).

Field Testing

Shaw conducted reacquisition of the anomalies from both processing methods in Grid C3A3C6. Most of these anomalies were false positives (Sum 4) as they did not register an EM 61 reacquisition value above background. In general 27 anomalies were generated. 16 of them had reacquisition values well below 14 mV (Sum 4 values of 0 to 8 mV). These were all excavated to a depth of 2 feet and nothing was found. Therefore, these anomalies were obviously caused by external noise. Ten anomalies were reacquired very close to the 14 mV threshold value. These anomalies were excavated and most of the anomalies were characterized by rusty soil or soil that had some small mV response. However, only one anomaly exhibited a small metal object (small piece of fence). One anomaly was reacquired at a 60 mV value and some range related debris (frag) was excavated. No other anomalies existed. It should be noted that the original value of all anomalies within this grid ranged from 15 to 401 mV. Therefore due to this testing process it is assumed the anomalies are generated by external noise of some kind.

Remedy Derived from Test Data

Since processing will not totally solve the problem (data is improved with different leveling scheme in the "noisy area"), Shaw suggests that the problem can be minimized by a reacquisition approach. Any anomaly with a reacquisition value significantly less than 14 mV will not be excavated. As referenced above, anomalies from 0 to 8 mV yielded no source. Therefore, any anomaly that is reacquired at 8 mV or less will not be excavated. Ten percent of the anomalies that are reacquired from 8 to 11 mV will be excavated. Although none of the anomalies in this range during the field testing yielded sources, they will be considered QC excavations. For a conservative approach, all anomalies above 11 mV will be excavated. This approach would cut down on the time and money spent with anomalies caused by external noise. It would also be somewhat consistent with the processing and other logistics used over the remainder of the site and would be a conservative safe approach to the situation.

Appendix B

Miscellaneous QA Quality Tracking Documents

b. Email on DGM QA issues to QC Geophysicists

i. Response to QA review (3/26/07)

TO: Jeremy Flemmer, Shaw QC Geophysicist
FR: Lewis Hunter, USACE Project Geophysicist
CC: Marty Miele, Cynthia Burris, Clinton Huckins, Kevin Siemann

RE: QA Review

I have been performing partial reviews of the geophysical data as they came and was finally able to take an entire day last Friday to perform a more thorough review of these data. In general, I think the geophysical data are of high quality and am generally happy with the results. I did note a few issues that are described below. With regards to the data issues, these are primarily to fill existing data gaps (i.e., summary sheet deliveries of missing files) or to acquire contractor verification that the data is adequate to meet project needs.

<u>Tracking form:</u>
This is an informative format, so keep it up. Only real issue QA has seen on a few of the forms is that the comments in the "Comment" field sometimes continue beyond the space available (e.g., 2/2, 2/9, 3/3, 3/16 and I think 3/23). Before converting to PDF, check that the cell size is adequate to include all the text. QA won't require resubmission of those files but requests that recurrence is avoided in future.

Feb 2 memo notes that there were some repeat grids run to investigate spiky data observed in some data that QC was holding and that these would be investigated further the following week. QA did not see specific reference to this verification in the Feb 9 memo. Please provide verification on the status and verification process performed by QC.

There were 2 QC weekly memos delivered with a date of 3/2 in the week ending line. One of the files was delivered as the QC report for 022707.

<u>Data Deliveries:</u>
Data format for raw, processed and pick files looks good. Good header files and no contradictory information have yet been detected in these headers. There are several PDF summary reports that have not been received. QA assumes this is due to the server issues so will not issue a 948 (non-conformance) at this time, but requests that missing files be posted as soon as they are available.

> Missing Raw Summary Reports for: C3A2H8, C3A3D1, B3J2J0, B3J3I4, C3A2B6, C3A2G8, C3A2I6, C2A2I7, C3A3F3, C3A3E3, C3A3G1
>
> Missing Processed Summary reports for: B3J4I2, C3A2C0, C3A3B7, B3J3I7, C3A3A7, C3A3B3

<u>Data reviews:</u>
QA has reviewed 31 grid blocks of data. This represents all data files downloaded as of the morning of 3/29/07. As stated above, these data in general appear to be of very good

quality. However, several observations were made during the review that QA requests a response on by QC. Recollection and/or reprocessing is not necessary as long as QC can justify the results. Several QC tracking sheets accompany this memo to provide clearer presentation of the individual observations.

Data gaps: Gaps such as those in grid C3A3G2 around trees should be narrowed so that the pointy ends are rounded out. Gaps look as though field teams diverted around an obstacle but did not return to run circles around the tree to clip off the points. Also, grid block B3J3H7

Streaky data: Please explain streakiness of data in C3A4B1.

Location of picks: Please justify location of picks in grid blocks B3J4J2, B3J4F5, B3J3J7, B3J3J1, B3J3I4 – did anomaly C3A3G2-0037 adequately capture the anomaly represented at the south end of grid C3A3H2 (grid block C3A2H8)

Confirmation lines: on grid blocks where the high concentration anomalies associated with the fence posts (e.g., B3J3J2) were observed, QA requests that array transects be run over those "strips" to verify that they have been cleaned. QA assumes that 2 passes (1 up & 1 down) will provide sufficient coverage, but Shaw should verify that areas under those anomaly strips have been cleaned. QA will hold those grids until the verification is received.

<u>QA Seeds:</u> Shaw has not followed the requested protocol for informing QA when seeds have been found in the field. As requested in an email to Kevin Siemann on (1/22/07), the process is to have the dig team record in the field the date found, item number (on attached laminated card), grid where found, and approximate depth where encountered. They should then notify QC manager who needs to email Huck **and myself** with the information noted above. Verbal notification to Huck does not verify that the find will be recorded in my electronic tracking spreadsheet, nor does it constitute a defensible notification. As of this date, I have no official notification of any QA seeds having been found and have several grids with pending failure once they are to be turned over to QA.

Feel free to contact me if you have any questions.

Appendix B

Miscellaneous QA Quality Tracking Documents

b. Email on DGM QA issues to QC Geophysicists

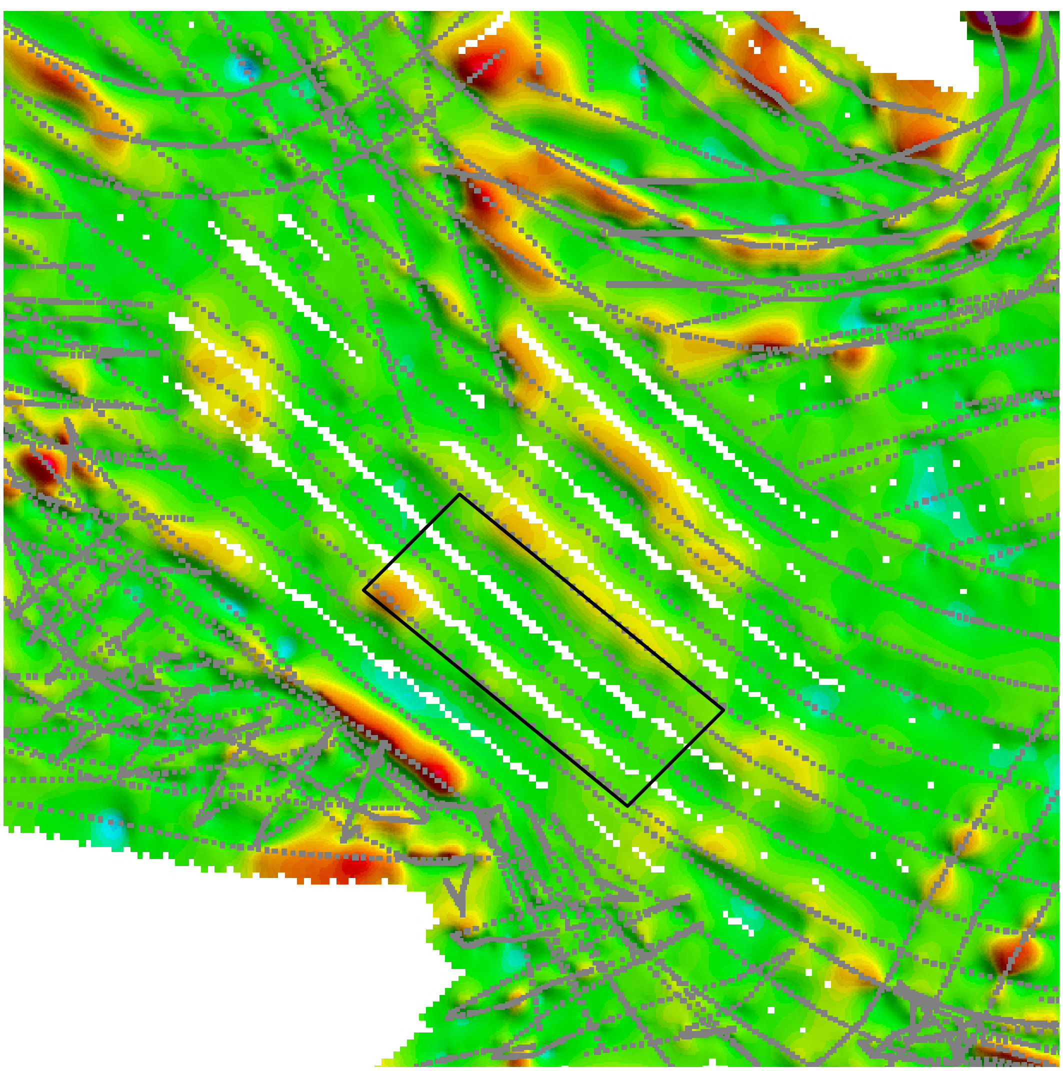
ii. Grid C3A1E0 (4/11/07)

Lew,

The following is the southwestern corner of grid C3A1E0. This is the image I looked at during QC of this grid. This was gridded with minimum curvature at 0.25 grid cell size with a blanking distance of 1. The gaps presented here are actually a deficiency in the blanking distance calculation in Geosoft. If you actually measure the distance between paths they are less than 2 feet. In fact, many of the gaps are occurring in between lines collected from the three static coils mounted on the EM61 cart. Geosoft calculates its blanking distance in an east-west and north-south fashion, not perpendicular to the direction of travel. Therefore, since the paths in this area occur at an azimuth of approximately 120 degrees, Geosoft miscalculated the blanking distance and there appears to be gaps, even though the line spacing is 2 feet or less. If you have any additional comments or questions I will be glad to address them.

Thanks,
Jeremy

* Note: The 3 paths within the boxed area represent a single EM61 cart traverse, in which they are permanently mounted at 2 foot spacing.



Appendix B

Miscellaneous QA Quality Tracking Documents

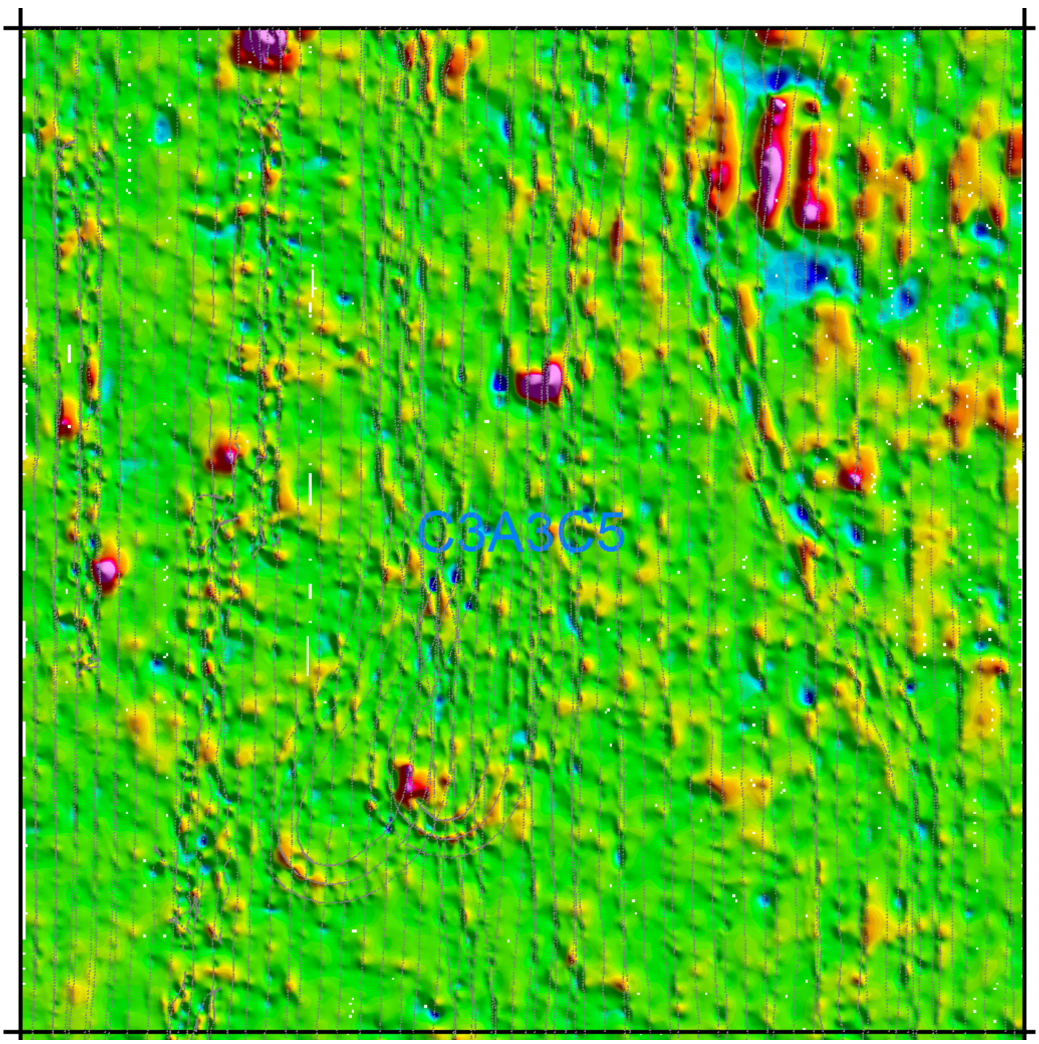
b. Email on DGM QA issues to QC Geophysicists

iii. Grid C3A3A5 (4/11/07)

Lew,

The following image is that of grid C3A3C5. This is the image I looked at during QC of this grid. This was gridded with minimum curvature at 0.25 grid cell size with a blanking distance of 1. The line spacing in the area of concern ranges from about 1.9 feet to up to about 2.3 feet. Due to the paths not being completely straight there are a few gaps present, but I was unable to find any single gap that was greater than 4 square feet. As the grid cell size is 0.25 feet and it will blank anything over 1 ft away from the actual data point, the white space does represent a gap. As each box is 0.25 ft square, each box represents 0.0625 square feet and requires 64 blank boxes together to equal a single 4 square foot gap. I have not been able to locate any of these in this grid. I did notice your map seems to have considerably greater gap sizes. I will have the processor re-post the data to be sure that the final version of the data is the one that was posted. If you notice the same issues or have any additional comments or questions I will be glad to address them.

Thanks,
Jeremy



Appendix B

Miscellaneous QA Quality Tracking Documents

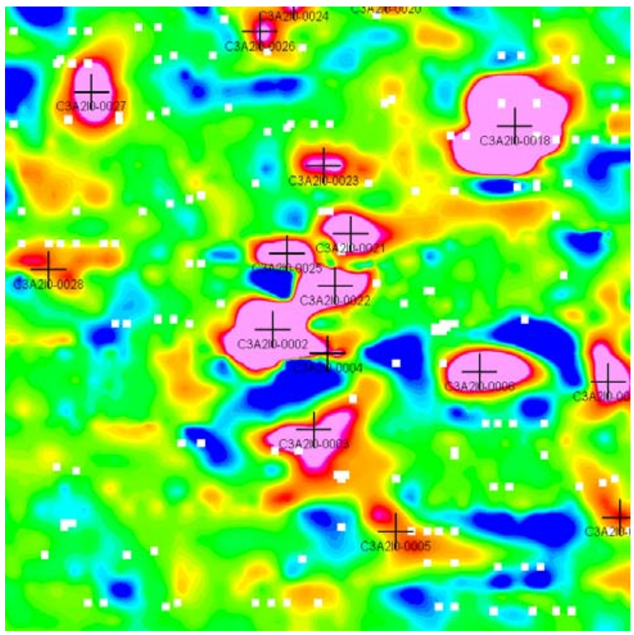
c. Resolution on MRS-16 Geophysical issues (7/19/07)

Resolution of MRS 16 Geophysical Data Issues

Issue 1 – Grid C3A2I0

The anomaly cluster (anomalies 0002, 0022, and 0025) has a “latency like” appearance. It was discussed whether it was in fact latency or if it was a real configuration. It must be noted that the other anomalies in the grid do not exhibit the same issue (or it is extremely minor).

Response: All three anomalies (anomalies 0002, 0022, and 0025) were reacquired successfully and separately. The original picks and the reaquired location were within inches for each separate anomaly. This grid was in the noisy area. Anomalies 0021 and 0023 were false positives. Therfore there was no latency issue reagarding the anomalies in question.



Issue 2 – Streakiness and multiple picks on elongated anomalies in Grid C3A3B7

This grid is a borderline noisy area grid. The following sequence of events involving this gridblock lead to the discovery of the “noisy area”. Attached are 3 images. Image 1 is raw data collected on 1/22 for grid block C3A3B7 (e-w), Image 2 is raw data collected 2/1 for B3J4F5 (n-s), Image 3 is raw data collected 1/23 for C3A4A2. Although this is raw data with only minor leveling corrections, it shows the overall quality of the data through the noisy area. Within each day all of the data was obtained within hours of one another (i.e The first pass with the array in one corner of the girdblock is typically only a few hours time difference from the opposite corner.)

As per the progression of images, the majority of data collected in these surveys is clean and looks pretty good (especially considering this is minimally processed at this raw data stage that is presented). In the noisy area, data gets somewhat unreliable (except for the real anomalies), generally bad and somewhat streaky. Image 2 shows overlap data (on purpose) to see if there was any correlation with the original data. Image 2 data (n-s) looks generally good until the noisy area is encountered.

We tried several techniques to remove the noise and streakiness but just could not do it without greatly altering the rest of the clean data. After this gridblock was obtained we encountered more of the noisy area. At that point we learned more about it's characteristics and developed an approach for processing data within that area. Due to the need for anomalies to keep UXO personnel moving, data from this gridblock were turned in for raw, processed and target picks by 2/15. This was well before we developed a method for better processing of the noisy data. This particular gridblock was probably the worst on the whole site. It is doubtful if additional processing would have helped much anyway.

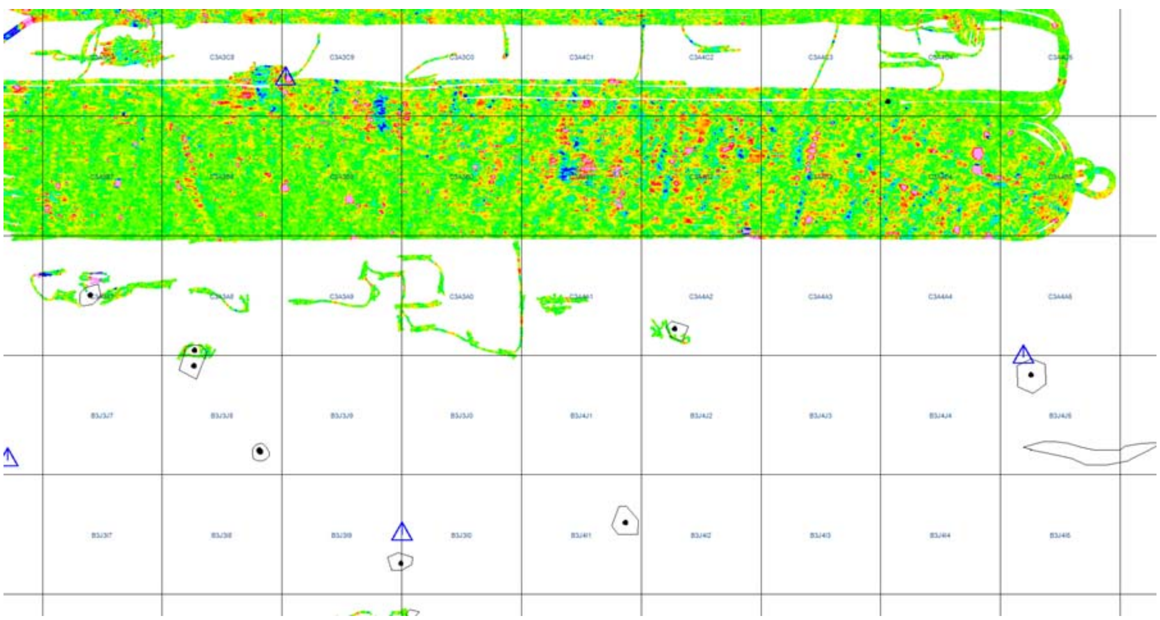


Image 1

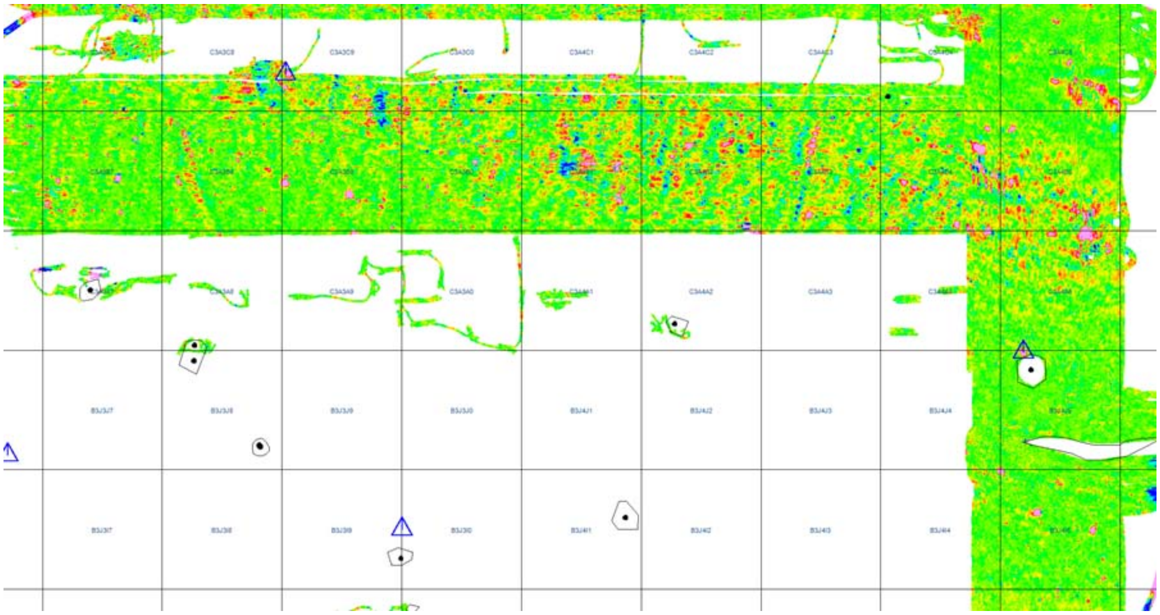


Image 2

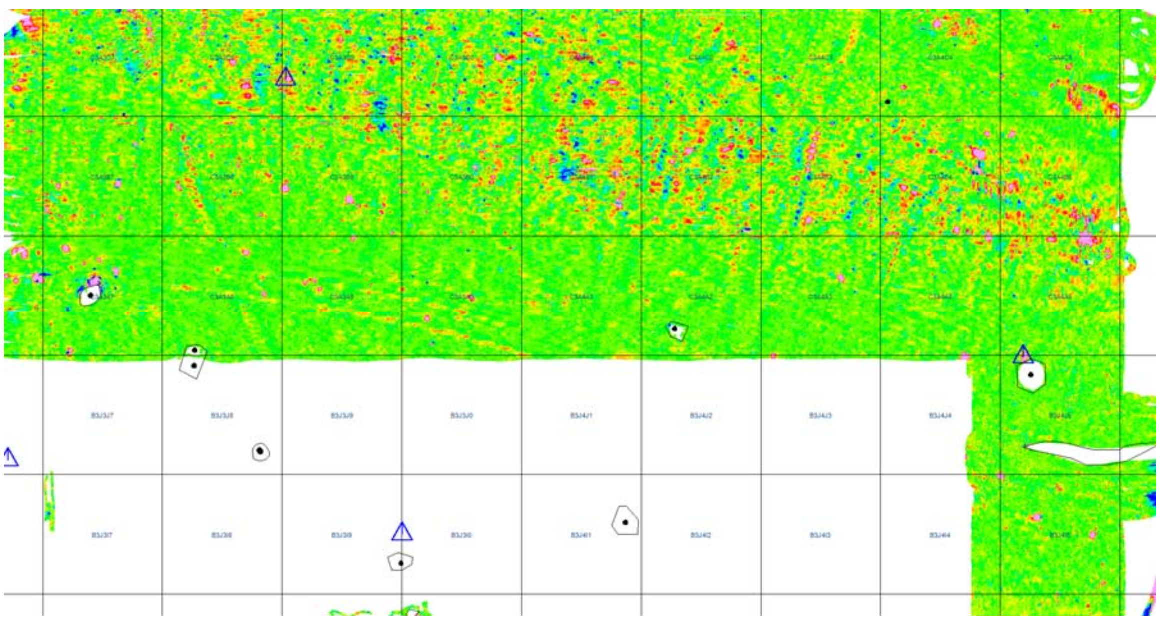
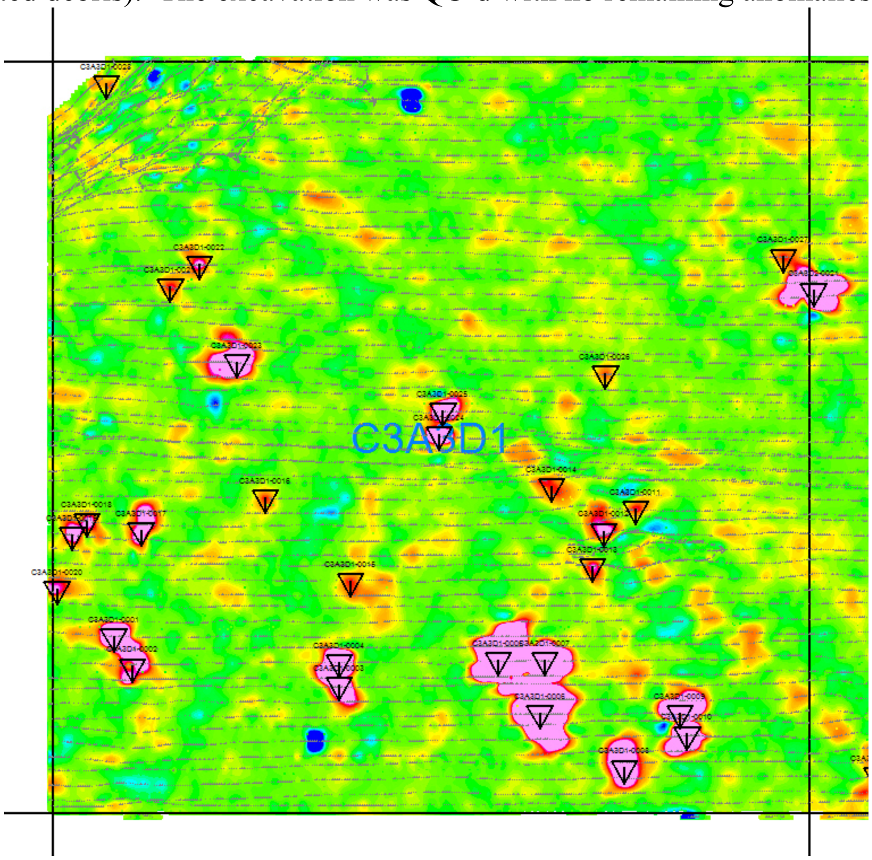


Image 3

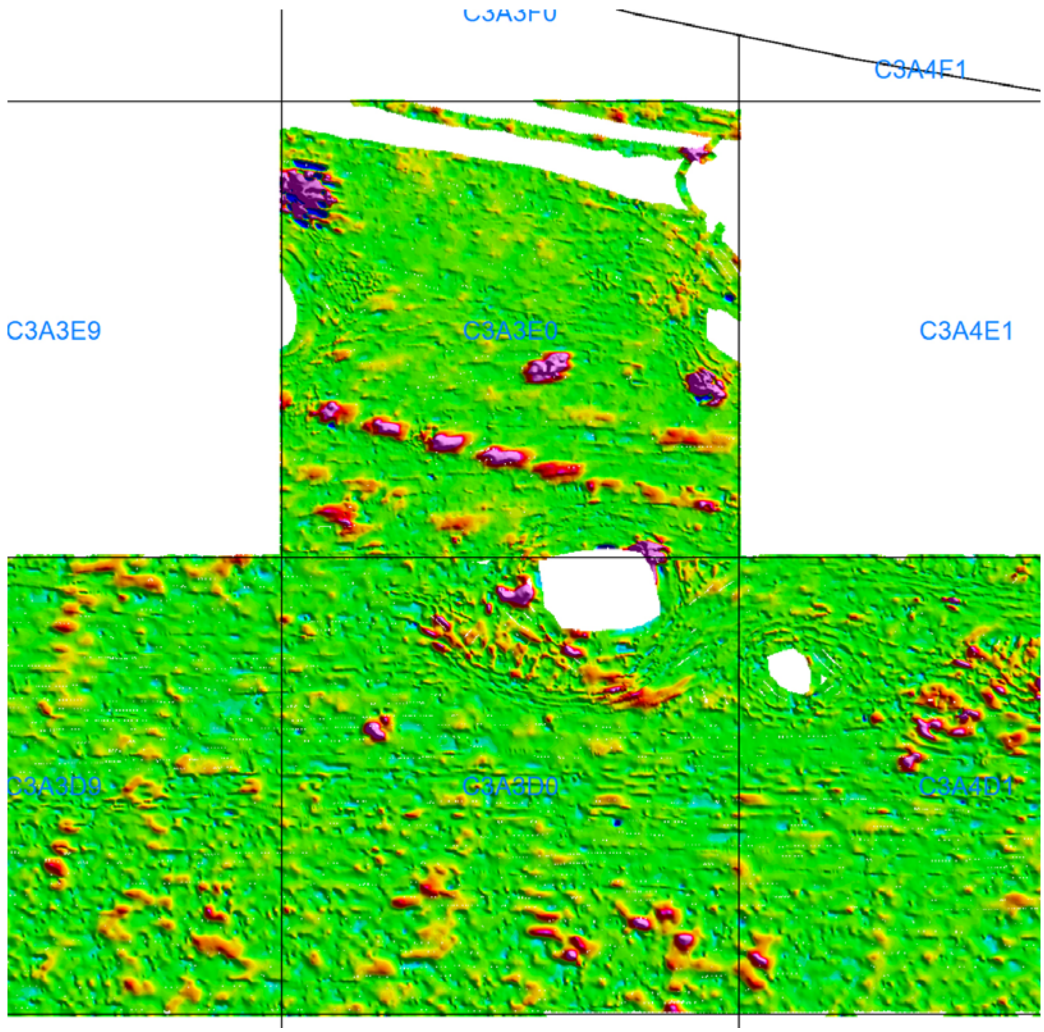
Issue 3 – Upper lobe of anomaly C3A3D1-0008 should have been picked.

The upper lobe of anomaly C3A3D1-008 (southern part of grid) is 3 feet north of the anomaly pick and looks like it should have been picked as a possible separate anomaly. The solution for this scenario was straightforward. The C3A3D1-0008 anomaly was actually reacquired 1.1 feet north of the shown pick (therefore the upper lobe was 1.9 feet north). The entire anomaly was excavated as per the 3 feet dig radius operation. The anomaly yielded 3 pieces of MDF (munition debris fragments) and 1 piece of RRD (range related debris). The excavation was QC'd with no remaining anomalies.



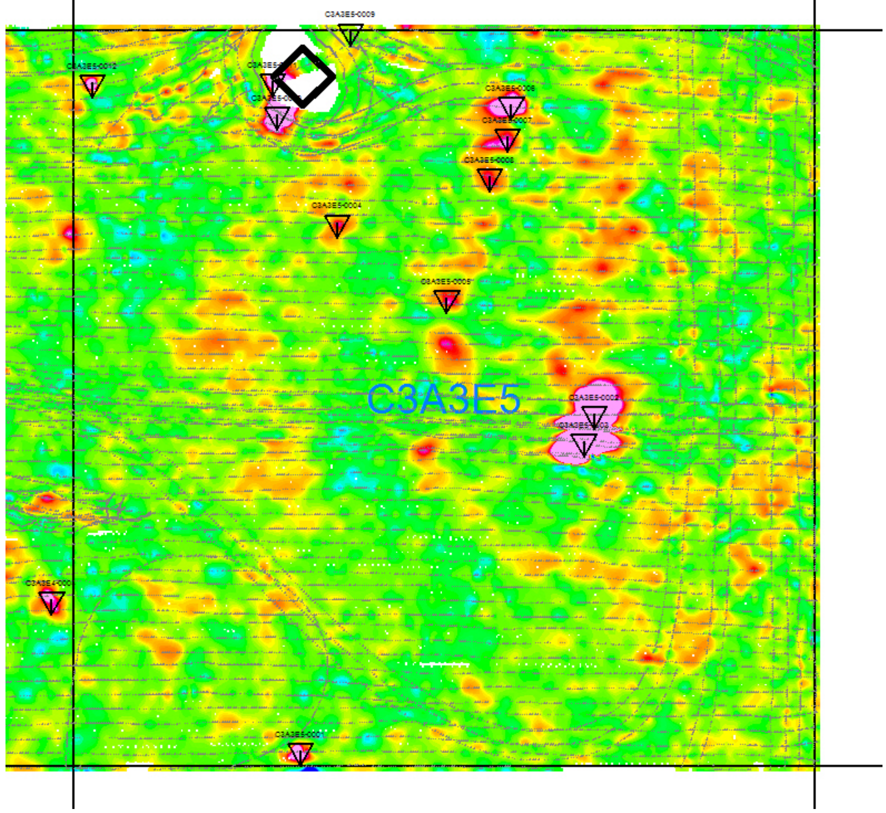
Issue 4 – Anomaly in Grid C3A3E0/C3A3D0

The occurrence of the anomaly along the northern border of grid C3A3D0 (northeast of the large tree as shown below in grid C3A3D0) should extend into grid C3A3E0. At the time and date of our meeting grid C3A3E0 was not yet processed. The grid is now processed and the grid images below show that the anomaly does indeed extend into grid C3A3E0. It is a sizeable anomaly and was picked.

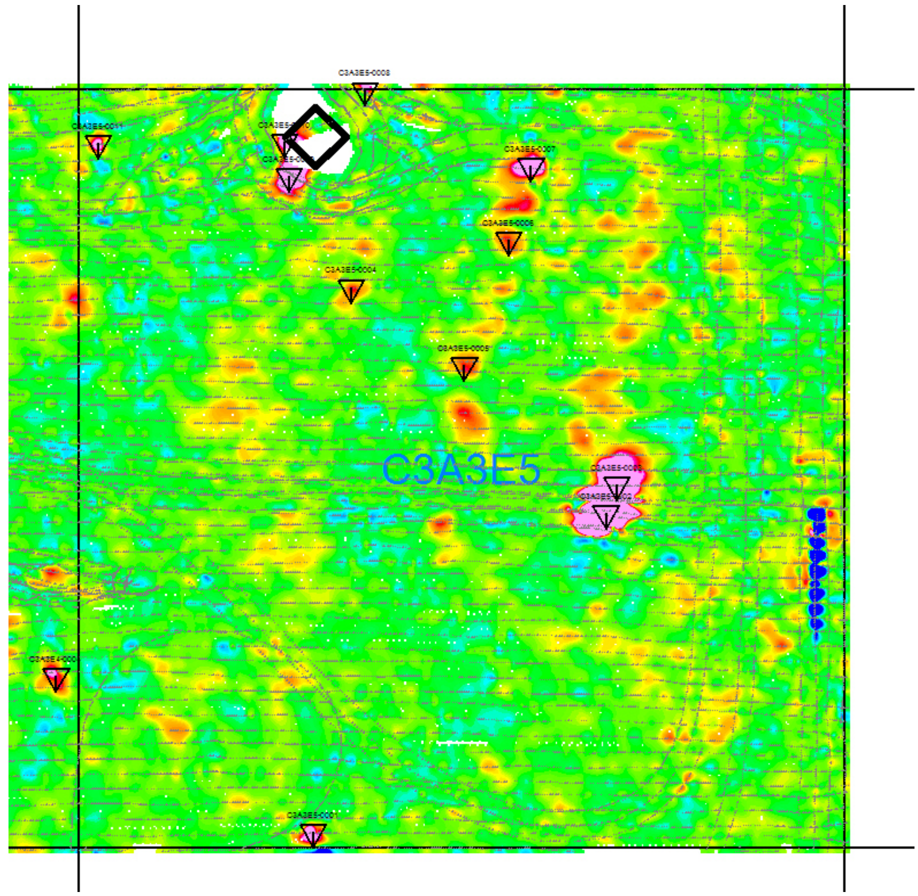


Issue 4 – Blue stacked image in Grid C3A3E5

This is another grid (in the noisy area) that was reprocessed after we finalized the proper way to process and handle the noisy grids. The reprocessed (posted) data was much cleaner but unfortunately had this small blue section due to the adjusted filtering. As there were no targets evident in either processing scheme (or the actual section of data – it was reviewed) we did not address it. However, in hindsight we should have just had that section of data removed as it would not have affected the coverage. That section is the beginning or end of a line and some filtering processes affect the ends of lines as they are attempting to apply a running average, however, as they butt up to the end of the data the average is distorted. The images are shown below.



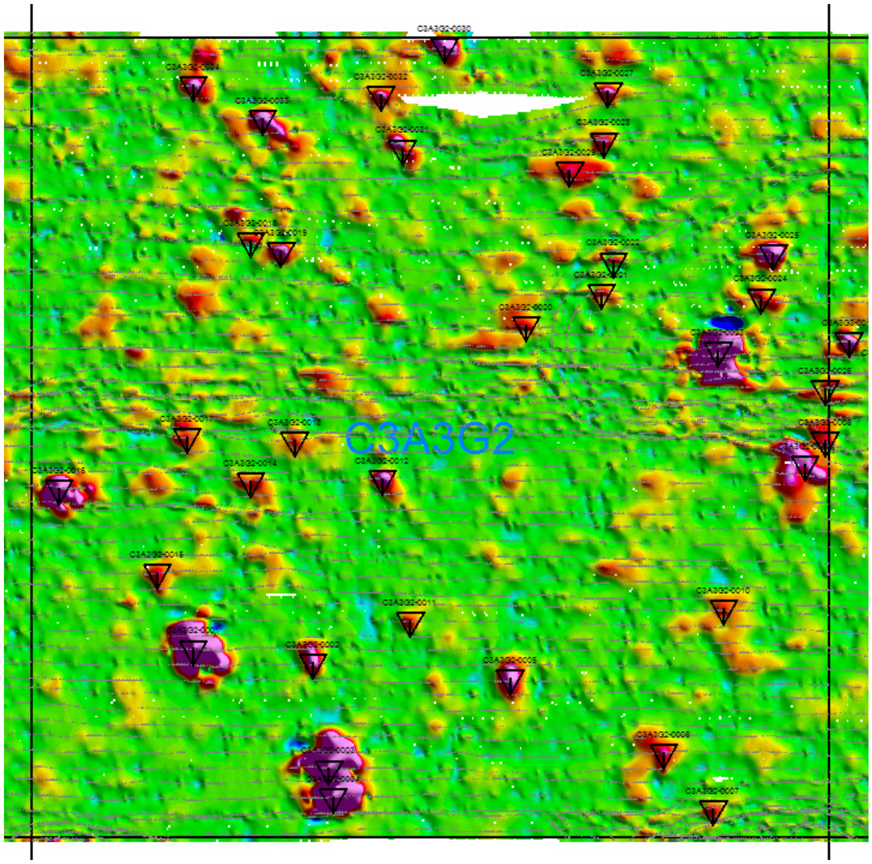
Original Processing



Reprocessed and Posted

Issue 5 – Elongated gap in Grid C3A3G2

The elongated gap in the northern section of Grid C3A3G2 is from a set of trees where the towed array had to drive around it. This is evidenced in the tracking data shown below. Due to the heavy canopy on the trees ssingle EM 61 MK2 fill-in was not possible. This gap will be covered using the EM61 Mk2 in real time as per the specifications that were established for the project.



Grid C3A3G2

Issue 6 – Anomalies in Grids C3B2B6, C3A4C4, C3A3E6, etc. with values above threshold were not picked..

These grids are within the noisy area. Several anomalies above threshold were not selected due to the decay rate. Most of these anomalies were rechecked and the decay curve is absolutely not consistent with a real buried metal object. The decay curves are typical for noise, therefore, they were not selected. However, there were some of these types of anomalies that were investigated for QC reasons. They were not reacquired successfully suggesting noise.

Issue 7 – Data and time columns were switched part way through the database for grid C3A2D8

This was noted after ward and the grid was reposted in proper format. We QC'd the grid to make sure all anomalies were addressed.

Appendix B

Miscellaneous QA Quality Tracking Documents

d. Memorandum on QA Seed issues (4/17/07)

MEMORANDUM FOR RECORD

TO: Cynthia Burris, Project Manager
George Siller, Program Manager
FR: Lewis Hunter, Project Geophysicist
RE: MRS-16
DATE: 4/17/07

Review of all processed geophysical data delivered prior to 4/12 noted that only 1 out of roughly 10 QA seeds planted in MRS-16 had been recovered and reported. All but one of these seeds however corresponds to anomalies picked within roughly 2-ft of the GPS location of the seeds. The QC update verified that only 1 QA seed has so far been recovered. Certainly some on the lack of finds relates to grids still being dug, yet it is concerning that only the one seed had been recovered.

I have discussed the issue with Marty Miele (Shaw Project Geophysicist) and he is very concerned about the situation. He noted that he has been talking with the QC geophysicist and they were noting similar issues with the QC seeds (although not as pronounced a lack of finds due to some of their misses being explained by seeding over the pipeline and in the heavily saturated area). They are also experiencing significant issues with the data base and are not able to track picks from the digital data through to the final dig results. As a result, Marty is headed to Ft Ord tomorrow and will be working on the data base to try to rectify the situation.

I strongly cautioned him about turning grid blocks over to QA before this issue is resolved. This is both for the impact to their company and to the program as a whole in terms of how it will look to the regulators if they miss 90% of the seeds in their initial deliverables.

e. Database modifications (11/21/07)

Field Working Database Modification

Original Requirements and Issues

A field working database was designed and built by Parsons Engineering while performing MEC removal operations at the Former Fort Ord from 2000 to 2005. This field working database was designed in Microsoft Access.

Shaw used the field working database for the MRS 16 MEC removal starting in early 2007. At this time, Shaw hired a former employee of Parsons with experience in the MEC removal operations and use of the MMRP database. Shaw planned to continue to use the previously existing MS Access database/personnel to manage the field working data and required reporting needs of the site.

During execution of the MRS 16 project there were a number of problems using the database efficiently, including: use of an inadequate server (resolved when a new server was purchased); restrictions caused by having the database in MS Access (especially remote access for home office support, resolved when the database was converted to SQL); use of old PDAs; structural problems with the database that caused significant problems in reporting. In brief, the geophysics team had difficulties with connecting to the database remotely, getting the types of reporting that they required, correcting and making changes to records.

Proposed Change

A complete overall of the database, forms, and hardware is required in order to effectively perform MEC removal activities. Shaw will take some of the positive elements that existed within the Parsons' application, and combine them with the positive elements of a previously existing SQL server application that Shaw developed for MEC removal activities. A combination of the best of both of these applications, and an overall improvement and update of forms and the necessary reporting tools is needed to meet the current reporting requirements specified within the Data Item Descriptions (DIDs) and required by USACE.

In addition to the creation of a new application that uses a backend SQL server database, Shaw will purchase 6 new PDAs and cases (to increase their field longevity). The current PDAs are 7 years old, and are antiquated hardware that can no longer effectively meet the project needs. Updating the PDAs is necessary due to memory limitations and general age and wear of existing hardware.

Some of the above problems will be corrected in Phase I of database modifications, to be completed prior to completing the MRS 16 work. Phase 1 modifications have largely been completed and tested. The remaining problems will be corrected in Phase II of database modifications.

The following paragraphs provide solutions to problems identified by users.

Phase I

1) When QC doesn't pass data, records sit in queue indefinitely. Can this data be put in a different queue? Or perhaps marked to distinguish it?
   The table structure was modified and additional fields have been added.

2) Leing Pham was the only one familiar with the underpinnings of the field working database.
   A number of Shaw people have made modifications to the existing database, and are now very familiar with the modified database.

3) Need to be able to query a grid to determine its status or to query by completion status etc.
   Was incorporated into Field Working database during MRS-16, though still remained problematic. Further modifications will be made no later then 11/26.

4) Maps are helpful, however it sounds like all information is being pulled from miscellaneous tables by a number of people which increases the chance of error.
   One centralized standardized information management system has been developed.

5) Lots of fields are not being utilized (?). Are they necessary and what are they linked to?
   The overall structure of the old system was very inefficient (duplication of fields, etc). The structure has been defined and standardized.

6) Still needs some streamlining in field PDAs and geophysics forms.
   New PDAs and import/export technology are being implemented currently (for reacquisition).

7) Should integrate Shaw forms and DIDs forms.
   DID forms will be implemented no later then week of 11/26

8) Remote users are still having connectivity issues and it is still slow.
   Database is in SQL server, and these issues no longer exist

9) Need more flexibility in things like assigning reaq, digs, etc.
   Appropriate flexibility has been incorporated

10) More up to date PDAs and PDA software would be helpful.

The old PDAs were way out of date, and the current system requires the purchase of update hardware. Shaw recommends the purchase of 6 units of either Trimble Juno SP/Dell SoMo 650E which both cost roughly $600 each.

Phase II (to be addressed)

1) Mistakes in the pre-processing or processing sections of the database are difficult to correct.
2) Pre-process/process reports do not show the data entered. You have to exit and re-enter the database so that report shows all the data properly.
3) In the pre-process/process sections of the database, gridblocks sit in queue even though they are complete. Primarily in Pre-form 1 and Pro-form 3.
4) Reaquisition gridblocks are also included in the pre-process queue. Can these gridblocks be excluded?
5) More fields are needed for survey crew to enter notes or more survey information can be added for these fields.
6) Geo crews should approve QC data file before data gets to QC. Crews may be able to catch mistakes quicker and easier than QC.

Appendix B

Miscellaneous QA Quality Tracking Documents

f. Response by P. Kelsall to QC issue email from C. Burris (11/21/07)

Responses to MRS 16 QC issues identified by USACE in 10/19/07 e mail from C. Burris to P. Kelsall

Responses shown in blue.

General

Shaw is conducting a comprehensive review of the issues raised by USACE. Responses to most items are complete as indicated below. We anticipate that all issues will be discussed at a meeting planned for December 17, 2007, or sooner at USACE convenience.

1. This is in regards to the CAR 004. Under "Action Taken to Correct Condition", page 2, "MD and RRD bgs: QA check performed with Schonstedt GA-52Cx, while DGM survey and QC check of targets was performed with EM61."

We considered this an unacceptable response. The target munitions for MRS-16 are 2.36" rockets. If the EM61 cannot detect it, there could be potential problems with confidence in the remaining data. **Please fully respond to this CAR prior to mobilization for completion**. This corrective action may need to be implemented on future work.

The attached file "CAR Status" is a summary of responses to all the CARs.

2. We recommend **replacing QC** on this project with a qualified QC person. It is QC responsibility to ensure each grid is ready for turn-over to the government and QA failures due to poor house keeping is unacceptable. By the way, in talking with Terry Gleason this week he told me that Tim Mathison was to start work on another project sometime in November. We recommend that Tim work on MRS-16 for the duration of the field work and not be switched out. I believe this move had a negative impact on field operations the last time.

We will propose Charles Hutchison as the UXOQCS for the remaining work. Mr. Hutchison has completed the USACE QC training. Jeremy Flemmer will continue as the QC Geophysicist. We will ensure that regular meetings occur between the UXOQCS and QC Geophysicist, coordinated by our site QC Manager, Tom Ghigliotto.

Tim Mathisen will be the SUXOS for the duration of the project. Prior approval will be obtained if Mr. Mathisen has to leave the site for unexpected reasons.

3. **Data and grid turnover is required to be timely**. Without it, the QC/QA process is meaningless. There should be no exceptions. If Shaw cannot turn over the data and grids in a timely manner, we will need to stop work and reconsider the alternatives. If data and grids had

previously been turned in on a timely manner, the team could have instituted corrective actions early on.

We agree that grids need to be turned over for QA in a timely manner. See further response below.

4. Data will be turned over within a specified timeframe (for example, within 2 days of collecting geophysical data). QC will be performed within a specified timeframe and grids will be turned over to QA within a specified timeframe. QA activities will be completed within a specified timeframe so that corrective actions can be implemented. The timeframes need to be realistic, valuable, and acceptable.

For the MRS 16 project we provided raw and processed data, plus QC reports to the USACE Geophysicist. The raw data are due 2 days after completion of the grid while the processed data are due 5 days after completion of the grid. All of this data was posted to the FTP site by the processor, Sally Lamb.

The attached file "QC Report" is the cumulative QC report that we submitted to the USACE Geophysicist every week. This form includes all of the dates for raw and processed data due as well as the actual date the data is turned in on the front page. More detailed information is provided in the worksheets.

This comprehensive report was apparently only submitted to the USACE Geophysicist. In future we will submit to USACE and Shaw PMs as a supplement to other performance data.

The attached file "Geo data flow_CS" is a data flow diagram that was put together by Cary Steibel with Shaw input. This will be a useful guide for all project participants for future work.

The database, which we know had problems in the past, also has to be in working order before we begin field work. **This agreement is required prior to re-mobilization**.

The database which we inherited at the beginning of the project had a number of problems that initially hindered data production. Some of the problems were fixed during the project as a workable solution but there are still some issues. We have started work on making further improvements which will be in place before the field work begins. Most of the essential modifications are already complete. The attached file "Field Working Database Modifications" describes the upgrades in more detail. Please note that we are recommending purchase of six new PDAs for the ongoing work.

James Jeansonne (Baton Rouge) has been assigned to provide database programming support and has been introduced to Cary Stiebel. Linda Hughes will support the project during field work. Eric Schmidt will coordinate database activities as necessary.

5. Shaw shall **provide a list of personnel to the USACE Contracting Officer with HNC database numbers and/or qualifications two weeks prior to re-mobilization**, as a minimum, and provide an updated organization chart identifying corresponding personnel. According to Chris, this is required by the contract DIDs for the entire UXO team.

We will provide this as requested, but please note that it may be necessary to make substitutions to balance project schedules, or for example to take advantage of a technician who lives nearer the project and who becomes available. The SUXOS and UXOQCS will not be substituted without prior USACE approval.

6. Shaw should follow through with a revised **weekly reporting mechanism prior to re-mobilization**. We will require that you provide us a comparison of actuals to estimated production rates. These need to include key parameters (digs/team/day, grids/team/day, acres/team/day, data turned over, QC grids completed, grids turned over to QA, QA completed, etc.) as applicable to geophysics, surface clearance, subsurface removal, QC and QA. We need to define the specific amounts remaining for completion so we can determine % complete on each element as Shaw progresses. The previous versions of the weekly reports contained budget numbers, but budget tracking did not indicate why the team was not meeting goals unless it related directly back to a specific work element.

The attached file "CP Ft Ord MRS 16 Grid Phases (Rev A) is a draft tracking spreadsheet modeled on a form sent to us by Mr. Prescott. We will modify this sheet prior to the work to incorporate comments and to populate with data for the grids we will be working in.

7. We need a narrative for the reason(s) for the schedule delays (from the negotiated 100 days for field execution to the actual 225 days plus) and cost growth (the additional $500K to finish the project). I know that you are going to prepare a WVN for this purpose.

The attached file "Evaluation of Schedule and Cost Variances" provides the narrative requested. The file "MRS vs Actuals" shows actual vs. baseline costs in spreadsheet form.

Part of this was already submitted as WVN 044 (approved as cost growth). We will submit a second WVN after review and discussion of the narrative.

g. Summary of responses to corrective action requests 1-4 (11/21/07)

Summary of Responses to Corrective Action Requests 1 through 4, MRS 16

Shaw received four Corrective Action Requests (CARs 1 through 4) related to work at MRS 16. This document provides an overview of the causes and the proposed actions to prevent recurrence.

Responses to each of the CARs have been submitted previously. It was intended that the responses would be updated after each could be investigated in the field. This field evaluation has now been completed. The CAR forms will be revised to incorporate additional discussions based on this summary.

The attached figure, “CAR Grids”, shows locations of grids referenced in the text. It is noted that all of the issues were in the western half of the site and most were located in or around either the special case area or the “noisy area”.

1. Overview and Proposed Quality Control Organization

Evaluation of the CARs identifies some areas in which Quality Control (QC) processes identified in the work plan were not fully implemented or should be revised.

The following QC procedures will be implemented before resuming work at MRS 16 and for future projects:

1. A new UXOQCS will be appointed. This individual will be trained in USACE QC requirements.
2. The UXOQCS and QC Geophysicist will both report functionally to the Fort Ord QC Manager (Tom Ghigliotto). Mr. Ghigliotto will coordinate QC activities as a check that the UXOQCS and QC Geophysicist are not working too independently, and as a check that problems are not arising from inadequate coordination between the UXO and geophysical functions. Mr. Ghigliotto will conduct a weekly QC meeting attended by the UXOQCS and QC Geophysicist, and by other project staff as appropriate. (This meeting could be appended to the weekly project management meeting.)
3. Documentation prepared by the QC Geophysicist including the weekly QC report, will be shared among the whole project team. (During the previous work this detailed report was issued only to the USACE Geophysicist).
4. The UXOQCS will spend a majority of his time in the field.

5. Implement additional training and QC field checks to ensure excavation check extends outside of limit of excavation. Implement procedures so that both UXOQCS and QC Geophysicist check that all DGM picks are addressed. A double check will be performed when EM 61 rechecks are reported to be zero.
6. For future projects, identify in the work plan different procedures and/or additional QC checks or phase 2 DGM that may be performed in "noisy areas"
7. After each grid or batch of grids is completed the UXOQCS and USACE OE Safety Specialist will conduct a joint field inspection. This will occur before the UXO crew leaves the site.

Other submittals to USACE will document improvements to the database and a clear definition of the data flow process. These will enhance QC and the process for accepting grids for Quality Assurance.

2. Summary of Corrective Action Requests and Actions required to Prevent Recurrence

2.1. CAR 0001: Received 3/27/07.

Synopsis: QA seed Ord QA29 was detected and recovered on 3/15/07. This seed was planted as a double seed with a second seed buried 6" below. The second seed, Ord QA08 is a 37mm planted horizontally that was buried below QA29. QA08 by itself is undetectable from the surface but should have been detectable with a Schonstedt from the bottom of the hole when QA29 was removed.
Evaluation: The excavation was checked with the EM-61 as required by the Work Plan. Discussions of problem resolution included checking bottom of each excavation hole with Schonstedt after anomaly excavation. Based upon discussions with USACE PM and geophysicist and U.S. Army MMRP Manager, implementation of checking excavations with Schonstedt was determined to be unnecessary. It was noted that the Schonstedt would ring off on all holes due to the presence of ubiquitous frag. The decision was made to continue as specified in the Work Plan, to QC excavations with only EM-61 where EM-61 was the tool used to detect anomaly initially. After excavation and subsequent QC check with EM-61, holes can be backfilled immediately. Problem resolution was detailed in FWV 019.
Actions Required to Prevent Recurrence: None, WP procedures were being followed. The issue was resolved by project management team after CAR was issued.

2.2. CAR 0002: Received 9/20/07.

Synopsis: QA seed missed in grid C3A2G5 resulting in failure of grid block C3A2C5. Grid C3A2G5 is the only grid in the grid block that has been released to QA. ORD-QA14 is a 37mm round buried vertically with a depth of 16-in. Anomaly pick C3A2G5-0023 is located approximately 1.3-ft from the seed and should have resulted in its recovery.

Evaluation: Investigative field work conducted 10/15/07 to determine if QA seed could be detected. Seed detected almost immediately and excavated. From review of the field data, two anomalies were identified in the DGM, C3A2G5-23 and C3A2G5-24. Both were excavated and both reported 0.1 lbs of frag. Both excavations were checked with EM 61 and reported values of 0 and 5 mV respectively. The exact cause for missing the QA seed may have been instrument or operator error and cannot be determined at this time. The seed should have been detected by extending the EM61 Mk2 check an adequate radius from the excavations.

Actions Required to Prevent Recurrence: Implement additional training and QC field checks to ensure excavation check extends outside of limit of excavation. Implement procedures so that both UXOQCS and QC Geophysicist check that all DGM picks are addressed.

2.3. CAR 0003: Received 9/20/07.

Synopsis: QA seed missed in grid B3J2I7 resulting in failure of grid block in which it was collected. ORD-QA15 is a 37mm round buried vertically with a depth of 15-in. The nearest pick is B3J2I7-0005 located more than 10-ft to the northeast. Item was initially indicated as not detected by the DGM survey.

Evaluation: Investigative field work conducted 10/15/07 and review of QA seed database indicates that seed was detected and removed, but not reported. Seed was actually located in close proximity to B3J2I7-0005 discussed above. Coordinates as reported by USACE QA were incorrect. Tracking sheet data indicated ORD-QA15 was excavated from pick B3J2I7-0005.

Actions Required to Prevent Recurrence: No revisions to field procedures required since seed was detected. Procedures will be adopted to double check that seed items are reported. At present the UXO crew report seeds to the task manager who then reports to the USACE geophysicist. In future they will also be reported to the QC geophysicist and included as a separate tab of the weekly QC report.

2.4. CAR 0004:

Synopsis: Following ten grids failed analog QA:

1. C3D2D6: Clutter
2. C3A2J6: MD, RG M11 on surface
3. C3A2F6: MD, RKT 2.36”, debris on surface
4. C3A2E6: Deep anomaly

5. C3B2A7: MD, RKT 2.36”, M7, 6” bgs
6. C3B2A8: MD, RKT 2.36”, M7, 3” bgs
7. C3A2H8: MD, RKT 2.36”, debris on surface
8. B3J2J9: RR, Metal>2”, 1” bgs
9. C3A3I2: MD, RKT 2.36”, M7, warhead on surface
10. C3A3E2: MD, RKT 2.36” fuzes on surface

For clarity these are addressed in two groups relating to surface and subsurface items.

2.4.1. Analog QA failure resulting from surface items (Items 1, 2, 3, 7, 9, 10)

Evaluation: Additional QC should have been conducted prior to demobilizing.

Actions Required to Prevent Recurrence: Subsequent to field work completion, and before demobilizing UXO crews, a team site walk and final QC site walk will be conducted in conjunction with USACE QA personnel. Particular attention will be paid to areas where MD sorting, and preparation for transport occurred, and where demolition operations occurred, but the entire site will be examined.

2.4.2. Analog QA failure resulting from subsurface items (Items 4, 5, 6, 8).

Item 4; C3A2E6: Deep anomaly
Evaluation: The deep anomaly is within the saturated zone and therefore was not intrusively investigated. This grid was delivered for QA by error. A minor portion of the grid (northeastern corner of the grid) is not located within the saturated zone. This part of the grid was reviewed for QC and this resulted in listing the grid in the database as delivered for QA even though most of the grid had not been investigated.
Actions Required to Prevent Recurrence: The database has since been modified so that partial grids will not show as ready for QA.

Item 5; C3B2A7: MD, RKT 2.36”, M7, 6” bgs
Evaluation: This grid was delivered for QA. DGM data originally detected three targets (C3B2A7-006, C3B2A7-007 and C3B2A7-008). The PRO XRS measured location was 2.4 feet from target C3B2A7-006; 5 feet from target C3B2A7-007; and 4.2 feet from target C3B2A7-008. All of these targets had items removed. Target C3B2A7-006 had one item - 0.2 pounds of metal removed at 2” bgs. Target C3B2A7-007 had one item - 1 pound of metal removed at 1” bgs. Target C3B2A7-008 had one item - 0.1 pound removed at 1” below ground surface. Review of field records indicates that the excavations were checked with the EM 61 and all had a zero milliVolt response. Although field QC reported the excavations to be clear, they missed the remaining target

at 6” bgs (likely target 006 or 008). The exact cause for missing the item may have been instrument or operator error and cannot be determined at this time. It is noted that EM 61 readings of exactly zero mV are unusual. The operator may have rounded down but should have put the actual value (e.g. 0.4 mV). Even if the instrument was malfunctioning it is unusual to be exactly zero.
Actions Required to Prevent Recurrence: This was an area with high density of anomalies and clutter. Geophysicists rather than UXO personnel should perform field QC in complicated areas like this. A double check will be performed when EM 61 rechecks are reported to be zero.

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Item 6; C3B2A8: MD, RKT 2.36”, M7, 3” bgs
Evaluation: This grid was delivered for QA. DGM data originally detected two targets (C3B2A8-0064 and C3B2A8-0065) within approximately 3 feet of the measured location (measured Pro XRS location). One 3 pound item was excavated at a depth of 3 inches at C3B2A8-0064. The excavation was checked with the EM 61 and was cleared with zero mV response. The C3B2A8-0065 location was also checked and had zero mV response. This was then marked “same item”. The exact cause for missing the item may have been instrument or operator error and cannot be determined at this time. It is noted that EM 61 readings of exactly zero mV are unusual.
Actions Required to Prevent Recurrence This was also an area with high density of anomalies and clutter (adjacent grid to Item 5). Geophysicists rather than UXO personnel should perform field QC in complicated areas like this. Also, UXOQCS and QC Geophysicist will check that all targets have been investigated. A double check will be performed when EM 61 rechecks are reported to be zero

Item 8; B3J2J9: RR, Metal>2”, 1” bgs
Evaluation: This grid was delivered for QA. However, the piece of metal (>2”) is located directly on top of the water line and would not be expected to be resolved in the EM61 Mk2 data due to a high magnitude interference from the water line.
Actions Required to Prevent Recurrence: Perform a Schonstedt sweep over all utilities that have the potential of masking small shallow anomalies.

Appendix C

Corrective Action Requests

CORRECTIVE ACTION REQUEST | NO. :CESPK-ED-GG-FY07-0001
Originator: Lewis Hunter **Date Issued:** 27 March 2007 **Issued to:** Kevin Siemann, Shaw **Project:** Former Ft Ord, MRS-16 Clean-up **CESPK Project Manager:** Cynthia Burris **CESPK Project Safety Officer**: Clinton Huckins **Response Due:** 3 April 2007
Description of Condition Found: (As observed or reported) QA seed Ord QA29 was detected and recovered on 3/15/07. This seed was planted as a double seed with a second seed buried 6" below. The second seed, Ord QA08 is a 37mm planted horizontally that was buried below QA29. QA08 by itself is undetectable from the surface but should have been detectable with a Schonstedt from the bottom of the hole when QA29 was removed.
(Appropriate personnel, i.e. contractor PM, Safety Officer, Team Leader, etc., receiving the CAR will provide the following information to the originator by the "Response Due" date above. Please contact the originator if you have any questions)
Actual Cause: (Appropriate personnel will investigate and determine cause of condition reported above. Actual cause should be stated as specifically as possible). Hole was checked with EM-61 but not checked with Schonstedt. WP dictated digitally identified anomaly would be rechecked with same digital equipment.
Action Taken to Correct Condition: (Corrective Action should address root cause, not the symptom). Discussions of problem resolution included checking bottom of each excavation hole with Schonstedt after anomaly excavation. Based upon discussions with USACE geophysicist and U.S. Army MMRP Manager, implementation of this proposed solution was determined to be unnecessary. Decision was made to continue to QC excavations with only EM-61 where EM-61 was the tool used to detect anomaly initially. After excavation and subsequent QC check with EM-61, holes can be backfilled immediately.
Action Taken to Prevent Recurrence: UXOQCS will brief UXO dig teams regarding the process and will conduct periodic checks to ensure process is being followed.
Action Taken to Monitor Effectiveness of Corrective Action: (Generate data as proof. State the monitoring method put in place and who is responsible for reviewing data.) UXOQCS will document periodic checks on Field Activity Daily Logs (FADLs).
Team Manager Signature/Title/Date Signed: (Form must be signed before returning)

Form 1401, 15 April 1997

CORRECTIVE ACTION REQUEST | NO. :CESPK-ED-GG-FY07-0001
Task Manager 5/7/07
(Government Use Only) Review of Corrective Action: 1) Has condition improved? ___ Yes ___ No 2) Additional corrective action required? ___ Yes ___ No Comments:

Form 1401, 15 April 1997

CORRECTIVE ACTION REQUEST | NO. :CESPK-ED-GG-FY07-0002

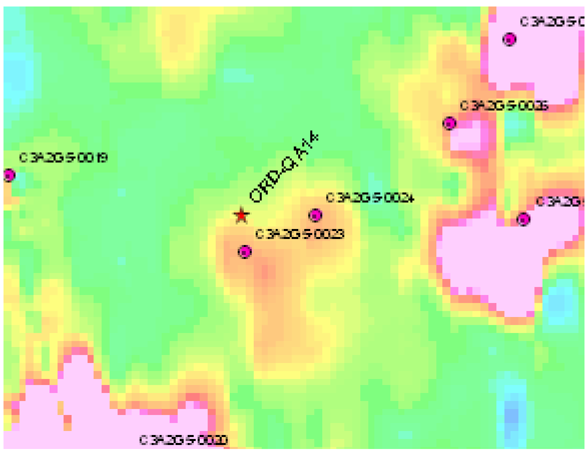
Originator: Lewis Hunter **Date Issued:** 19 September 2007

Issued to: Kevin Siemann, Shaw
Project: Former Ft Ord, MRS-16 Clean-up
CESPK Project Manager: Cynthia Burris
CESPK Project Safety Officer: Clinton Huckins
Response Due: 27 September 2007

Description of Condition Found: (As observed or reported)

QA seed missed in grid C3A2G5 resulting in failure of grid block C3A2C5. Grid C3A2G5 is the only grid in the grid block that has been released to QA.

ORD-QA14 is a 37mm round buried vertically with a depth of 16-in. Anomaly pick C3A2G5-0023 is located approximately 1.3-ft from the seed and should have resulted in its recovery.



(Appropriate personnel, i.e. contractor PM, Safety Officer, Team Leader, etc., receiving the CAR will provide the following information to the originator by the "Response Due" date above. Please contact the originator if you have any questions)

Actual Cause: (Appropriate personnel will investigate and determine cause of condition reported above. Actual cause should be stated as specifically as possible).

Although CAR 2 does not give coordinates of the QA seed we believe the QA seed is located in proximity to anomalies C3A2C5-0023 and C3A2C5-0024 shown in the CAR 2 map above. The location is shown under the star approximately 1.3 ft north of anomaly C3A2C5-0023. The EM61Mk2 response on reacquisition was 23 mV. This is above the pick threshold. This location was excavated and munitions debris removed. The excavation was then rechecked with EM61 Mk2. The EM61 Mk2 response was 0 mV. There are a number of possible causes for lack of recovery of this QA item as outlined below:

1) EM61 Mk2 check of excavation did not extend to 1.3 ft radius from excavation which would have resulted in detection of QA seed.
2) QA seed may have settled or been masked by munitions debris encountered nearby.
3) Malfunction of EM61 Mk2 resulting in false response of 0 mV.

Form 1401, 15 April 1997

CORRECTIVE ACTION REQUEST | NO. :CESPK-ED-GG-FY07-0002

Action Taken to Correct Condition: (Corrective Action should address root cause, not the symptom).

Recommended that we bring a single new EM61 Mk2 system to see if the QA seed is detectable at the project threshold and ensure excavation check extends outside of excavation radius (at least 1.3 feet). Should also check with single EM61 Mk2 currently at Fort Ord. If it is not detectable then the depth of the seed needs to be examined. We also need to confirm the exact location of the QA seed item by getting the coordinates. If the seed is detectable with new system and not old system at the project threshold then the old EM61 Mk2's should be taken out of service for good. If indication is that item was missed because EM61 Mk2 check subsequent to excavation was not of sufficient radius, implement additional QC field checks to ensure excavation check extends outside of limit of excavation.

Action Taken to Prevent Recurrence:

After the above testing is completed an action to prevent recurrence will be proposed based on determination of actual cause.
Order new EM61 Mk2 systems if it is proven to be an equipment malfunction. If not, increase the QC intensity of after excavation checks to ensure EM61 Mk2 excavation check extends outside of limit of excavation.

Action Taken to Monitor Effectiveness of Corrective Action: (Generate data as proof. State the monitoring method put in place and who is responsible for reviewing data.)

After the above testing is completed an action to monitor effectiveness of corrective action will be proposed based on determination of actual cause.

Team Manager Signature/Title/Date Signed: (Form must be signed before returning)

(Government Use Only)
Review of Corrective Action:

1) Has condition improved? ___ Yes ___ No
2) Additional corrective action required? ___ Yes ___ No

Comments:

Form 1401, 15 April 1997

CORRECTIVE ACTION REQUEST | NO. :CESPK-ED-GG-FY07-0003

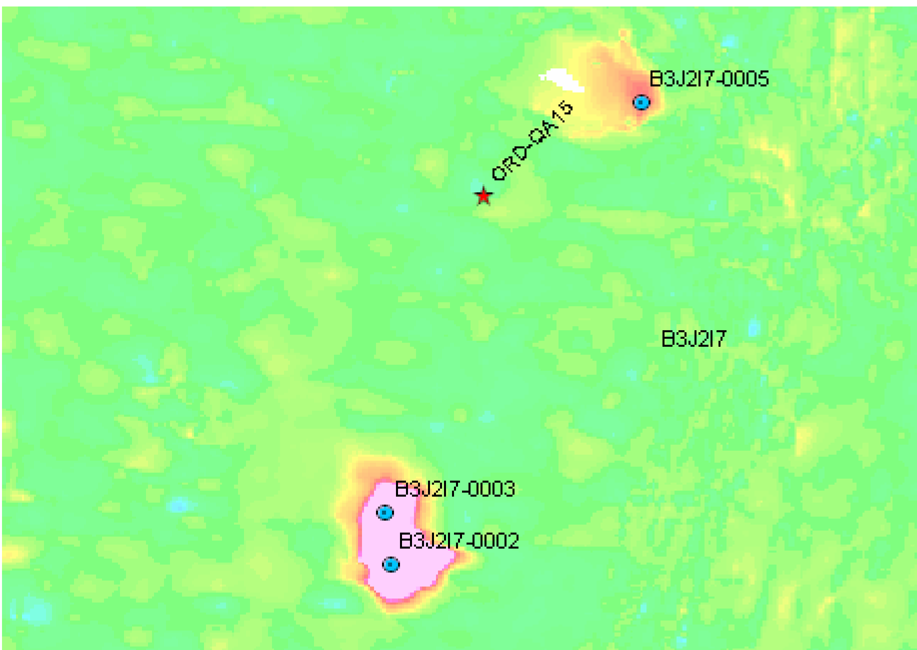
Originator: Lewis Hunter **Date Issued:** 19 September 2007

Issued to: Kevin Siemann, Shaw
Project: Former Ft Ord, MRS-16 Clean-up
CESPK Project Manager: Cynthia Burris
CESPK Project Safety Officer: Clinton Huckins
Response Due: 27 September 2007

Description of Condition Found: (As observed or reported)

QA seed missed in grid B3J2I7 resulting in failure of grid block in which it was collected.

ORD-QA15 is a 37mm round buried vertically with a depth of 15-in. The nearest pick is B3J2I7-0005 located more than 10-ft to the northeast. Item was not detected by the DGM survey.



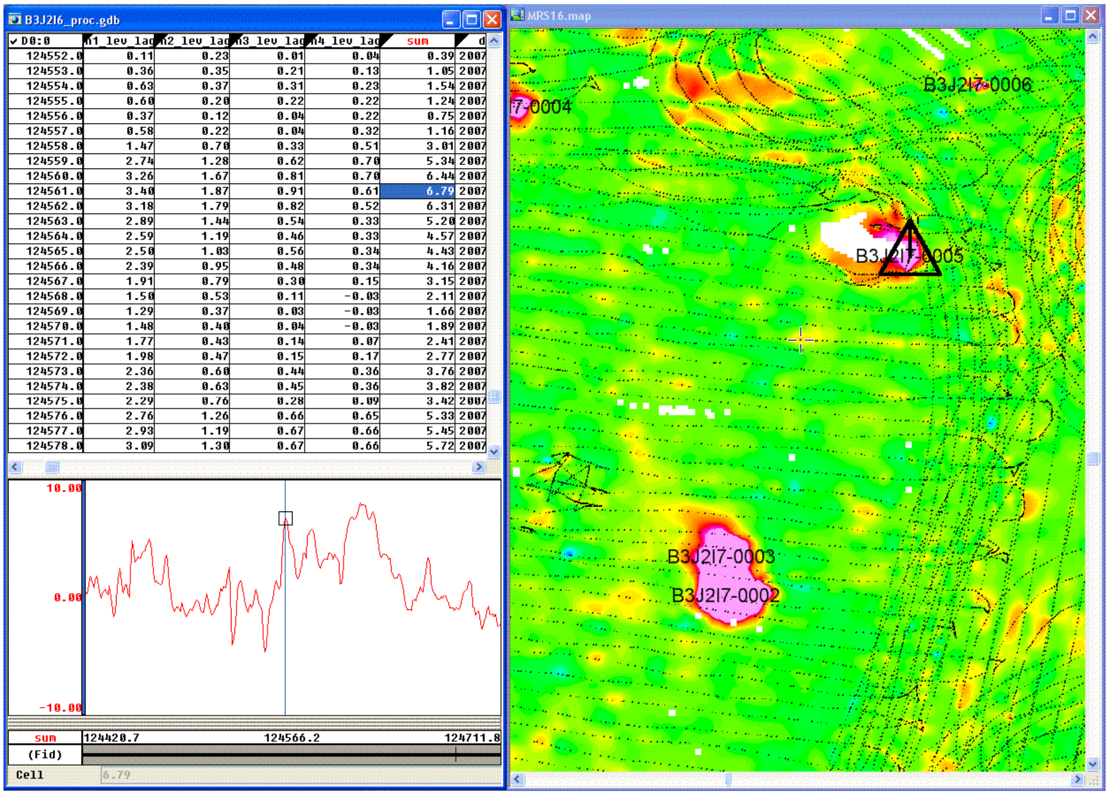
(Appropriate personnel, i.e. contractor PM, Safety Officer, Team Leader, etc., receiving the CAR will provide the following information to the originator by the "Response Due" date above. Please contact the originator if you have any questions)

Actual Cause: (Appropriate personnel will investigate and determine cause of condition reported above. Actual cause should be stated as specifically as possible).

Although CAR 3 does not give coordinates of the QA seed we believe the QA seed is located as shown below in proximity to two other anomalies shown in the CAR 3 map above. The location is shown under the cross-hair point slightly more than 10 feet south west of anomaly B3J217-0005 in map below. The EM61Mk2 response is 6.79 mV. This is below the pick threshold. Since we have detected and picked all of the other QA seeds it is unlikely that the equipment couldn't detect this QA seed. Therefore the explanation is complex. Since the data and anomalies throughout the rest of the grid are acceptable and consistent we don't believe there was an equipment malfunction. The tracking data also show good coverage. It may be possible that the QA seed settled or has been shifted by animal activity.

Form 1401, 15 April 1997

CORRECTIVE ACTION REQUEST | NO. :CESPK-ED-GG-FY07-0003



Action Taken to Correct Condition: (Corrective Action should address root cause, not the symptom).

It would be recommended that we bring a single new EM61 Mk2 system to see if the QA seed is detectable at the project threshold. If it is not detectable then the depth of the seed needs to be examined. We also need to confirm the exact location of the QA seed item by getting the coordinates.

Action Taken to Prevent Recurrence:

Address after additional field investigation. If the item was buried deeper than thought there is no more action required. Order new EM61 Mk2 systems if it is proven to be an equipment malfunction. If not we may increase the number of QC digs below the project threshold.

Action Taken to Monitor Effectiveness of Corrective Action: (Generate data as proof. State the monitoring method put in place and who is responsible for reviewing data.)

Address after additional field investigation. .

Team Manager Signature/Title/Date Signed: (Form must be signed before returning)

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CORRECTIVE ACTION REQUEST | NO. :CESPK-ED-GG-FY07-0003

(Government Use Only)

Review of Corrective Action:

1) Has condition improved? ___ Yes ___ No
2) Additional corrective action required? ___ Yes ___ No

Comments:

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CORRECTIVE ACTION REQUEST	NO. :CESPK-ED-GG-FY08-006

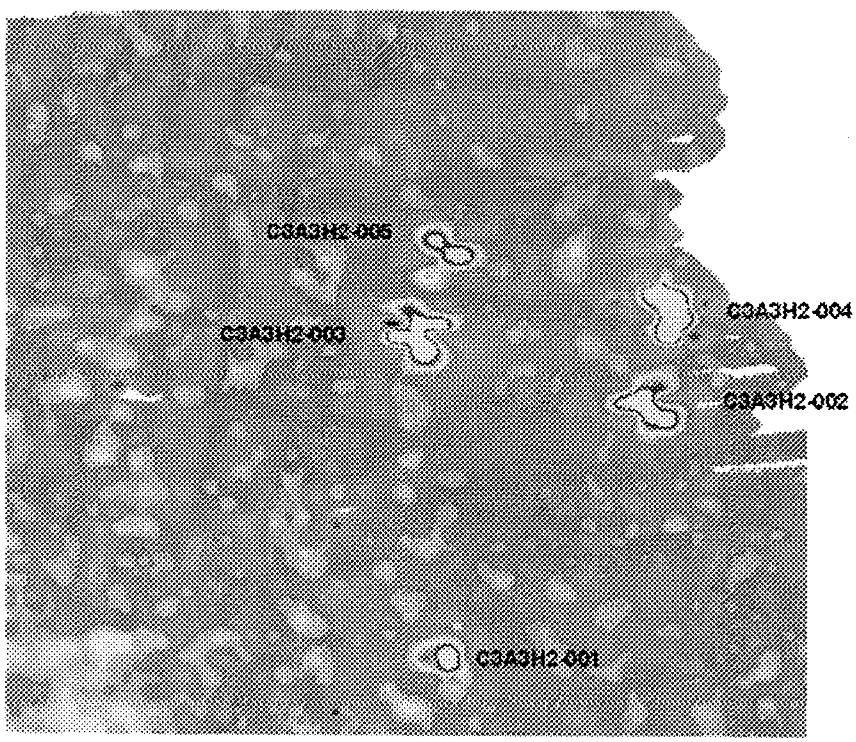
Originator: Lewis Hunter **Date Issued:** 19 June 2008

Issued to: Shaw E&I
Project: Former Ft Ord
CESPK Project Manager: Chris Prescott
CESPK Project Safety Officer: Clinton Huckins
Response Due: 26 June 2008

Description of Condition Found: (As observed or reported)

Grid block C3A3H2. 5 anomalies above pick thresholds were identified following QA digital surveys. Dig results found:

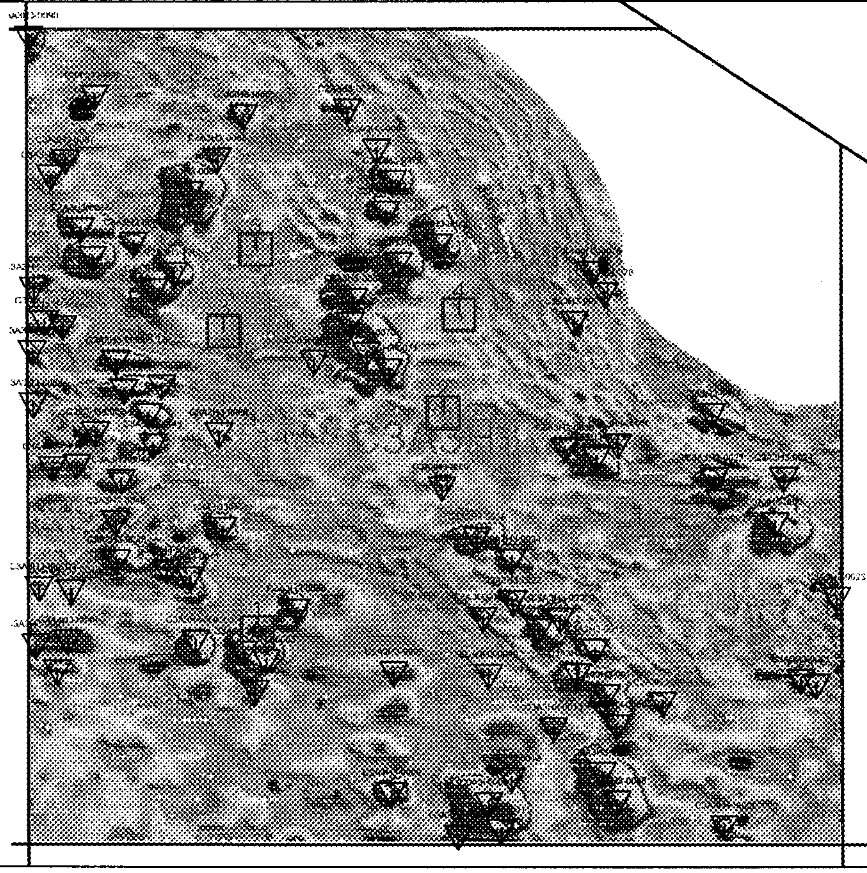
ID	mV (Ch3)	Target_ID	X	Y	Comment
C3A3H2-001	17	1	5747728	2122726	rust at 10"
C3A3H2-002	17	2	5747751	2122753	horseshoe at 6"
C3A3H2-003	15	3	5747724	2122763	horseshoe at 8"
C3A3H2-004	34	4	5747753	2122765	2.36 warhead MD at 4"
C3A3H2-005	20	5	5747728	2122773	horseshoe at 8"



Status: QA grid failure

Additional information will be provided 6/23 when QA geo is back in office.

CORRECTIVE ACTION REQUEST | NO. :CESPK-ED-GG-FY08-006



(Appropriate personnel, i.e. contractor PM, Safety Officer, Team Leader, etc., receiving the CAR will provide the following information to the originator by the "Response Due" date above. Please contact the originator if you have any questions)

Actual Cause: (Appropriate personnel will investigate and determine cause of condition reported above. Actual cause should be stated as specifically as possible).

After plotting the locations of the anomalies detected in the QA mapping of grid C3A3H3 Shaw noticed that there were no anomalies for 4 out of the five locations indicated in the QA data (anomalies 2,3,4, and 5 - see above figure). Anomaly 1 is located in a cluster of anomalies and may represent one of the anomalies. We also noticed that all of the anomaly locations, when shifted 10.5 feet to the northwest, fall on top of one of the mapped anomalies. Many times anomaly clusters displaced by the same amount are caused by GPS problems (ergo: one cause can be lack of correction to position from a base station). This caused Shaw to look at the GPS in detail.

Shaw has done extensive research into this particular problem and has found the cause. The data were collected on 3/21/07. To start with the USACE protocol, and Fort Ord MRS-16 Geophysics QC Plan, requires that daily quality control (QC) of GPS data be implemented by taking a daily GPS reading against a known survey monument in the morning before fieldwork to verify that the GPS is working (static navigational test). The standard is that the reading has to be within 2.0 feet of the known survey location. On the morning of 3/21/07 the morning GPS reading was within 0.32 feet of the known survey location. In addition a daily "dynamic navigational test" is conducted by placing a hitch ball on an existing grid corner (surveyed) within the area to be surveyed that day. The dynamic navigational test indicated that the hitch ball was 0.10 feet from the grid corner on 3/21/07. Additional checks were also executed by looking at the GPS data during afternoon calibration tests for sensor drift and lag correction.

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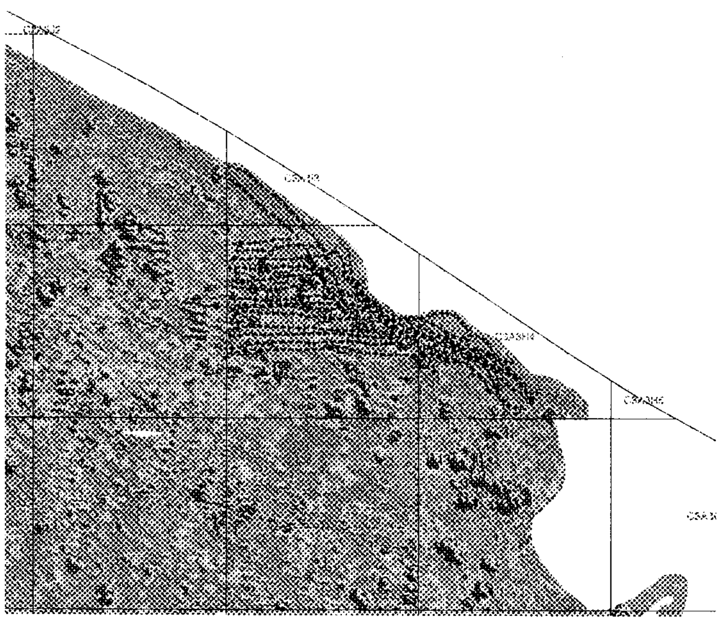
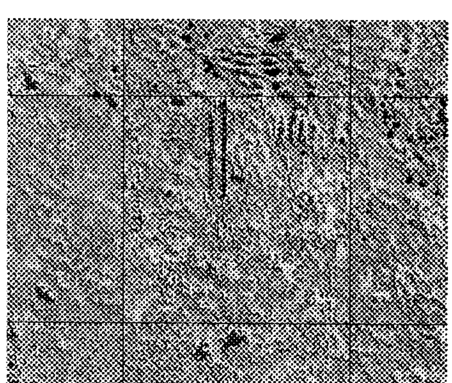
These GPS locations were also extremely close (0.2 feet) and well within tolerance. Therefore, all of the required QC checks indicated that the GPS was working properly for that day (3/21/07). It should be noted that these are the industry standard tests for navigational quality.

The next step that Shaw conducted was to extract the raw GPS files (before it enters MagLog) to determine if GPS lock quality can be extracted from the raw files. Raw GPS files do have an indicator of GPS lock quality. Each data point has an associated number (from 1 to 4). Number 1 indicates that the RTK GPS is "out of lock" and represents an uncorrected (no RTK) GPS location. Numbers 2 through 4 indicate that RTK GPS is "in lock" with increasing accuracy (even a 2 is within standards). Numbers 2 through 4 represent corrected GPS locations (RTK is working). Shaw then wrote a program to examine the raw GPS files for the numbers associated with the lock accuracy of a given raw GPS file. Shaw found that the data on 3/21/07 had some number 1 (out of lock) data. Approximately 1/16th of the data collected that day was affected by loss of lock. That area affected also correlates directly with the area where the anomalies were found during the QA inspection.

Shaw's next step was to go back and check ALL of the data collected at MRS-16. After checking all of the data from MRS-16 only one other, much smaller area, was affected (in Grid C3A3C5). Both affected areas are shown in the graphic below.



GPS Track-lines showing area where Grid C3A3H3 was affected.



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Two GPS Track-lines showing where Grid C3A3C5 was affected.

Action Taken to Correct Condition: (Corrective Action should address root cause, not the symptom).

The action taken to correct the occurrence is to conduct a re-survey in the areas affected by the loss of lock. This can be done in real-time with the EM-61 Mk2. Most of the other anomalies in Grid C3A3H3 have been excavated in C3A3H3 (excavated from "good lock" data in the rest of the grid). However, the affected "no-lock" area does extend slightly onto the two adjacent grids and covers a very minor part of those grids. Those areas should be surveyed. Anomaly 1 from the QA data in Grid C3A3H3 falls outside of the "no lock" area. The anomaly falls in an area where several anomalies are clustered and is likely the result of inadequate field QC.

Action Taken to Prevent Recurrence:

The action taken to prevent recurrence is to

1.) Put in place one more QC check on all DGM data collected in the future. The raw GPS files will be extracted from the MagLog system and will be inspected for the lock numbers on every single raw GPS file daily.

2.) In addition, it will be investigated whether MagLog can be configured to generate some type of signal (on the remote computer generating the data file) when RTK GPS is out of lock. This is a very rare occurrence but it could be alleviated in the field if a signal is generated which indicates the loss of GPS lock.

Action Taken to Monitor Effectiveness of Corrective Action: (Generate data as proof. State the monitoring method put in place and who is responsible for reviewing data.)

The QC Geophysicist will utilize the program Shaw generated to inspect each raw GPS file for lock conditions. This information will also be part of the weekly QC report to the QA geophysicist.

Team Manager Signature/Title/Date Signed: (Form must be signed before returning)

7/1/08

(Government Use Only)
Review of Corrective Action:
1) Has condition improved? ✓ Yes ___ No
2) Additional corrective action required? ___ Yes ✓ No

Comments: Concur with recommended action. C. Guscott 8 July 08

Form 1401, 15 April 1997

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CORRECTIVE ACTION REQUEST | **NO. :CESPK-ED-GG-FY08-~~006~~ 007**

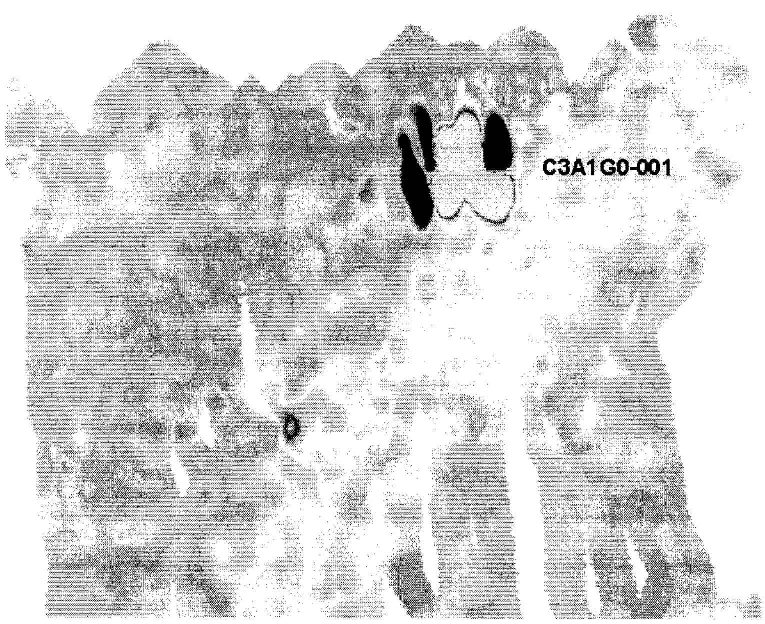
Originator: Lewis Hunter **Date Issued:** 19 June 2008

Issued to: Shaw E&I
Project: Former Ft Ord
CESPK Project Manager: Chris Prescott
CESPK Project Safety Officer: Clinton Huckins
Response Due: 26 June 2008

Description of Condition Found: (As observed or reported)

Grid block C3A1E0. 1 anomaly above pick threshold identified following QA digital surveys. Dig results found:

ID	mV (Ch3)	Target_ID	X	Y	Comment
C3A1G0-001	307	6	5746440	2122704	large metal cultural debris item embedded in ground at 6"



Status: QA grid failure

Additional information will be provided 6/23 when QA geo is back in office.

1 of 3

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Form 1401, 15 April 1997

CORRECTIVE ACTION REQUEST	NO. :CESPK-ED-GG-FY08-~~006~~ ~~007~~ 8

(Appropriate personnel, i.e. contractor PM, Safety Officer, Team Leader, etc., receiving the CAR will provide the following information to the originator by the "Response Due" date above. Please contact the originator if you have any questions)

Actual Cause: (Appropriate personnel will investigate and determine cause of condition reported above. Actual cause should be stated as specifically as possible).
Target lies outside of the recently removed fenceline in grid C3A1H0. Real-time EM61 survey was completed along fenceline following fence removal, but did not extend beyond fenceline in accordance with FWV 0024.

Action Taken to Correct Condition: (Corrective Action should address root cause, not the symptom).
None.

Action Taken to Prevent Recurrence:
None.

Action Taken to Monitor Effectiveness of Corrective Action: (Generate data as proof. State the monitoring method put in place and who is responsible for reviewing data.)

None.

Team Manager Signature/Title/Date Signed: (Form must be signed before returning)

7/1/08

(Government Use Only)
Review of Corrective Action:
1) Has condition improved? ___ Yes ___ No
2) Additional corrective action required? ___ Yes ___ No

Comments: Concur. C. Prescott 9 July 08

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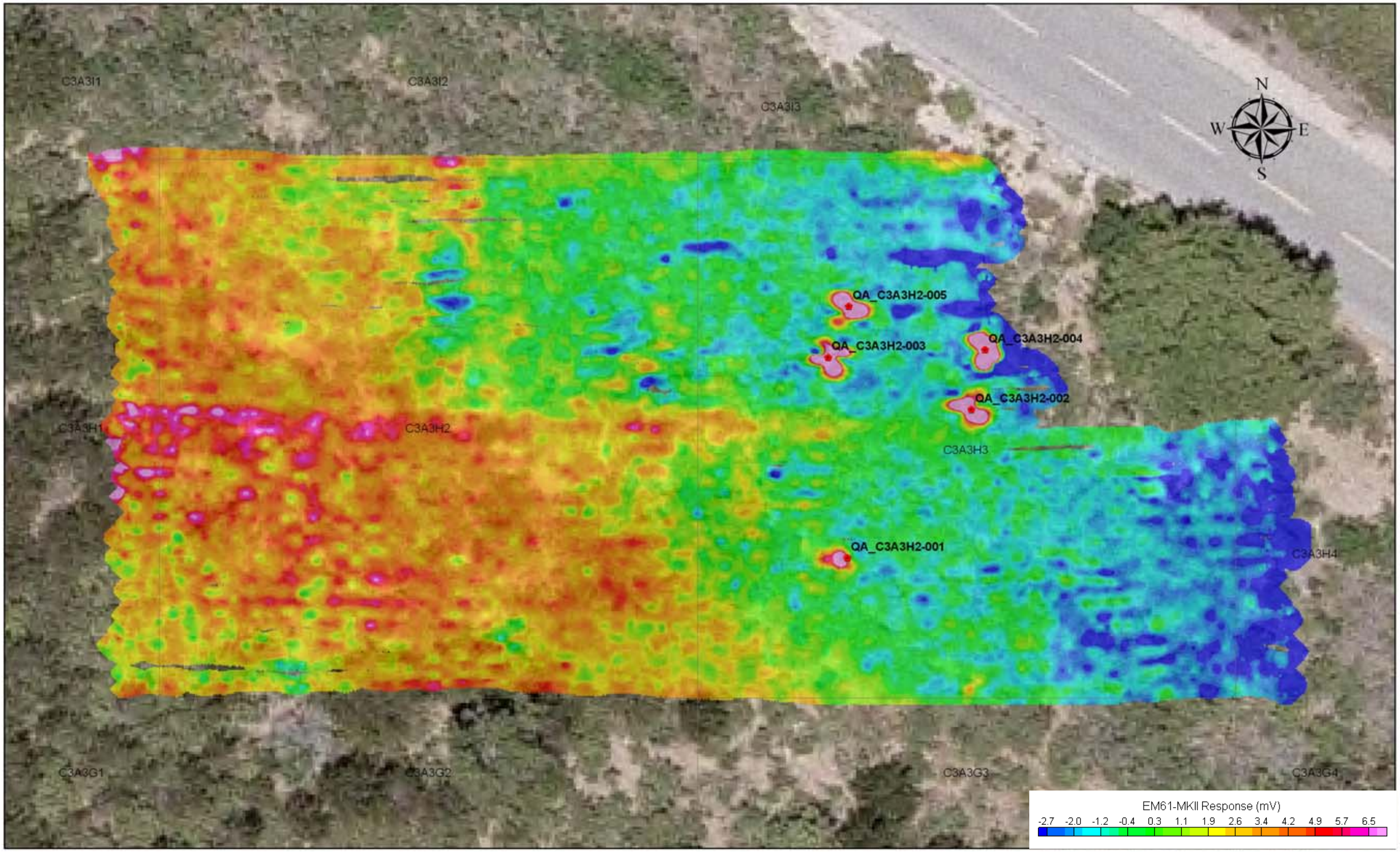
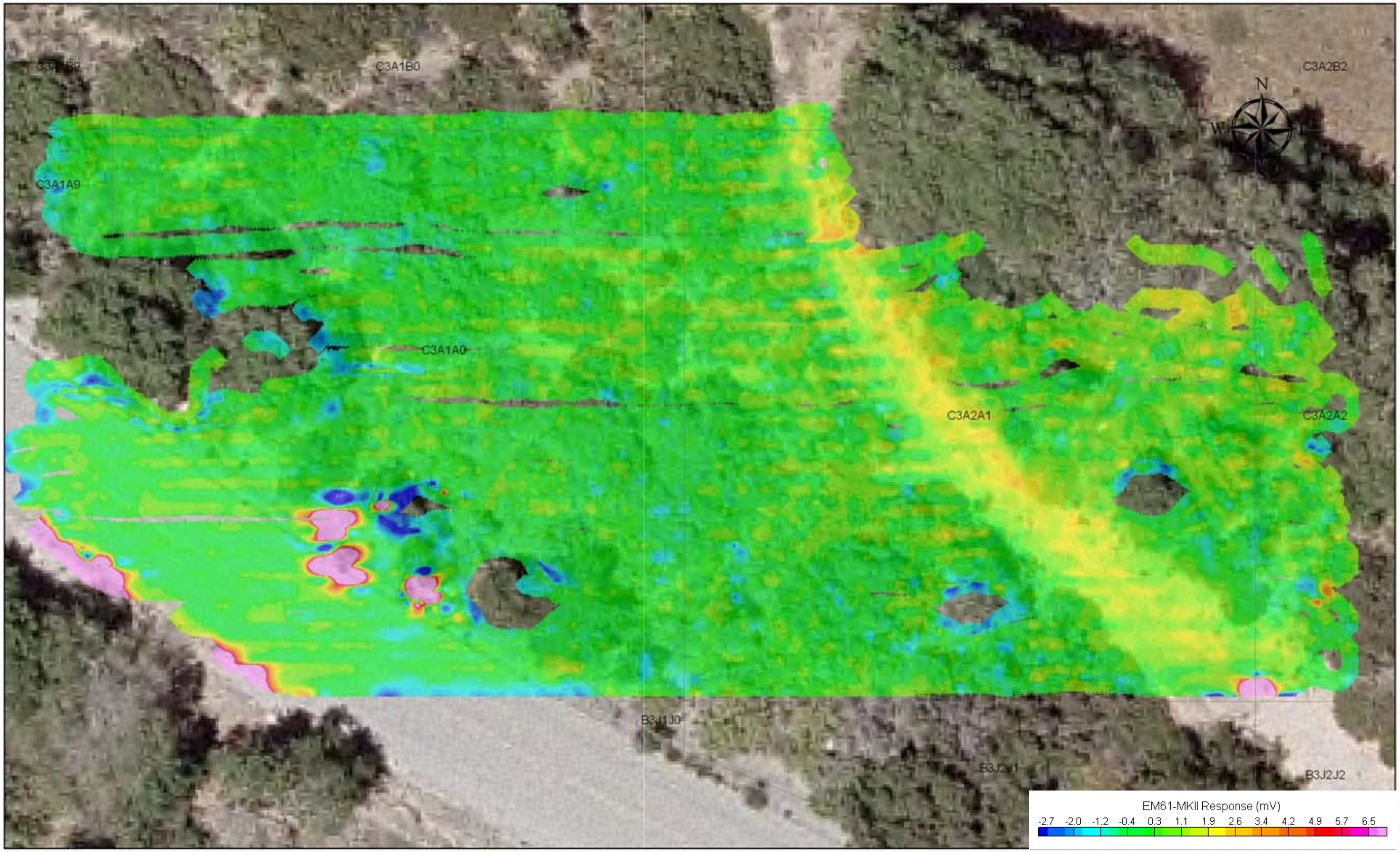
Appendix D

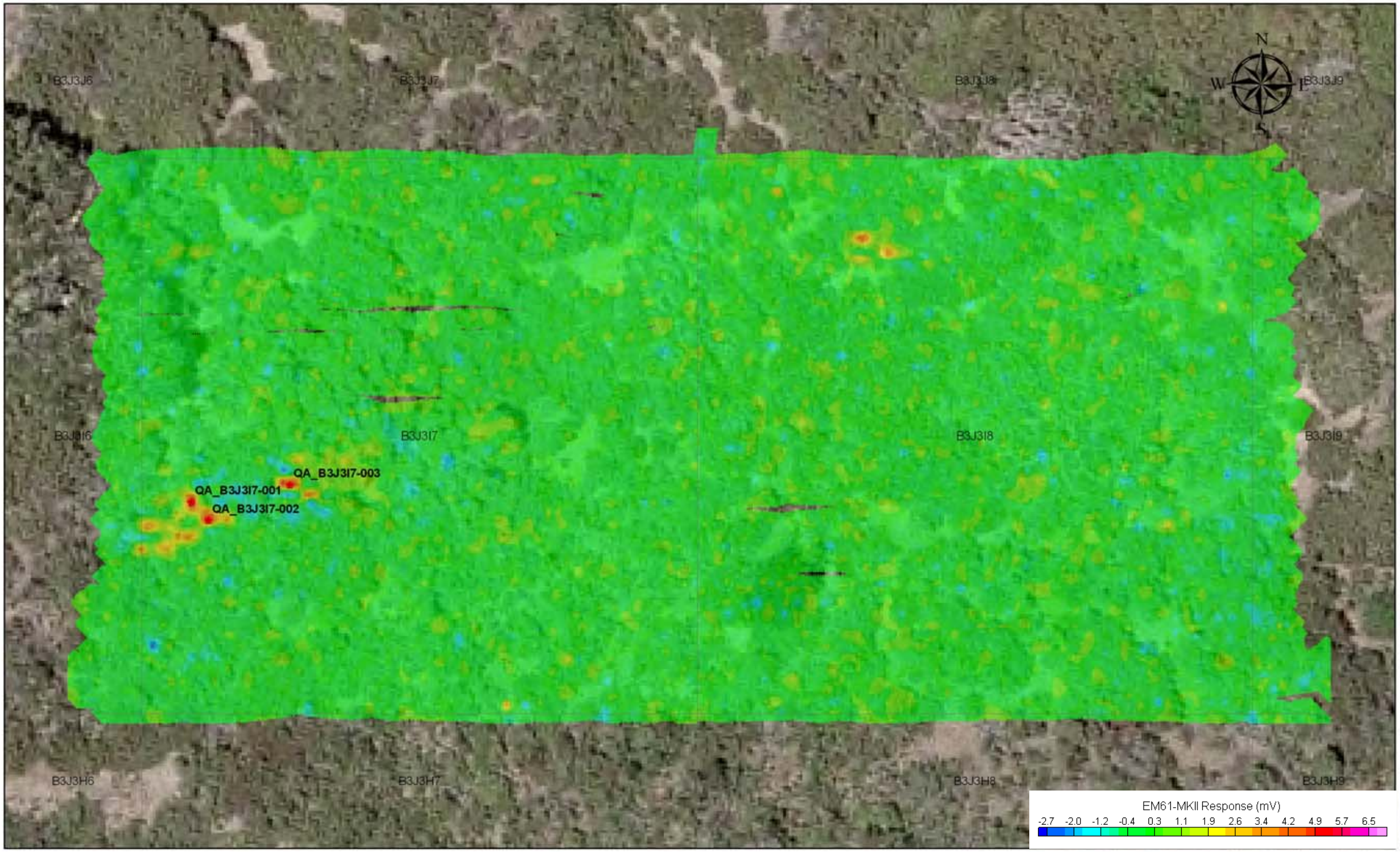
QA Digital Geophysical Mapping



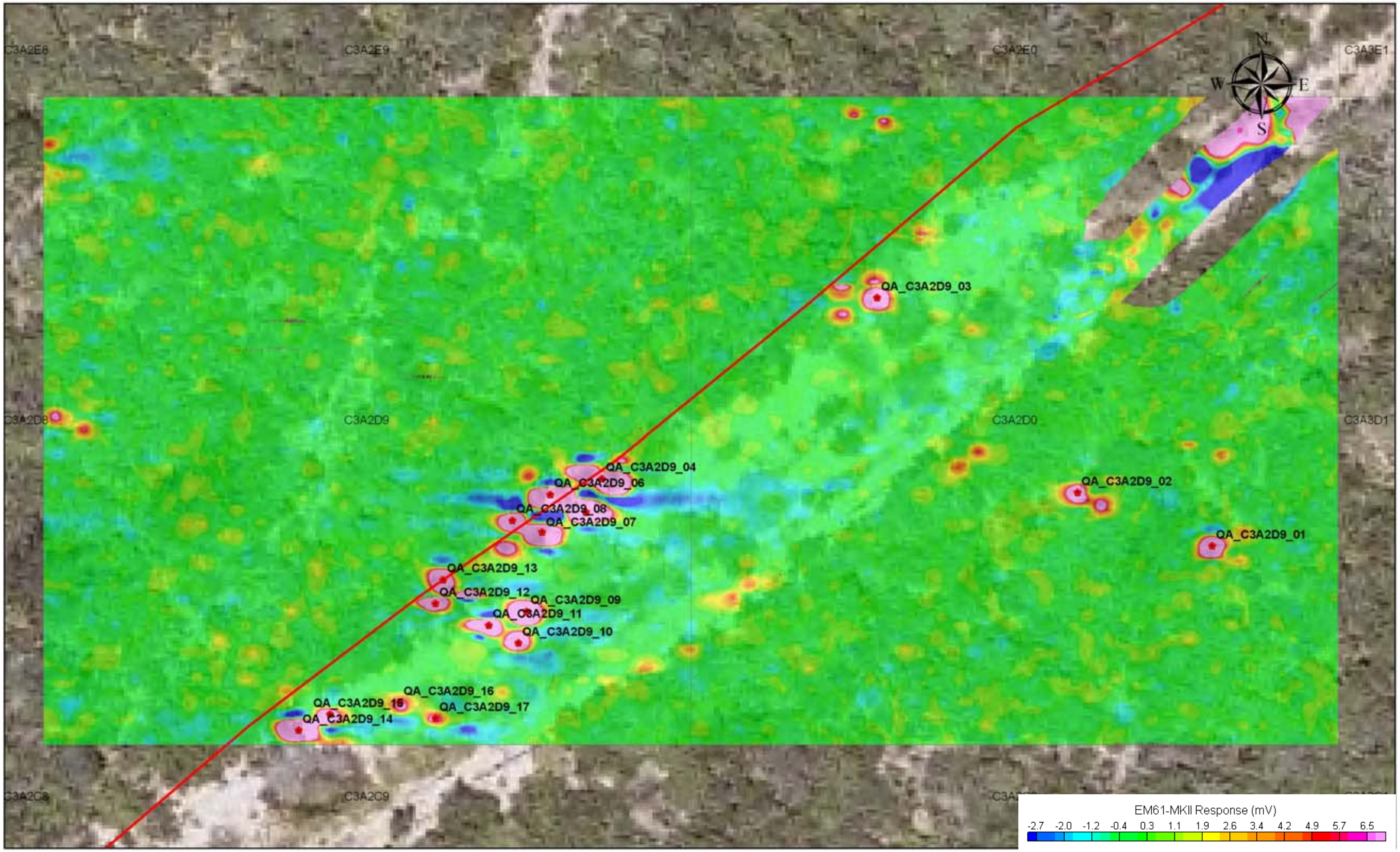
QA digital grid block C3A3H2



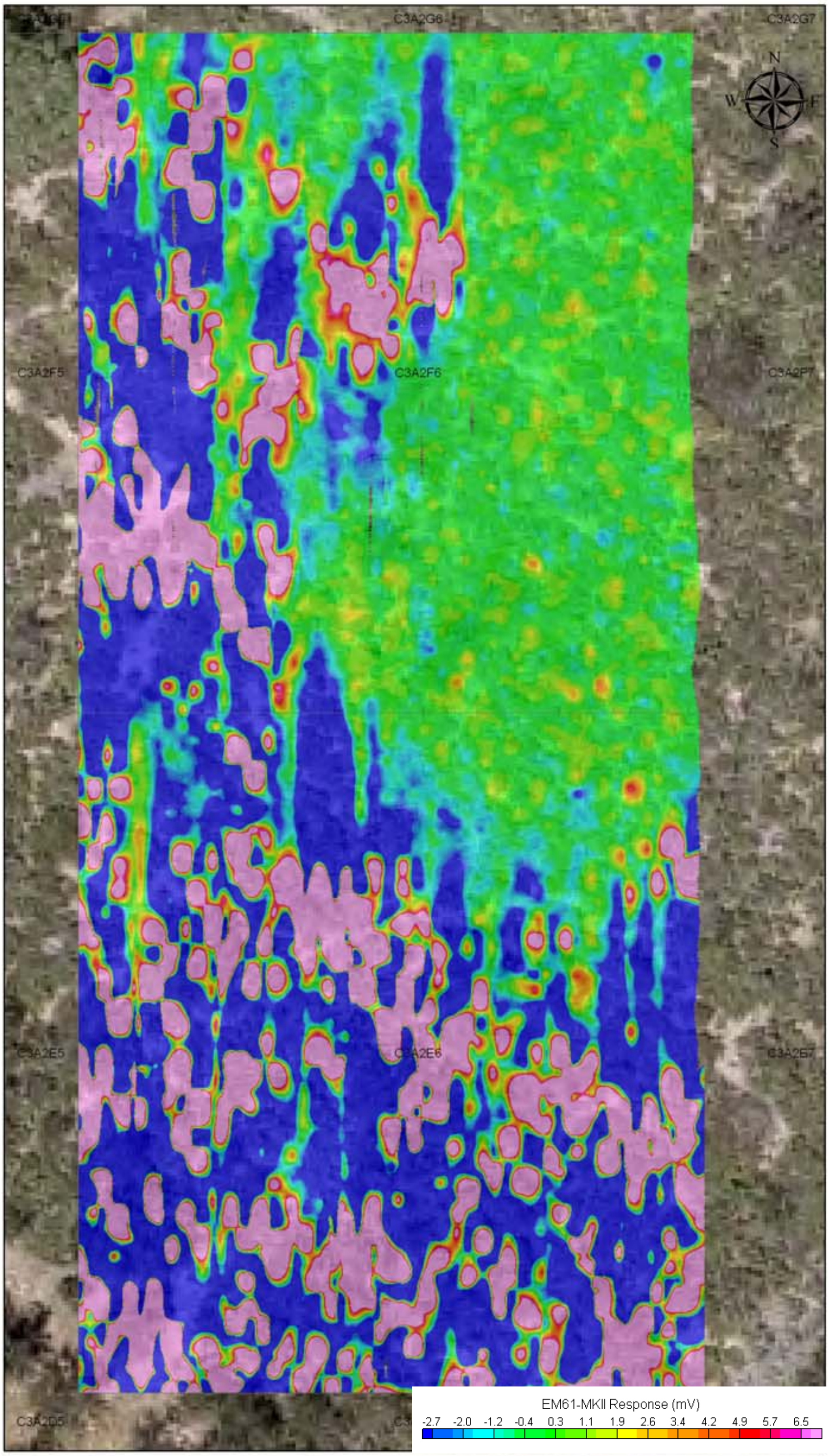
QA digital grid block C3A1A0



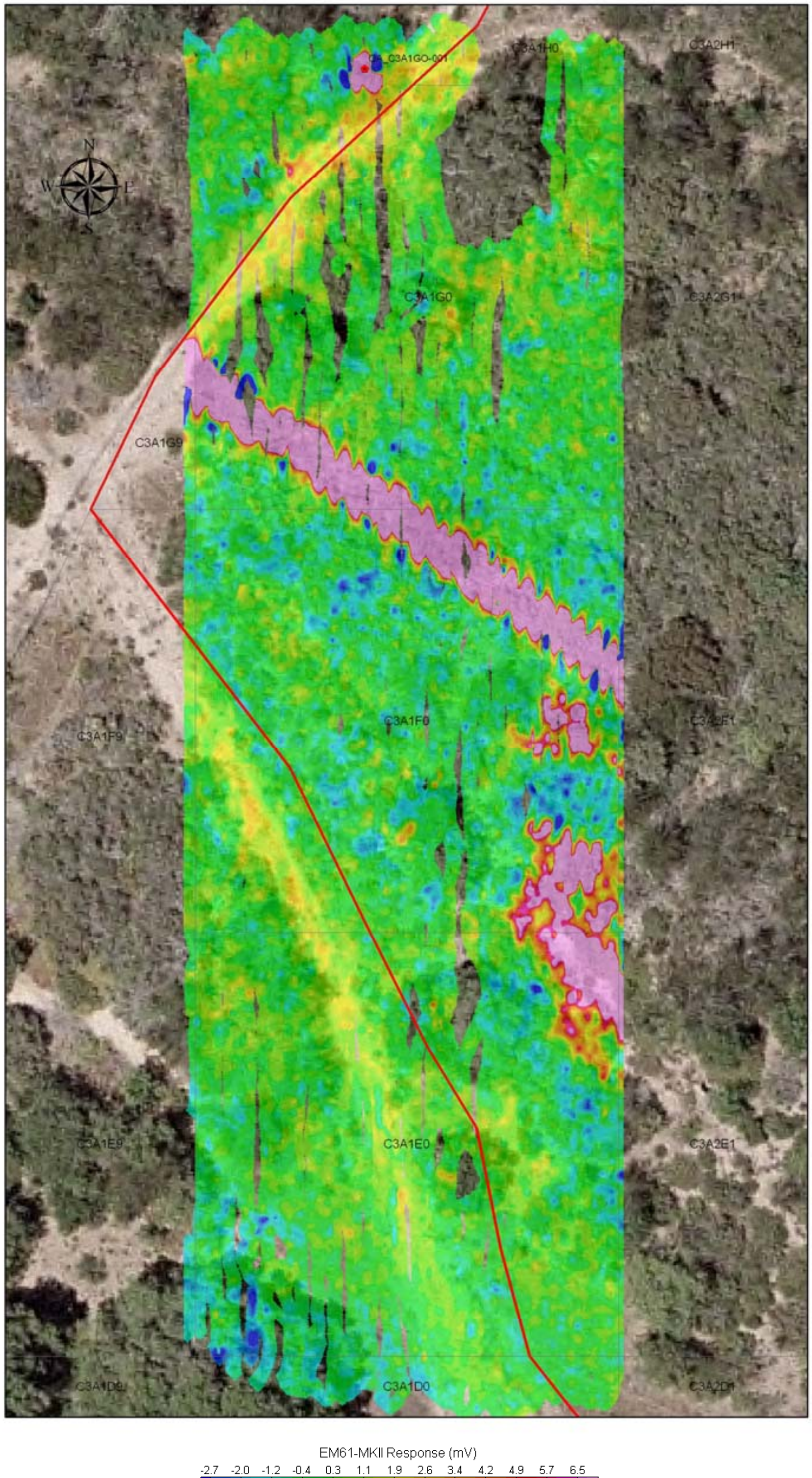
QA digital grid block B3J3I7



QA digital grid block C3A2D9



QA digital grid block C3A2E6



QA digital grid block C2A1E0

Appendix E

Lessons-learned handout for project team meeting developed in August 2007

General Project Items

1.) Systematic project planning is required up front. Issues and "conflicts" developed because project was not functioning as a "team." All activities need to be defined up front so that all team members understand how each component interacts and fits together. Project management needs to account for personnel requirements in advance to realize that personnel requirements will shift throughout project. MRS-16 had a high demand for UXO technicians at the onset, then DGM activities should have taken priority. A window with low UXO tech footprint was needed for DGM to generate a number of grids ready for digital excavations, then UXO presence should have been increased to conduct the digital excavations.

> *a) Modern paradigm with UXO clearance is that DGM is becoming the defining component. It produces anomaly maps that regulators can evaluate and review. This paradigm requires very strict procedural requirements and oversight that are well defined by the Corps.*

2) Project delays and cost impacts were realized at times due to low-manpower available to support DGM activities and equipment functionality.

For optimal performance of the DGM activities a minimum number of dedicated personnel should include: 2 people on the towed array; 2 people for man-portable, 2 people for reacquisition, 1 QC geophysicist, and 2 data processors. (Note: on smaller projects the man-portable fill-in team and reacquisition team can be the same).

> *a) Dedicated and trained field techs for the geophysical team.*
> *b) Allocation of personnel (for the next day) should be established on site after the field day to keep teams moving in an organized manner.*
> *c) This is a total team effort and everybody has an important role (when things go wrong and get stressful we tend to forget this).*

To maintain production equipment inventory as a minimum should included:

> *3 EM61-MK2s for towed-array*
> *1 EM61-MK2 for fill-in/reacquisition*
> *1 EM61-MK2 per UXO team during dig operations*
> *1-2 EM61-MK2s for back-up*

3.) USACE perceived that the timeline drove the project more often than data quality. A compromise needs to be achieved. These data will be scrutinized by regulators and outside parties looking for faults. The rush to make deadlines came at the expense of following standard MMRP procedures, which were at best addressed in a "make-up" fashion.

a.) We need to remember that documentation of decisions, procedures, issue resolution, etcetera are things that make the project defensible during future critical review and future closure.

4.) Prioritization and proactive planning of EOD and Geophysics field activities. Project delays were encountered as DGM teams were shuffled around to collect data, perform reacquisition functions, etc. to provide work areas for UXO teams. These additional duties removed them from systematic and orderly collection of grid data, which resulted in delays with regards to DGM collection that had ramifications throughout the program.

a)We need to keep the towed array moving daily (with tractor) until it has completed its task.

b) Grids processed and excavated in an optimal sequential manner with a daily feedback mechanism for assessment of dig results and continuous release of grids to QA.

5.) More direct communication between EOD personnel and geophysics team (including Project Geophysicist) regarding project issues.

6.) Have database designed and working as needed well before project begins (this needs to be done soon).

Specific Project Items

1.) Equipment (EM 61 Mk2's) need to be replaced (at least 4 units). The older stuff can be refurbished one more time for back-up or reacquisition/QC only. The GPS equipment still works well but is showing signs of extreme wear

2.) Foam should be purchased for the tractor wheels to avoid punctures.

3.) Use newly established Leica permanent base stations for RTK GPS (Monterey or Salinas). This requires the purchase of an inexpensive modem for each GPS unit. However, it will eliminate on-site base station maintenance which is a considerable amount of time.

4.) We need to resolve the backfilling of excavations with metal debris. This has a very negative impact on the geophysical portion of the project which generates costs.