FINAL
PILOT STUDY
ADVANCED GEOPHYSICAL CLASSIFICATION

SPRING VALLEY FORMERLY USED DEFENSE SITE
SPRING VALLEY, WASHINGTON, DC

Contract No.: W912DR-15-D-0015, Delivery Order 0001





Prepared for:

US ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT

US Army Corps of Engineers®
BUILDING STRONG®

APRIL 21, 2017

April 21, 2017

Attn: Alex Zahl, Project Manager
CENAB-EN-HN
10 S. Howard Street
Baltimore, MD 21201-1715

Dear Mr. Zahl,

ERT, Inc., is pleased to present the Final Advanced Geophysical Classification Pilot Study Report for the Spring Valley FUDS Pilot Study, Washington, DC. This document is submitted under Contract W912DR-15-D-0015, Delivery Order 0001. There were no comments from stakeholders and the Draft-Final version has therefore been finalized.

Please do not hesitate to call me at 301-323-1442 if you need anything more.

Sincerely,

ELECTRONIC SIGNATURE

Thomas J. Bachovchin, P.G.
Project Manager

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Spring Valley Formerly Used Defense Site
Spring Valley, Washington, DC

Prepared for:

U.S. Army Corps of Engineers
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Prepared by:

ERT, Inc.

Laurel, Maryland 20707

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02/28/17

Thomas Bachovchin — Date
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12/20/16

Jennifer Harlan — Date
Program Manager, PMP

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COMPLETION OF SENIOR TECHNICAL REVIEW

This document has been produced within the framework of the ERT, Inc. (ERT) quality management system. As such, a senior technical review has been conducted. This included review of all elements addressed within the document, proposed or utilized technologies and alternatives and their applications with respect to project objectives and framework of U.S. Army Corps of Engineers regulatory constraints under the current project, within which this work has been completed.

12/20/16

Jennifer Harlan Date
Senior Technical Reviewer

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

This document has been produced within the framework of ERT's quality management system. As such, an independent technical review, appropriate to the level of risk and complexity inherent in the project, has been conducted. This included a review of assumptions; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the project objectives. Comments and concerns resulting from review of the document have been addressed and corrected as necessary.

12/20/16

Michelle Chestnut Date
Independent Technical Reviewer

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LIST OF ACRONYMS AND ABBREVIATIONS

AGC	Advanced Geophysical Classification
AOI	area of interest
ARB	Anomaly Review Board
AU	American University
AUES	American University Experiment Station
bgs	below ground surface
BTG	Black Tusk Geophysics
CA	Corrective Action
CEHNC	USACE Huntsville Center
CENAB	Corps of Engineers, Baltimore District
cm	centimeter
CSM	Conceptual Site Model
CWM	Chemical Warfare Materiel
DD	Decision Document
DGM	digital geophysical mapping
DGQCRs	Daily Geophysical Quality Control Reports
DMM	discarded military munitions
DOEE	District of Columbia Department of Energy and Environment
DQO	data quality objective
DUA	data usability assessment
EMI	electromagnetic induction
EOD	Explosive Ordnance Disposal
ERT	ERT, Inc.
ESTCP	Environmental Security Technology Certification Program
FS	Feasibility Study
FUDS	Formerly Used Defense Sites
GPS	global positioning system
GSV	geophysical sensor verification
IMU	Inertial Measurement Unit
ISO	industry standard object
IVS	instrument verification strip
LOE	level of effort
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
ms	millisecond

mV	millivolt
mV/A	millivolts per amp
MPV	Man-Portable Vector
MQO	measurement quality objective
NAD	North American Datum
NCR	Non-Conformance Report
NRL	Naval Research Laboratory
OESS	Ordnance and Explosives Safety Specialist
PP	Proposed Plan
QA	quality assurance
QC	quality control
RAOs	Remedial Action Objectives
RCA	root cause analysis
RI	Remedial Investigation
ROC	receiver operating characteristic
RTK	real-time kinematic
RTS	robotic total station
SOP	standard operating procedure
SUXOS	Senior UXO Supervisor
SVFUDS	Spring Valley Formerly Used Defense Site
TEMTADS	time-domain electromagnetic multi-sensor towed-array detection system
TOI	target of interest
TPC	Three-phase Control
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
UXOQC/SO	Unexploded Ordnance Quality Control Specialist/ Safety Officer

EXECUTIVE SUMMARY

INTRODUCTION AND SCOPE

ERT, Inc., (ERT) was tasked with performing a Pilot Study of Advanced Geophysical Classification (AGC) Technology in cooperation with an Environmental Security Technology Certification Program (ESTCP) Demonstration Project at the Spring Valley Formerly Used Defense Site (SVFUDS). The recommended remedial alternative to meet the Remedial Action Objectives (RAOs) of reducing the potential for encountering Munitions and Explosives of Concern (MEC) is to utilize AGC to classify anomalies and potentially reduce the number of anomaly removals.

The primary objective of the study was to evaluate the implementation and effectiveness of AGC technology using Time-domain Electromagnetic Multi-sensor Towed Array Detection System (TEMTADS) and Man Portable Vector (MPV) instrumentation at the SVFUDS in order to best inform planning for the remedial action. The Pilot Study was initially scoped to be performed on five SVFUDS residential properties where digital geophysical mapping (DGM) had previously been collected between 2007 and 2009. However, right-of-entry (ROE) for two of the five properties could not be obtained, and the study proceeded using the three remaining properties.

FIELD WORK APPROACH

Prior to performing the geophysical surveys, a landscape survey to document the existing landscaping and vegetation was conducted by a qualified arborist. A site visit was also conducted to define and document all accessible areas where the geophysical surveys could be completed, to allow reasonable access for TEMTADS and MPV equipment. Landscape removal was limited to low-lying vegetation that could adversely affect the geophysical results.

Geophysical system verification was conducted using an Instrument Verification Strip (IVS) and a blind seeding program. The IVS was constructed in proximity to the existing Geophysical Prove Out on the federal property. Blind seeds were installed at each property using both inert munitions and industry standard objects (ISOs). The results of these efforts were captured in Memoranda, submitted to USACE and approved prior to the start of work.

The geophysical survey activities included conducting AGC Geophysics using the TEMTADS and MPV instruments to complete dynamic surveys (mapping with a moving sensor) and cued surveys (collecting data with a static sensor on a specific point) on each property. The instruments were operated by demonstrators under the ESTCP, with personnel from the Naval Research Laboratory (NRL) operating the TEMTADS, and personnel from Weston Solutions, Inc. and Black Tusk Geophysics (BTG) operating the MPV. The EM61 instrument, operated by ERT, was also used in selected areas not previously available during the earlier DGM investigations.

DYNAMIC AND CUED SURVEYS

The MPV dynamic data collected in the field were processed and analyzed by the BTG team, and the TEMTADS dynamic data collected in the field were processed and analyzed by the NRL team.

Targets were selected from dynamic TEMTADS and MPV data by the respective instrument demonstrators, and cued data were then collected over the targets. Following the processing of the cued MPV and TEMTADS data, and the addition of the EM61 data, the synthesis of the cued targets into the final dig target list was performed. From this list, final dig sheets were generated for use by the UXO intrusive team.

INTRUSIVE INVESTIGATION

For this Pilot Study, all targets were intrusively investigated. On average, 200+ targets were excavated from each of the three properties, under softscape and hardscape (sidewalks and driveways), by a qualified UXO team. Excavations were completed using shovels in softscape, or using power tools (concrete saws, jackhammers) in hardscape.

The 4720 Quebec property was the only property where munitions-related items were found during this Pilot Study. These included a 3-inch Stokes Mortar unfuzed practice round. In accordance with the approved Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP), this item was turned over to the USACE Ordnance and Explosives Safety Specialist (OESS) for further processing. The OESS initiated a response from the Fort Belvoir Explosive Ordnance Disposal (EOD) unit, who took control of the item, removing it from the site for further assessment. It was ultimately determined to be a practice round and was properly disposed by the EOD unit. Targets #94, #201, and #202, at 4720 Quebec were also determined to be munitions debris. At the other properties, nails, steel scrap, and wires were common.

CLASSIFICATION RESULTS

In order to analyze the data and assess each demonstrator's classification process, Receiver Operating Characteristic (ROC) curves, clutter rejection rates, and ultimately, the correct classification of targets of interest (TOI) and non-TOI were used to show how well the data were classified.

TOI were classified into various categories, for example:

- Cannot Analyze targets (data quality too poor to confidently classify).
- High Confidence Digs (targets are likely TOI).
- Lower Confidence Digs (targets could be TOI).
- High Confidence Do Not Dig (targets should not be TOI)

Figures representing the final dig recommendations based on classification, specific to each instrument, were prepared. Note that while all targets were intrusively investigated for this Pilot Study, for an actual AGC-based approach, only those targets recommended for digging would actually be excavated.

CONCLUSIONS

AGC methods employing MPV and TEMTADS systems were successfully used at the SVFUDS. For three private properties, 200+ targets per property were detected, classified, and intrusively investigated. Four MD items, including one intact Stokes Mortar (determined to be an unfuzed practice round), were found. Both demonstrators correctly classified the Stokes Mortar found at 4720 Quebec.

In support of the primary objective of the Pilot Study, a comparison of AGC methods relative to traditional DGM methods used at the SVFUDS was conducted. In general, while there were challenges with noise in an urban environment, the findings of this Pilot Study support the implementation of AGC methods over the traditional DGM methods for future SVFUDS remedial actions.

A secondary objective of the Study was to determine which of the two AGC systems might be most effective for future remedial actions at the SVFUDS. With regard to performance of the individual AGC methodologies, while the MPV technology appears to have a slight advantage over the TEMTADS, given the lack of a strong preference for one system over the other, it is concluded that either technology could be effectively utilized to meet the RAOs for the SVFUDS.

Finally, with regard to the need to detect larger items at greater depths than either AGC system could achieve, AGC methodologies could be supplemented by traditional DGM technology, such as the G-858, to address deeper targets.

RECOMMENDATIONS

The findings of this Pilot Study support the implementation of AGC methods over traditional DGM methods for future SVFUDS remedial actions. The specific AGC methodology to be implemented should be refined through the planning process, considering the recommended procedures presented in Section 8.4, as well as input from project stakeholders.

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1.0 INTRODUCTION AND BACKGROUND

ERT, Inc., (ERT) was tasked with performing a Pilot Study of Advanced Geophysical Classification (AGC) Technology in cooperation with an Environmental Security Technology Certification Program (ESTCP) Demonstration Project at the Spring Valley Formerly Used Defense Site (SVFUDS). The recommended remedial alternative to meet the SVFUDS Remedial Action Objectives (RAOs) of reducing the potential for encountering Munitions and Explosives of Concern (MEC) is to utilize AGC to classify anomalies and potentially reduce the number of anomaly removals.

ERT conducted this work for the U.S. Army Corps of Engineers (USACE), at the SVFUDS, located in Washington, D.C., under the Small Business Multiple Award Military Munitions Services II Contract #W912DR-15-D-0015, Delivery Order 0001. This effort falls under the Defense Environmental Restoration Program/Formerly Used Defense Sites (DERP/FUDS). All work was performed in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300. As these activities involved work in areas potentially contaminated with MEC and Chemical Warfare Materiel (CWM) related items, it was conducted in full compliance with USACE, Baltimore District (CENAB), USACE Huntsville Center (CEHNC), Department of the Army, and Department of Defense regulations regarding personnel, equipment, and procedures.

1.1 Purpose and Objectives

The purpose of the AGC Pilot Study was to assess the recommended remedial alternative presented in the *Site-Wide Proposed Plan* (PP), finalized in June 2016 (USACE, 2016b). The recommended remedial alternative to meet the RAOs of reducing the potential for encountering MEC is to utilize AGC technology to classify anomalies and potentially reduce the number of anomaly removals. Reducing the number of removals is especially advantageous at the SVFUDS as it will not only likely result in a reduced overall cost for the future remedial action by eliminating unnecessary digs, but will also minimize adverse impacts such as landscape or hardscape damage at residential properties where the remedial action will occur.

The primary objective of the study was to evaluate the implementation and effectiveness of AGC technology using Time-domain Electromagnetic Multi-sensor Towed Array Detection System (TEMTADS) and Man Portable Vector (MPV) instrumentation at the SVFUDS in order to best inform planning for the remedial action. In addition, an EM61-MK2A instrument was used to survey several areas not previously surveyed during the 2007 – 2009 geophysical survey activities, and to provide supplemental data to support submittal of assurance letters to property owners that verify remediation is complete.

1.2 Study Scope

The Pilot Study was initially scoped to be performed on five specific SVFUDS residential properties where digital geophysical mapping (DGM) had previously been collected between 2007 and 2009. However, right-of-entry (ROE) for two of the five properties could not be obtained, and the study proceeded using three properties.

The work included conducting AGC Geophysics using the TEMTADS and MPV instruments to complete dynamic surveys (mapping with a moving sensor) and cued surveys (collecting data with a static sensor on a point) on each property. The instruments were operated by demonstrators under the Environmental Security Technology Certification Program (ESTCP), with personnel from the Naval Research Laboratory (NRL) operating the TEMTADS, and personnel from Weston Solutions, Inc. and Black Tusk Geophysics (BTG) operating the MPV.

The EM61 instrument, operated by ERT, was also used in selected areas not previously available during the earlier investigations. Following the surveys, final dig lists were developed and all target anomalies were excavated.

All properties included in this study were categorized as low probability sites (i.e., the probability of encountering MEC/CWM during intrusive investigations is "seldom" or "remotely possible"). All work was conducted in accordance with the *Advanced Geophysical Classification for Munitions Response Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Munitions Response*, Final March 2016 (USACE, 2016c). Additionally, procedures from the *Site-Wide Work Plan for the SVFUDS*, USACE, 2007, were also followed.

1.3 SVFUDS Background

The SVFUDS comprises 661 acres in northwest Washington, D.C. This is a largely residential area with local shops and restaurants, surrounded by dense apartment buildings and/or townhouses, and spreading out into single-family homes. Land use in and around the SVFUDS is primarily low-density residential, with smaller portions zoned for commercial use. The campus of American University (AU) occupies a large portion of the SVFUDS.

During World War I, the U.S. Government established the American University Experiment Station (AUES) to investigate the testing, production, and effects of noxious gases, antidotes and protective masks. The AUES, which was located on the grounds of the current AU, used additional property in the vicinity to conduct this research and development on CWM, including mustard and lewisite agents, as well as adamsite, irritants and smokes. After the war, these activities were transferred to other locations, the AUES was demobilized, and the site was returned to the owners.

Figure 1 shows the entire SVFUDS boundary and the three residential Pilot Study properties. (All figures are presented in Appendix A while Tables and Exhibits are contained within the body of the report).

1.3.1 Previous Investigations

The *Site-Wide Remedial Investigation Report* (RI Report) documents all previous investigations. The discussions below summarize the investigations most relevant to the Pilot Study.

Geophysical investigations were conducted on 99 residential properties between 1998 and 2011. The investigations were conducted in two phases: non-intrusive geophysical surveys to identify buried metallic anomalies; then, following analysis of the survey results by an Anomaly Review Board (ARB), excavations of metallic anomalies with characteristics of buried munition items.

Each of the three properties selected for this Pilot Study has previously undergone DGM and anomaly removal, as discussed below.

1.3.1.1 4720 Quebec Street

USACE conducted a DGM investigation on this property in 2007, with follow-on anomaly removal completed in 2009. Out of 69 total anomalies, 54 were selected by the ARB for removal and were successfully excavated in 2009. Two munition debris (MD) fragments (one from a 75 millimeter (mm) projectile and one not further identified) were found during the investigation (USACE, 2010).

1.3.1.2 4733 Woodway Lane

USACE conducted a DGM investigation on this property in 2009, with follow-on anomaly removal completed in 2011. Out of 32 total anomalies selected by the ARB for removal, 31 were successfully investigated. One anomaly was not investigated due to its location under the walkway. No MEC/Recovered CWM (RCWM) items or other (AUES)-related items were encountered (USACE, 2011b)

1.3.1.3 4740 Quebec Street

USACE conducted a DGM investigation on this property in 2009, with follow-on anomaly removal completed in 2010. Out of 45 total anomalies selected by the ARB for removal, all were successfully investigated at 4740 Quebec Street. A pipe that contained explosives was categorized as a MEC item. Based on the results of soil sample associated with the MEC find, the 4740 Quebec Street property included spot removal of soil based on trinitrotoluene (TNT) contamination (USACE, 2011a).

1.3.2 Conceptual Site Model

Conceptual Site Models (CSMs) present the pathway analysis that identifies all complete, potentially complete, or incomplete pathways for both current and reasonably anticipated future land uses for a site. Each pathway must include a source, a receptor, and interaction between them (access and activity). Sources are those areas where MEC have entered the site. A receptor is an organism (human or ecological) that contacts the source. Interaction describes access and activities that facilitate receptors coming into contact with a source.

The primary release mechanisms resulting in the occurrence of MEC are related to the type of military munition activity. Releases may result from the improper functioning of the military munition, or military munitions may be lost, abandoned, or buried, resulting in unfired munitions. In addition, the munitions may possibly be spread beyond the immediate vicinity by the detonation (“kickouts”), or incomplete combustion or low/high order detonation failure can leave uncombusted explosives. In some cases, excess, obsolete, or unserviceable munitions may have been buried near the testing areas as discarded military munitions (DMM).

The MEC CSM for the SVFUDS is based on the historical AUES activities, where munitions were ballistically and statically fired. The SVFUDS Range Fan was developed based on ballistically fired testing activities of 3-inch and 4-inch Stokes Mortars and Livens projectiles. Static firing, the remote firing of fixed or stationary munitions, was also conducted (at the SVFUDS, this primarily involved 75mm munitions). The investigations of the sources of munitions for the SVFUDS were focused around the past activities most likely to result in MEC, specifically:

- Ballistically Fired Testing (e.g., Range Fan);

- Statically Fired Testing (e.g., Circular Trenches); and
- Disposal or Burial (e.g., area of interest [AOI] 13).

Ballistic firing can result in MEC in impact areas or buffers around these areas, while static firing often produces kick-out. DMM are often associated with static fire areas where these munitions are buried near the test site. All of these can result in MEC being present in the subsurface. All but burial pits can result in MEC at the surface.

Figure 2 indicates that all three of the Pilot Study properties are considered areas of focus for response actions because they lie within the AOI 13 possible disposal area. AOI 13 is one of two areas of the SVFUDS identified as 'possible' disposal areas based on the findings of various investigations. These are considered 'possible' disposal areas based on a weight of evidence assessment, but it is not certain that they contain buried munitions. Note that Figure 2 shows munitions-related finds from the previous investigations and not from this Pilot Study.

1.3.3 Current Site Status

The RI Report, characterizing the nature and extent of contamination, was finalized in June 2015 (USACE, 2015). The *Site-Wide Feasibility Study* (FS), evaluating alternatives to address remaining risks or hazards, was finalized in January 2016 (USACE, 2016a). Figure 2 indicates the areas of active response action necessary to mitigate explosive hazards, as identified through the FS, and the three residential properties involved in the Study. The *Site-Wide Proposed Plan* was finalized in June 2016, and the *Site-Wide Decision Document* (DD), formalizing the selection of the recommended alternative, is in the process of being finalized.

The RI Report concluded that, with regard to explosive hazards, the unknowns associated with the locations identified as possible disposal areas, and the moderate potential explosive hazard conditions they represent, suggest that follow-on actions may be required to mitigate unacceptable explosive hazards that could exist in these areas.

The RAOs to mitigate these unacceptable explosive hazards, as initially presented in the FS and slightly modified through the PP and DD process, are:

- Reduce the potential for encountering MEC in the identified focus areas of potential explosive hazards by investigating and removing subsurface anomalies that are most likely military munitions, to the depth of detection of the technology and procedures used.

- Reduce the probability of residents, workers, and visitors handling MEC encountered during residential or construction activities conducted within the SVFUDS, through education and awareness initiatives (in addition to the focus areas, these initiatives will also be applied to all areas of the SVFUDS to address the possibility that MEC could be relocated to, or less likely, found there).

Based on the FS's detailed analysis of explosive hazards remedial alternatives for the areas of focus, DGM Accessible Areas, Remove Selected Anomalies, was the preferred remedial alternative to achieve the RAOs. This alternative was selected as the preferred alternative through the PP/DD process. The Pilot Study is intended to further evaluate the implementation and effectiveness of AGC Technology as part of this alternative.

1.3.4 Stakeholder Involvement

The project stakeholders include, but are not limited to, USACE; the District of Columbia Department of Energy & Environment (DOEE); the U.S. Environmental Protection Agency (USEPA) Regional office (Region III); and the Pilot Study property residents. CEHNC provides additional oversight for activities involving CWM.

1.4 Report Organization

This Pilot Study Report is organized into sections as follows:

- Section 1.0 is an introduction and background section.
- Section 2.0 discusses site logistics and field procedures. It describes the significant preparation activities required, including what was set up and how the demonstrators used it.
- Sections 3.0 and 4.0 describe the Dynamic and Cued AGC surveys, respectively, including data processing procedures and results.
- Section 5.0 provides the intrusive investigation details.
- Section 6.0 discusses the AGC survey final classification results.
- Section 7.0 provides a comparative analysis of the AGC methodologies
- Section 8.0 presents Study conclusions and recommendations.

The report also contains seven appendices, as follows:

- Appendix A presents all relevant figures.
  Tables and Exhibits are contained within the test, but all large scale figures presenting data results are contained in Appendix A. The figures are organized into a series of 9 maps per property, representing the sequence of the phases of work. They are sequential for a given property so that all phases can be followed on consecutive maps. That is,
    - *Figures 3 through 11 show the results of different phases for the 4720 property.*
    - *Figures 12 through 20 show the results for the 4733 property.*
    - *Figures 21 through 29 show the results for the 4740 property.*

- Appendix B presents IVS and Blind Seed Memoranda.
- Appendix C presents verification documentation including Quality Control (QC), Three-phase Control (TPC) checklists, and SUXOS Daily reports.
- Appendix D presents Non-conformance Reports and Recommended Corrective Actions.
- Appendix E presents field dig sheets.
- Appendix F presents a series of target lists generated by different phases of the Study.
- Appendix G presents a photolog.

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2.0 SITE LOGISTICS AND FIELD WORK PROCEDURES

This section discusses the field work procedures, including site set-up and preparation, the results of the geophysical system verification (initial instrument testing and prove-out), and DGM data collection methods used at the Pilot Study properties.

2.1 Community Outreach

Prior to start of work in the neighborhood, ERT provided support to the SVFUDS Community Outreach Team to work with and notify property owners of all aspects of the Pilot Study schedule from the planning phase to the restoration phase. Significant coordination was involved, both with individual property owners as well as with the greater community, in order to prepare for the field effort. Individual resident support involving many meetings and telephone calls was necessary prior to, during, and after the individual work tasks described below.

2.2 Site Preparation

2.2.1 Landscape Survey/Arborist Appraisal

Prior to performing the geophysical surveys, a landscape survey to document the existing landscaping and vegetation was conducted. The flora of each property was documented and inventoried by a qualified arborist who assessed the flora of each property and provided appraised values in the event that damage and restoration was required. As part of this survey, the property's landscaping/vegetation was videotaped to document the existing pre-investigation conditions so that it could be consulted if any landscaping was destroyed requiring replacement or owner reimbursement for the loss. Following intrusive activities, a post-restoration landscape survey was conducted at each property to determine the impact to properties, to assess any damage caused, and to estimate the cost for repairs.

2.2.2 Civil Survey

Prior to commencement of the field activities, a licensed surveyor (Charles P. Johnson & Associates, Inc.) captured current site conditions including locations of buildings, structures, landscaping, and major plants at each property, and provided CAD drawings. The data obtained were of second order, Class I accuracy and referenced to the Maryland State Plane Coordinate System [North American Datum (NAD) 83].

2.2.3 Boundary Definition Study

NRL collected data on June 22, 2016 at four of the original five properties within the SVFUDS. The data collection plan was designed to evaluate the effects of the houses themselves on the EM data and to help define how close to the houses data collection could reasonably be planned. These data were additionally used to help determine what vegetation and landscaping required removal prior to the Pilot Study. The Boundary Definition Study concluded that vegetation and landscaping clearance should be conducted to within 40 cm of the houses at each property, and that EM data could be collected to within this range of each property. In some locations, the approach distance was found to be greater, such that some sections of cleared ground would be considered unsurveyable. These conclusions were used to plan the Pilot Study field effort.

2.2.4 Determination of Geophysical Survey Accessible Areas

Prior to commencement of the geophysical survey activities, a site visit, including USACE personnel, was conducted at each property on July 19, 2016, to define and document all accessible areas where the geophysical surveys could be completed. The objective was to allow reasonable access for TEMTADS and MPV equipment, with landscape removal limited to predominantly low-lying materials that could adversely affect the geophysical results.

2.2.5 Vegetation Removal

Using the information gathered during the civil survey, the landscape survey and appraisals, and the geophysical survey access site visits, the properties were prepared for geophysical activities by removing landscaping and/or other moveable objects as needed. This included mowing, cutting, removal, and/or tying back of low lying bushes and ornamental plantings, temporary re-location of ornamental objects, and temporary removal of recreational equipment.

Vegetation removal was required to improve geophysical survey coverage and to facilitate access for intrusive investigations. It was accomplished by use of hand-held tools including machetes and gasoline-powered weed eater type equipment. Removal of trees and/or bushes up to six inches in diameter was only required where low lying branches impeded geophysical instrument access around the trunk.

Valuable vegetation was addressed by either replacing the individual item in kind (in accordance with the Arborist appraisals), or removing it, transplanting it and maintaining it during the investigation, and then replanting it upon completion of the field activities.

2.3 Geophysical Equipment

Geophysical equipment used during this Pilot Study is described below.

2.3.1 MPV

The MPV is a handheld sensor with wide-band, time-domain, electromagnetic-induction (EMI) technology. The main EMI sensing elements are a transmitter coil and an array of five vector receiver units or cubes. Each 8-centimeter (cm) cube bears a set of three orthogonal air-coil receivers that measure the EMI vector field. The transmitter and receiver elements are contained in the MPV sensor head, a plastic disk enclosure with 50-cm diameter and 8.5-cm height. The circular transmitter coil is wound around the disk while the receiver cubes are distributed in a cross pattern inside the disk. For cued interrogation the sensor head is complemented with a pair of orthogonal horizontal-axis transmitter loops. These are packaged as detachable rectangular shaped units that can be placed on top of the main sensor head. Their main purpose is to provide transverse excitation of a buried object of interest while keeping the MPV sensor head at the same location. The transmitters and receivers are connected to a compact data acquisition system mounted on a backpack and to a field tablet that controls the acquisition and helps monitor data quality. The MPV sensor head is carried with a telescopic handling boom that retracts and detaches for storage. The opposite end of the boom holds the positioning units: the Attitude and Heading Reference System sensor, the global positioning system (GPS) antenna or robotic total station (RTS) retroreflector, and a data conditioning box. Photographs of the MPV can be seen in Appendix G.

2.3.2 TEMTADS

The TEMTADS is an advanced electromagnetic induction sensor designed for the detection and classification of buried metal objects. The sensor consists of four sensor elements arranged on 40-centimeter (cm) centers in a 2x2 array. Each sensor element consists of a 35-cm square transmit coil for target illumination with an 8-cm three-axis receiver cube centered in the transmit coil. The transmitters are energized in sequence and the decay curve is recoded up to 25 milliseconds after the transmitters are turned off for each of the 12 (4 cubes with 3 axes each) receiver channels. A schematic of the sensor coil configuration is shown on Exhibit 2.1. The TEMTADS orientation is measured using a six-degree-of-freedom Inertial Measurement Unit (IMU).

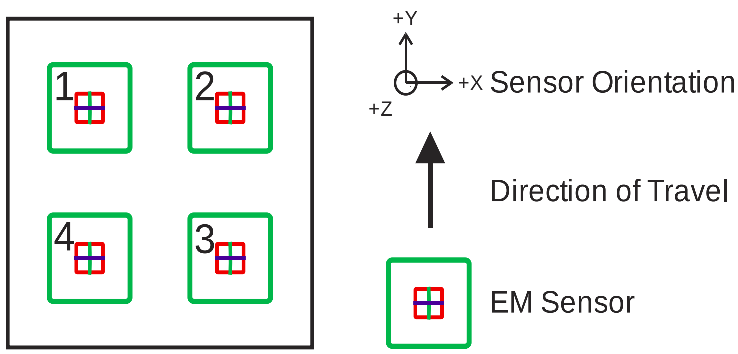


Exhibit 2.1. Orientation of the Four TEMTADS Sensor Elements

2.3.3 Robotic Total Station

A Trimble S7 RTS was utilized for the majority of the Pilot Study data collection. A Leica 1200 RTS was used for most cued target reacquisition and all final target reacquisition. Both models include a total station laser rangefinder ("gun") and a retroreflecting prism supplemented with LED lights for enhanced tracking abilities. Laser distancing between the gun and the prism is used to provide centimeter level accuracy. Establishing the RTS location and verifying the setup of the RTS requires a minimum of three known control points within line of sight of the setup location.

2.3.4 Real Time Kinematic Global Positioning System

Real Time Kinematic Global Positioning System (RTK GPS) relies on a constellation of satellites to obtain positional information in real time. A Trimble R10 RTK GPS was utilized for some of the data collection. Real-time corrections were obtained through a cellular based subscription using a T-Mobile sim card. A Topcon HiperGa system was used for some of the cued target reacquisition, with the base station set up on control points. The RTK GPS provides centimeter level accuracy.

2.3.5 EM61-MK2A

An EM61-MK2A (EM61) was also used during the Pilot Study (it had been previously used during the 2007 – 2009 geophysical survey activities). As described in Section 1.1, the EM61 is not an AGC instrument, but was used in this Study in areas not previously accessible to provide supplemental data to support submittal of assurance letters to property owners that verify remediation is complete

The EM61-MK2A, manufactured by Geonics Ltd., is a time-domain electromagnetic device consisting of a computer, data logger (Juniper Systems Allegro CX), and cart assembly towed on wheels. This instrument measures the response of the immediate area to a primary pulsed electromagnetic (EM) field, generated in the lower copper coil. The device records EM data in units of millivolts (mV) in four channels, or time gates, corresponding to four durations after an EM pulse. The device was integrated with the Leica 1200 RTS for navigation.

2.3.6 Schonstedt GA-52Cx Magnetometer

This magnetic locator is a hand-held gradiometer that detects the magnetic field of a ferromagnetic object. It responds to the difference in the magnetic field between two sensors spaced about 0.5 m apart. The response is a change in the frequency of the signal emitted by the piezoelectric speaker. The locator can be oriented in any direction without producing a significant change in the frequency of the tone from its idling frequency. The GA-52Cx was used by qualified UXO personnel for intrusive clearance.

2.3.7 White's DFX-300 metal detector

The White's DFX-300 is an electromagnetic metal detector capable of operating at multiple frequencies. It can detect ferrous as well as non-ferrous metals. Although most ordnance found at the SVFUDS to date has been primarily ferrous metal, the DFX-300 was included in the Study for anomaly resolution procedures because the AGC sensors are electromagnetic and detect both ferrous and non-ferrous metal.

2.4 Geodetic System Selection

The geodetic system historically used for the SVFUDS, over many years of project work, is the Maryland State Plane, NAD83, with units of U.S. Survey Feet. However, the AGC systems used during this Pilot Study require use of UTM coordinates (Zone 18 North), with units of meters. Both systems were used during the course of fieldwork and both are included in project geodatabases. The use of these multiple systems, and the conversion between them, was readily accomplished without issue.

2.5 Geophysical System Verification (GSV)

2.5.1 Background

The guidance document *Geophysical System Verification (GSV): A Physics-Based Alternative to Geophysical Prove-Outs for Munitions Response*, (July 2009, 2015) was followed to construct an instrument verification strip (IVS) and complete the blind seeding program.

The IVS component of GSV consists of installation of a line of munitions surrogates buried in the shallow subsurface at known locations. The munitions surrogates used in this project were inert munitions and industry standard objects (ISOs), which are welded steel pipes of standard sizes, and conform to specifications listed in Table 2-1 of the GSV guidance document. After burial, the ISOs are referred to as "seeds." An anomaly-free "noise line" is placed next to the line of ISOs. Geophysical sensors are used to collect dynamic or static data on the seed line and the noise line twice daily to document that the instrument produces a repeatable response with accurate positioning throughout the duration of the project.

The other component of GSV is a blind seeding program. Blind seeds are inert munitions or ISOs placed in the subsurface at the Study properties at locations unknown to the geophysical data collectors and data processors. Detection of blind seeds by the demonstrators is a key component of quality control in this project.

At the project kick-off meeting on May 24, 2016, USACE gave permission to extract inert munitions items from the existing Geophysical Prove Out (GPO) grids on the Federal property (USACE SVFUDS headquarters), and to install a new IVS there. The GPO was constructed in approximately 2004 and contained dozens of items buried in the subsurface. Items included both metallic and non-metallic objects, and both inert ordnance items and non-ordnance such as rebar and pipe. Many items were extracted from the GPO in July-August, 2016, and used as IVS items and blind seeds on the Study properties. The procedures for completion of the GSV program were submitted in separate Memoranda for the IVS and for the Blind Seed Program; these are presented in Appendix B.

2.5.2 Instrument Verification Strip Construction

Following removal of items from the GPO, a background survey was conducted with the TEMTADS instrument. A subset of anomalies mapped by the TEMTADS were reacquired and dug, and other metallic debris was removed. The IVS was installed on 1 August 2016. A summary of the IVS is shown in Table 2-1.

Table 2-1: IVS Summary

Seed ID	Description	UTM Zone 18, NAD83, meters		MD State Plane, NAD83, US Survey Feet		Diameter (cm)	Depth to center (cm)
		Easting	Northing	Easting	Northing		
1	Inert Stokes Mortar, Horizontal, small diameter end points south	317469.999	4311986.730	1282183.98	462959.89	7.5	29.5
2	Inert 75mm projectile, Horizontal, nose to south	317470.213	4311982.371	1282184.99	462945.61	7.5	36.1
3	Medium ISO, Horizontal, Cross track	317470.161	4311977.887	1282185.15	462930.90	5.08	13.5

Table 2-1: IVS Summary							
Seed ID	Description	UTM Zone 18, NAD83, meters		MD State Plane, NAD83, US Survey Feet		Diameter (cm)	Depth to center (cm)
		Easting	Northing	Easting	Northing		
4	Small ISO, Horizontal, Along track	317470.006	4311973.248	1282184.97	462915.67	2.54	28.0

The UFP-QAPP called for a "background" location (with no seed buried) in line with the IVS seeds. However, the TEMTADS established and verified a background location to the west of the IVS area prior to conducting the background survey, and this was subsequently used by both demonstrators. The background location was selected by NRL and a 5-point static background verification test was run, based on a suspected clean area within the former GPO grid.

Note that the smallest Target of Interest (TOI), based on the munitions related items confirmed or suspected to exist in the SVFUDS study area, was determined to be a booster/fuze from a 75mm MkIV Booster at 1 foot below ground surface (bgs). For the IVS, seed item #4 (Table 2-1), the small ISO, was used to designate the smallest TOI. At the time of the background survey, an inert MkIV Booster was not available, so the small ISO was used to define the minimum response.

Photographs of the items prior to burial are shown in Appendix G, photos 1 to 4. The completed IVS is shown in photo 5.

After installation of the IVS, the TEMTADS team returned to the site and collected dynamic data on the seed line and the noise line using the TEMTADS integrated with both the RTK GPS and the RTS. Cued measurements were also collected over each seed. The results of TEMTADS testing at the IVS are documented in *Initial Dynamic and Static Instrument Verification Strip (IVS) Technical Memorandum* presented in Appendix B. This memorandum also presents the results of the background survey.

The MPV team collected dynamic data on the seed line using the MPV integrated with both the RTK GPS and the RTS. Cued measurements were also collected over each seed. The results of MPV testing at the IVS are documented in *Initial Dynamic and Static Instrument Verification Strip Technical Memorandum*, presented in Appendix B.

The ERT team collected dynamic data on the seed line and noise line using the EM61-MK2A integrated with the RTS. The results of testing at the IVS are documented in the memorandum presented in Appendix B.

All demonstrators collected data daily at the IVS, in the morning prior to production work, and in the afternoon after production work.

2.5.3 Blind Seeding Program

Blind seeds were installed at 4733 Woodway Lane and at 4740 Quebec Street on August 9, 2016, and blind seeds were installed at 4720 Quebec Street on August 10, 2016. Both inert munitions and ISOs were used at each of the properties. The UFP-QAPP called for installation of up to 5 seeds at each property. Installation is documented in the memorandum *Blind Seed Installation*, also presented in Appendix B. A summary of the blind seeds is shown in Table 2-2.

Table 2-2: Blind Seed Summary

Property	Seed Number	Description	MD State Plane, NAD83, US Survey Feet		Depth to Top (cm)
			Easting	Northing	
4733 Woodway	7	Inert 75 mm	1285625.24	462787.93	21.3
	8	Inert Stokes Mortar	1285550.97	462764.08	34.7
	9	small ISO	1285601.60	462851.46	26.5
	10	small ISO (stainless steel*)	1285599.99	462780.07	18.9
	11	medium ISO	1285559.97	462791.41	46.3
4720 Quebec	12	Inert 75 mm	1285723.77	462843.80	18.9
	13	Inert Stokes Mortar	1285698.92	462863.79	39.6
	14	small ISO	1285687.83	462949.68	4.5
	15	Inert M353 projectile	1285641.91	462871.95	23.8
	16	large ISO	1285758.22	462920.62	77.7
4740 Quebec	17	Inert 75 mm	1285520.91	462898.40	57.6
	18	Inert 75 mm projectile part	1285501.23	462902.74	18.9
	19	small ISO	1285514.27	462920.20	18.9
	20	medium ISO	1285505.65	462916.60	23.4

* - note that stainless steel properties are not the same as welded steel.

2.6 Geophysical Data Collection

2.6.1 IVS

Initial testing was performed at the IVS prior to collecting dynamic data at the three Pilot Study properties. The primary objectives of the initial IVS testing were to:

- Verify correct assembly and basic functionality of the MPV and TEMTADS sensors,
- Confirm that the measurement quality objectives (MQO) and measurement performance criteria (MPC) in the UFP-QAPP are appropriate and achievable, and
- Demonstrate dynamic location repeatability over the IVS items.

A summary of each AGC system's initial IVS activities are provided below, with further detail provided in the IVS Technical Memoranda in Appendix B.

2.6.1.1 Instrument Assembly

Proper assembly of each instrument in accordance with Standard Operating Procedures (SOPs) 2 and 3 (contained in the UFP-QAPP) was verified during the initial IVS activities.

2.6.1.2 Function Tests – General

Sensor-specific function tests were performed to confirm that all geodetic, inertial and electromagnetic transmitters and receivers were operating as expected. This was achieved by recording the instrument response to a known calibration item, and then comparing the data to a reference measurement. The reference measurement represents data acquired of the calibration item when the instrument was already established to have been operating properly. For both AGC systems, the instrument functionality was verified and applicable MQOs were achieved prior to collecting initial IVS data.

2.6.1.3 Function Tests – MPV

The MPV function tests consist of acquiring a static measurement with a Schedule 80 small ISO in the middle of the horizontal transmitter coils, and performing a spin test. Both tests were performed at least twice per day, as follows:

- The small ISO is oriented vertically and stands on the x-component coil on top of the center cube. To improve the repeatability of the ISO placement, a circle drawn on the coil indicates where the small ISO should be placed. A background measurement is acquired such that the instrument and background response can be subtracted from the function test data. The MQO for the function test is that the background subtracted response is within 20% of a reference measurement. The data must then be post processed to confirm that the MQO is achieved.
- The spin test is designed to verify proper operation of the GPS or RTS and IMU, as well as the correct integration of their respective data streams. If the GPS and IMU function properly (e.g. no bias in the IMU data stream) and the sensor geometry is correctly defined in sensor definition files, the center cube of the MPV should exhibit a limited range of motion when the MPV is rotated about the center of the sensor head. The spin test consists of doing a full 360 degree rotation of the MPV head, with the center of the MPV head in the same location. To minimize lateral movement of the sensor head, the sensor head is placed in jig during the rotation. Dynamic data are recorded during the rotation. If the MPV position on the field display appears to remain within a tight circle, then the positioning sensors are deemed to be operating correctly. The spin test was done at the beginning and end of each day.

2.6.1.4 Function Tests – TEMTADS

The TEMTADS function tests consist of acquiring a static measurement with a Schedule 80 small ISO in the middle of the transmit coils and verifying the IMU is correctly oriented. The first is performed at least twice daily and the second is only performed after assembly.

- In order to verify the functionality of the TEMTADS, a known reference response for the small ISO is required. After collecting a background reading, a vertical small ISO is placed in the hole on the top of the sensor housing and a static reading is collected. The MQO for the TEMTADS function test is: response (mean static spike minus mean static background) within 25% of predicted response for all monostatic Tx/Rx combinations.
- The IMU orientation is verified by rotating the sensor around various axes and ensuring that the data acquisition system records the correct sign (e.g. positive or negative) in

accordance with the SOP. Once the orientation has been confirmed, this test is not needed unless the system must be disassembled and reassembled.

2.6.1.5 Initial Dynamic IVS Data Collection

Each AGC system acquired dynamic data with both RTK GPS and RTS positioning systems. The purpose of dynamic data collection at the IVS is to confirm that the system is effectively detecting and accurately positioning targets for subsurface metallic items. Ropes and/or flags were used to guide the operators down and back over the IVS items. For both AGC systems, all targets were successfully detected and accurately positioned.

The amplitudes and offsets for each item are summarized in Tables 2-3 and 2-4. The targets selected from the TEMTADS data were consistently more accurate than those of the MPV. This may have been due to additional error introduced in the offset calculation for the distance and direction of the GPS/RTS prism relative to the center of the MPV sensor head.

Table 2-3: Initial IVS Results of MPV and TEMTADS with RTK GPS

IVS ITEM	Description	MPV (RTK GPS)		TEMTADS (RTK GPS)	
		Location Offset (m)	Amplitude (mV/A)*	Location Offset (m)	Amplitude (mV/A)**
IVS-01	Stokes Mortar	0.143422	21.717	0.122	36.8
IVS-02	75mm	0.117886	14.299	0.092	11.0
IVS-03	Medium ISO	0.086833	147.65	0.096	57.8
IVS-04	Small ISO	0.309472	4.031	0.199	4.1

Table 2-4: Initial IVS Results of MPV and TEMTADS with RTS

IVS ITEM	Description	MPV (RTS)		TEMTADS (RTS)	
		Location Offset (m)	Amplitude (mV/A)*	Location Offset (m)	Amplitude (mV/A)**
IVS-01	Stokes Mortar	0.248	26.250	0.105	34.7
IVS-02	75mm	0.131	14.337	0.092	12.4
IVS-03	Medium ISO	0.151	99.566	0.096	78.1
IVS-04	Small ISO	0.293	8.561	0.199	4.2

* Composite channel 0.31 to 0.79 milliseconds (ms)

** Time gate 0.137 ms

2.6.1.6 Background Noise Analysis

Electromagnetic background noise is typically analyzed to develop amplitude thresholds for target selection. Causes of background noise include, but are not limited to, utilities, terrain induced noise, radio frequencies, and standard noise in the electronic hardware. When the target selection threshold (the instrument response level at which an item of interest is identified) is set too close to the background noise level, the frequency of false positives increases. The standard rule is to set the target selection threshold at three to five times the standard deviation of the background response. Analysis of the dynamic IVS background line showed that both systems experienced relatively high noise levels at the IVS. The average noise for each system on the channel selected for target selection was as follows:

- MPV: 0.41 mV/A for the 0.45 ms time gate and 0.30 mV/A for the composite channel of 0.31 – 0.79 ms
- TEMTADS: 0.34 mV/A for the 0.137 ms time gate

These system specific channels presented the highest signal to noise (SNR) and were therefore used for target selection. The IVS noise was not as high or irregular as what was observed at the individual Pilot Study properties. Site specific noise is discussed further in Section 3.4. Incidentally, it is noted that the data collected using the RTS consistently produced higher noise levels.

2.6.1.7 Dynamic Target Selection Threshold

Target selection threshold is the instrument response level at which an item of interest is identified. The initial target selection threshold for each system was initially defined as follows:

- MPV: 1.19 mV/A for the composite channel of 0.31 – 0.79 ms
- TEMTADS: 1.69 mV/A for the 0.137 ms time gate

The 1.69mV/A threshold was selected because it corresponded to the response of a small ISO at a depth of 35cm (approximately 13.8 inches, which is slightly deeper and thus more conservative than the project objective of 1ft (12 inches) bgs.

When comparing the two AGC systems, it is not appropriate to rely on a direct comparison of the amplitudes recorded by the two systems because different time gates were used for target selection. A more accurate comparison is to evaluate the SNR for each system's defined selection threshold. Each demonstrator based their target selection threshold on the response curve for a small ISO at 1 foot bgs, as this was determined to be the best representation of the smallest TOI, a MarkIV Booster at the required depth of detection. The response curves for each system are shown in Exhibits 2.2 and 2.3. The TEMTADS was able to detect a small ISO using a threshold equal to 5 times the IVS background noise. Note that the MPV threshold at the properties had to be set to 4.3 and 2.8 times the background noise for RTK and RTS data, respectively.

Based on this analysis of IVS data, the TEMTADS data provided a higher SNR and is therefore more likely to detect the smallest target of interest at depth.

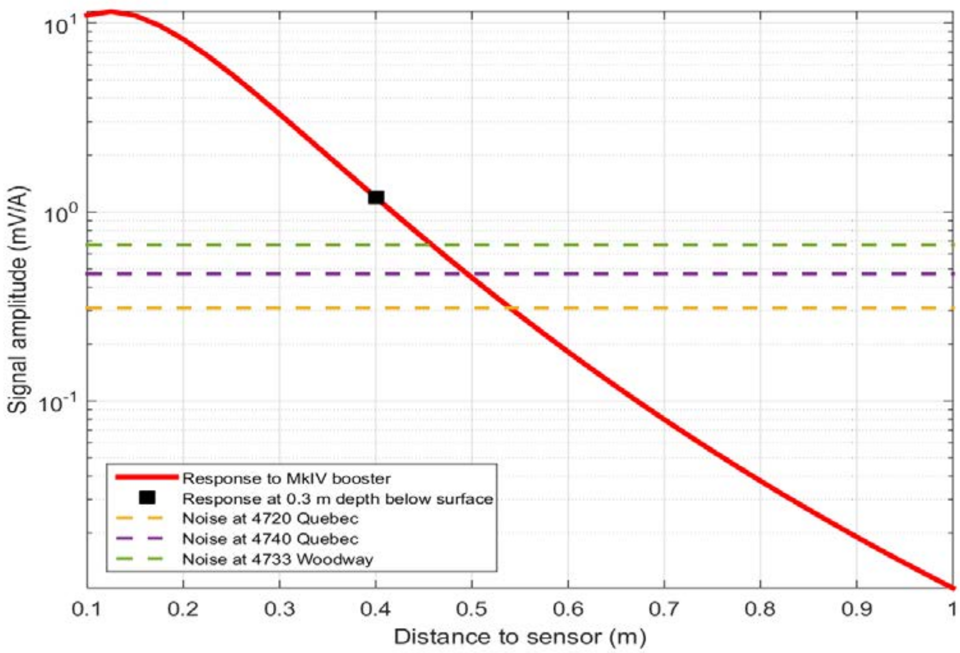


Exhibit 2.2. MPV Response Curve (at Properties)

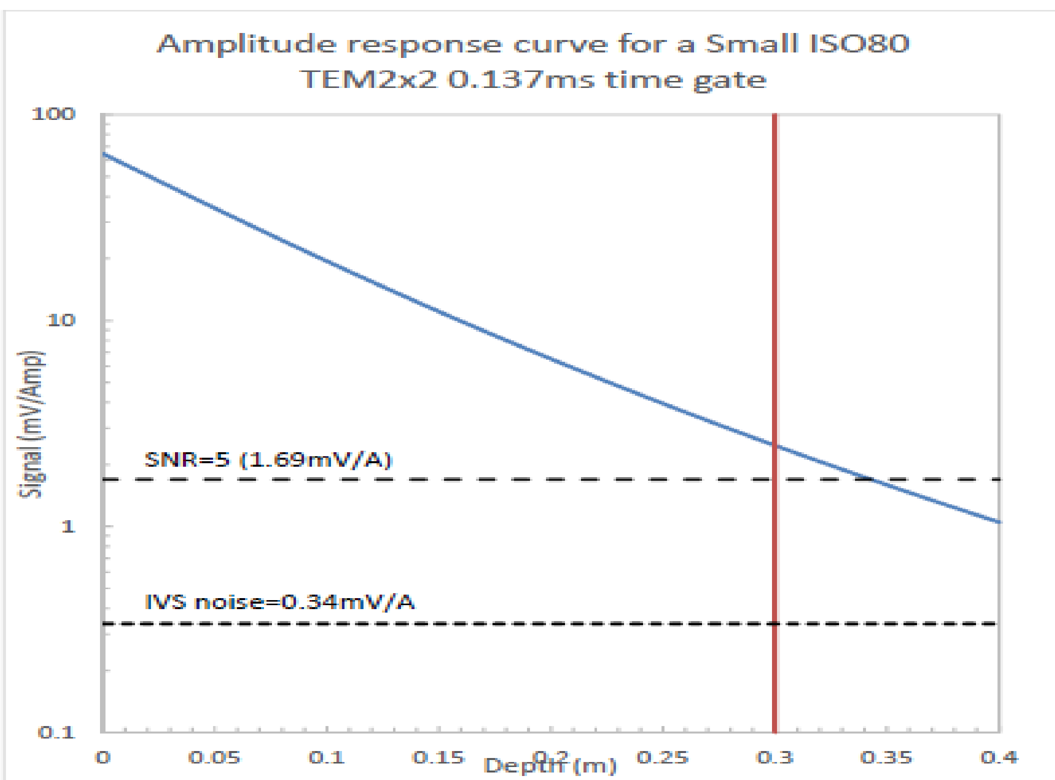


Exhibit 2.3. TEMTADS Response Curve (at IVS)

2.6.1.8 Dynamic Source Selection

Dynamic source selection is inverting the dynamic data to identify dipole sources rather than selecting targets based on amplitude threshold. It was utilized for selecting targets from the dynamic MPV data, unlike TEMTADS data which used the threshold discussed in the previous section. This process involves first identifying targets that meet the amplitude selection threshold and then inverting the data within a specified distance of the selected target to estimate additional parameters such as size and depth of the item. Additional thresholds for size and decay of the polarizabilities were defined for the MPV data and were incorporated into the initial target selection process. These thresholds were based on the derived polarizabilities of the small ISO at 30 cm depth (approximately 1 ft bgs). Note that this process had to be modified as part of the corrective action for Non-conformance Report (NCR) 002 and is discussed further in Section 3.7.2.

2.6.1.9 Initial Cued IVS Data Collection

Cued data was also collected with both the RTK GPS and RTS positioning systems. Each AGC sensor was positioned over each IVS item and static data was collected. The inverted source parameters for each AGC system are provided in Tables 2-5 to 2-8.

Polarizability curves were recovered for all IVS targets; however neither system consistently achieved the MQO for derived polarizability accuracy for the IVS-04 item. The acceptance criteria for this MQO is that the library match metric must be greater than or equal to 0.9 for each set of inverted polarizabilities. The root cause of the failure for both systems was that due to the site noise and the presence of additional metal in the vicinity, the data did not match the reference library at the required level. As a result, the IVS-04 item was removed from the daily IVS requirement. It should be noted that although the MQO was not achieved, the matches were sufficient to be classified as a TOI. Therefore, the IVS confirmed that the Data Quality Objective (DQO) to detect and correctly classify an item the size of a small ISO at a depth of 1 ft bgs was achievable.

Table 2-5: TEMTADS IVS results using RTK GPS and Single Source Solver								
IVS Item	**Seed Description**	**UTM Easting (m)**	**UTM Northing (m)**	**Depth (m)**	**Location offset (m)**	**Depth offset (m)**	**Fit coherence**	**Library match metric**
IVS-01	Stokes Mortar	317470.086	4311986.759	0.312	0.091	-0.017	0.9985	0.9443
IVS-02	75mm	317470.282	4311982.377	0.393	0.070	-0.032	0.9988	0.9592
IVS-03	Medium ISO	317470.222	4311977.826	0.176	0.087	-0.041	0.9995	0.9799
IVS-04	Small ISO	317470.104	4311973.193	0.274	0.112	0.006	0.9503	0.8324

Table 2-6: TEMTADS IVS results using RTS and Single Source Solver								
IVS Item	**Seed Description**	**UTM Easting (m)**	**UTM Northing (m)**	**Location offset (m)**	**Depth (m)**	**Depth offset (m)**	**Fit coherence**	**Library match metric**
IVS-01	Stokes Mortar	317470.105	4311986.790	0.121	0.312	-0.018	0.9984	0.9440
IVS-02	75mm	317470.306	4311982.390	0.095	0.390	-0.029	0.9984	0.9537
IVS-03	Medium ISO	317470.221	4311977.822	0.089	0.176	-0.041	0.9995	0.9782
IVS-04	Small ISO	317470.105	4311973.183	0.118	0.252	0.028	0.9482	0.8450

Table 2-7: MPV IVS results using RTK GPS							
IVS ID	**Seed Description**	**UTM Easting (m)**	**UTM Northing (m)**	**Location offset (m)**	**Depth (m)**	**Depth offset (m)**	**Library match metric**
IVS-01	Stokes Mortar	317470.00	4311986.72	0.01	0.338	0.049	0.996
IVS-02	75mm	317470.18	4311982.31	0.07	0.438	0.078	0.957
IVS-03	Medium ISO	317470.14	4311977.78	0.11	0.167	0.028	0.989
IVS-04	Small ISO	317470.95	4311973.17	0.10	0.309	0.029	0.937

Table 2-8: MPV IVS results using RTS							
IVS ID	**Seed Description**	**UTM Easting (m)**	**UTM Northing (m)**	**Location offset (m)**	**Depth (m)**	**Depth offset (m)**	**Library match metric**
IVS-01	Stokes Mortar	317470.00	4311986.80	0.07	0.339	0.049	0.989
IVS-02	75mm	317470.21	4311982.29	0.08	0.428	0.068	0.988
IVS-03	Medium ISO	317470.12	4311977.84	0.06	0.159	0.019	0.99
IVS-04	Small ISO	317470.98	4311973.20	0.06	0.305	0.025	0.843

In summary, the two AGC systems produced consistent results for the inversion of the IVS items. The depth estimate was slightly more accurate for the TEMTADS because the standoff height is fixed, while the MPV height is variable and must be estimated. The Library (repository of geophysical response data for munitions items) Match Metrics appear to be higher for the MPV; however, the MPV metric is based on a solution more similar to the multi-source solution for the TEMTADS (which was not provided in the TEMTADS demonstrator's IVS Memorandum for all IVS items).

2.6.1.10 Daily IVS Procedures

Demonstrators collected IVS data twice daily during field operations. Cued and/or dynamic surveys at the IVS were performed to be consistent with the day's field work. If no dynamic data was collected during the day, only a cued data survey at the IVS was required and vice versa. Additionally, any positioning system utilized during the day was required to be demonstrated at the IVS. So, for days when both RTS and RTK GPS were used, both systems were demonstrated at the IVS. All daily IVS MQOs were achieved.

2.6.2 AGC Geophysical Data Acquisition

Demonstrators collected data at the three Pilot Study properties in accordance with the approved UFP-QAPP and SOPs. Both cued and dynamic data collection took approximately two days per property, as shown in Table 2-9. This is approximately twice as long as was initially planned. The field procedures as well as a qualitative assessment for each system are discussed below.

Table 2-9: DGM Survey Durations

Property	Days for TEMTADS Dynamic	Days for MPV Dynamic	Days for TEMTADS Cued	Days for MPV Cued
4720 Quebec	2	3	2	2
4733 Woodway	2	2	2	2
4740 Quebec	1	1	2	1
Total	**5**	**6**	**6**	**5**

2.6.2.1 Dynamic Data Collection

Dynamic data was collected to achieve 100% coverage of accessible areas on each property.

The contoured dynamic and anomalies detected for the TEMTADS for the 4720, 4733, and 4740 properties are shown in Figures 3, 12, and 21, respectively. The contoured dynamic and anomalies detected for the MPV are shown in Figures 4, 13, and 22.

As expected, coverage percentage for the smaller, more maneuverable MPV was significantly higher than that of the TEMTADS (see Table 2-10). The MPV design is advantageous for fitting in tight spaces, and under and around vegetation. The MPV operator can maneuver the instrument to maintain lock with the RTS gun while collecting data in difficult locations. This is especially advantageous for dealing with low lying branches and larger bushes and shrubs. The largest difference in coverage was seen at the 4740 Quebec property, where the MPV was able to maneuver around restricted access associated with sensitive plants in the front yard; the TEMTADS was not able to collect data in these areas without harming the plants.

Table 2-10: Percent Coverage – Dynamic Survey

Property	TEMTADS Dynamic (sq ft)	MPV Dynamic (sq ft)
4720 Quebec	2,421	3,404
4733 Woodway	1,993	2,500
4740 Quebec	1,485	2,278

Following processing of dynamic data as described in detail in Section 3.0, and generation of a synthesized cued target list for each property, the cued surveys began.

2.6.2.2 Cued Data Collection

Based on the dynamic data, targets synthesized from MPV, TEMTADS, and the previous EM61 data, were selected for cued data collection with each AGC system, using the cued target list generation process described in Sections 3.8 and 4.0.

The cued locations were reacquired using wooden golf tees with flagging to mark the locations. This flagging method was considered to be low profile as was used to accommodate the property owner. However, the flags were less visible to the teams and were sometimes disturbed by the property owner, requiring reacquisition and causing unwarranted delays during the cued investigation phase.

One advantage of the MPV was the ability to actively reacquire targets, meaning that the MPV software allowed the user to see a real-time map showing the cued target locations relative to the sensor location. This was very helpful for identifying missing flags. The TEMTADS software was not designed to have this ability, and this meant that for the TEMTADS, if a flag was missing, it would not have been identified until the data were processed in the office.

Both systems have the ability to perform real-time single source inversions in the field. This allows the operator to see the estimated location of the metallic object beneath the sensor. If the estimated location was too far from the center of the sensor, the operator moved the sensor to the estimated location and collected additional data. The MPV would commonly repeat this process multiple times to ensure that adequate data were acquired, however the TEMTADS would typically only collect one additional data point to maximize efficiency in the field. It was very common for the estimated location to be influenced by underground utilities and/or surface or subsurface metal. In these cases the field teams typically opted not to recollect additional data and recorded a field note to document the observation.

As with the dynamic data, the MPV was able to collect more cued data than the TEMTADS, the smaller sensor size and increased maneuverability allowing the MPV to acquire data in locations where the TEMTADS was not able to access. The cued target totals for each property are detailed in Section 3.8 and shown in Table 3-9.

2.6.2.3 Field Efficiency Issues

Due to the different operating procedures for each AGC sensor, the field efficiencies for collecting dynamic data were varied. When considering the two systems, independent of the positioning system used, the TEMTADS typically provided a more efficient method for collecting data with a smaller field team. The TEMTADS utilizes real-time physical guidance for maintaining line spacing and can be accomplished with two or three personnel. To maintain the required line spacing, one person pushes the cart and one person follows behind moving bean bags with a grabber to mark the path for the return line. The bean bag mover can also operate the data acquisition tablet, or a third individual can be used for this purpose. In general, only one technically competent person is required for TEMTADS operation.

The MPV operation can also be accomplished with two personnel, however, as with TEMTADS, a third individual is advantageous for taking notes. Some efficiency is lost when collecting dynamic MPV due to the necessity to lay out lanes using ropes and/or flags prior to starting data collection. This can easily be done with two people, but it will take approximately 10-30 minutes depending on the size of the area to be mapped. Due to the small size of the sensor head and the way in which the MPV is carried, the bean bag method is not sufficient for maintaining the required line spacing for the system. Additionally, a tighter line spacing is required for the MVP to account for the smaller sensor footprint. This also increases the amount of time needed for dynamic MPV data collection.

While subtle differences in the mapping procedures for the two systems affect the field efficiency, the type of geodetic system utilized can have a far greater influence. Utilizing the RTK GPS (with a cell phone correction system) rather than the RTS, is by far the most efficient for areas where corrections can be received. RTK GPS using a cell based correction service is the most efficient method as long as cellular service is available at the site. This option eliminates the need for a base station and only requires that the user confirm that corrections are being received.

During the demonstration, the MPV team commonly had to drive away from the property to obtain cell corrections, but once initial corrections were received, they continued to stream at the site. A traditional RTK GPS (using a base station) would provide the second most efficient option, but could potentially require multiple base station setups per day depending on the relative location of the IVS and the property to be mapped. If this option is used it would be necessary to utilize a control point on an adjacent property so that the base station does not generate a data gap.

The RTS is the least efficient geodetic option. It requires multiple set-ups per property and necessitates the installation of numerous control points. An efficient field team should be able to set up the RTS and perform a resection or back sight in approximately 15 minutes. Considering that this process is likely to happen at least four times per day (morning IVS, front yard, back yard, and PM-end of day, IVS), a minimum of 1 hour is spent performing this task.

Based on site conditions, the majority of the Pilot Study acreage was not suitable for maintaining fixed positions with the RTK GPS. As a result, the RTS was utilized for the majority of the dynamic data collection at the three Pilot Study properties. Despite having a clear sky view for the majority of the 4733 Woodway property, the RTK GPS was only able to receive corrections for part of the front yard. MPV also utilized GPS positioning for the majority of the front yard at 4720 Quebec, however data gaps were created under trees due to loss of satellite reception. Depending on the location of these data gaps, and how they relate to other data gaps on the property, they can be very time consuming to collect after the fact because they may require multiple RTS set-ups. On average, four to six RTS set-ups were needed to provide 100% coverage of each property and additional set-ups were required for collecting data gaps identified in the original data set. Based on observations made during dynamic data collection, roughly two hours were spent each day tearing down and setting up the RTS gun.

2.6.2.4 Equipment Durability and Technical Issues

Both systems experienced minor technical issues in the field that ultimately caused a delay in field work. The TEMTADS computer was prone to overheating and required that ice packs be attached to the CPU to aid in cooling the system. This issue delayed field work on several occasions and in one instance prevented the field team from collecting the afternoon IVS. This issue has been identified on other TEMTADS systems, but it is not clear if it would be likely to present itself on all systems; the commercially available TEMTADS equivalent (MetalMapper2x2) can reportedly operate at higher temperatures than experienced during the

Study. Additionally, on few occasions, the TEMTADS tablet had difficulty connecting to the computer via Wi-Fi, causing additional delays. This could be prevented by hardwiring the tablet to the computer or improving the wireless connection.

Another delay for the MPV was encountered when the CPU batteries were completely drained, causing the computer to shut down. When this happened the operator could not reboot the computer without connecting it to an external keyboard. This could be prevented by having a keyboard readily available and/or implementing a better battery monitoring system. Other factors affecting durability include weather resistance and availability of spare parts/systems. At this time, neither system is waterproof, so field activities would be limited to fair weather. Spare parts/systems are more available for the TEMTADS.

It should be noted that both systems used for this Pilot Study were developed in house, by each respective demonstrator, and neither are commercially available at this time.

2.6.2.5 Field Activities Verification and Validation

The QC Geophysicist was present for the duration of the field activities. Daily Geophysical Quality Control Reports (DGQCRs) and Three Phase Inspection checklists were used to document that the field activities were performed in accordance with the approved UFP-QAPP. These are provided in Appendix C. Additionally, a USACE QA Geophysicist was on site for the majority of the field activities. No Non-Conformance Reports directly related to field activities were issued during this project.

2.6.3 Supplemental EM61-MK2A Surveys

Following all dynamic and cued surveys with both AGC instruments, a survey of the Pilot Study properties using the EM61-MK2A was conducted by ERT. This was performed for two reasons:

- To demonstrate that the blind seeds are within the detection range of an instrument (a reaction to the failure of the MPV and TEMTADS to detect all blind seeds during the dynamic surveys), and
- To collect data in areas that were inaccessible to the EM61-MK2A during the previous investigations in 2007-2009 (significantly more vegetation removal was completed in preparation for the Pilot Study AGC surveys).

The EM61-MK2A was used on the IVS on September 19, 2016, as documented in the memorandum in Appendix B. The device was then used to perform dynamic surveys over all blind seeds (although the locations were not blind to ERT operators and the seed locations were specifically targeted for coverage) as well as areas not previously covered. Targets within areas not previously covered, and which were not detected by the MPV or TEMTADS, were added to the final dig sheets for intrusive investigation.

The EM61-MK2A contoured dynamic data showing anomalies detected, for the 4720, 4733, and 4740 properties, are shown in Figures 5, 14, and 23, respectively.

3.0 DYNAMIC SURVEY DATA QUALITY

The MPV dynamic data collected in the field were processed and analyzed by the BTG team. The TEMTADS dynamic data collected in the field were processed and analyzed by the NRL team. A summary of each demonstrator's data processing procedures and Dynamic Data MQOs are detailed below.

3.1 MPV

Data processing for the MPV data was performed using UXOLab, software that was developed by BTG. Initial processing steps included normalizing to the transmitter current, positioning the data, correcting for instrument latency and removing background noise (i.e., leveling the data). The dynamic target selection process for the MPV evolved throughout the Study, due to observations made regarding the dynamic data.

Initially, BTG selected all targets that exceeded the threshold defined in the IVS Memorandum (1.2mV/A) for the composite of the Z-component response for time gates 0.31 to 0.79 ms. Using the Z-component response amplitude as a detection metric is essentially the same as using a Geonics EM61 response amplitude detection. This process alone, however, produced an extremely large target population greater than 5 times that for the TEMTADS. The extreme number of targets was likely due to a combination of many factors. For one, the MPV is situated much closer to the ground during dynamic data collection which can increase the number of small anomalies that meet the target selection threshold and can also increase the effect of underground utility noise. Additionally, BTG selected targets on profiles rather than on a grid of the data. Although the profile picks were merged, selecting targets using this method typically results in high target counts.

In order to reduce the MPV target list to a more reasonable number, a two-stage process was developed to eliminate targets that were not representative of the site specific TOI. First, the detection algorithm selected anomalies where the amplitude exceeded the detection threshold defined in the IVS Memorandum. Second, the data surrounding each anomaly were inverted using models with 1, 2 or 3 objects to determine whether there could a dipole source equal to or greater than the size of the MkIV Booster (smallest TOI) at or near the selected anomalies. The inversion results and models were then processed similar to the routine used for cued data. Data that did not fit dipole models very well were eliminated from the list. The remaining models were classified according to the estimated size and, initially, decay of the polarizability curves. The decay threshold was ultimately eliminated based on the root cause analysis for NCR002 (see Section 3.7.2). Sources where the size exceeded 0.6 were retained, as well as anomalies where no reliable model was available, similar to a "cannot analyze" category. Source locations were merged to provide the final dynamic target list.

3.2 TEMTADS

Data processing for the TEMTADS data was performed using Geosoft Oasis montaj, a commercially available software package. As with the MPV data, the initial processing steps included normalizing to the transmitter current, positioning the data, correcting for instrument latency, and removing background noise (i.e., leveling the data). After initial corrections, the Z-Component for time gate 0.137 ms was gridded and targets were selected based almost entirely on signal response amplitude.

The Geosoft automatic grid peak detection algorithm was used to extract locations of all grid peaks in the gridded data that were above the project detection threshold, 1.6mV/A. These target anomaly locations were reviewed by the project geophysicist and manual additions and deletions were made to the list. In many instances several targets were removed from the list, because the target selection threshold was within the site noise levels. Additionally, areas of saturated response, typically due to reinforced concrete or underground utilities, were identified, but not selected for cued interrogation.

3.3 Dynamic Data Measurement Quality Objectives

The dynamic data MQOs and the completion status are presented in Table 3-1.

Table 3-1: Dynamic Data MQOs

Measurement Quality Objective	Frequency	Acceptance Criteria	Status
Verify correct assembly	Once following assembly	Instrument is correctly assembled	Achieved for both TEMTADS and MPV. Documented on Initial TPC Checklist.
Initial sensor function test (instrument response amplitudes)	Once following assembly	Response (mean static spike minus mean static background) within 25% of predicted response for all monostatic transmit/receive (Tx/Rx) combinations	Achieved for both TEMTADS and MPV. Documented on Initial TPC Checklist and IVS Report.
Initial dynamic positioning accuracy (IVS)	Once prior to start of dynamic data acquisition	Derived positions of IVS target(s) are within 25 cm of the ground truth locations	Achieved for both TEMTADS and MPV. Documented in the IVS Report.
Ongoing instrument function test (instrument response amplitudes)	Beginning and end of each day and each time instrument is turned on	Response (mean static spike minus mean static background) within 25% of standard response for all monostatic Tx/Rx combinations	Achieved for both TEMTADS and MPV. Documented in DGQCRs, TPC Checklists and Demonstrator Data.
Ongoing dynamic positioning precision (IVS)	Beginning and end of each day	Derived positions of IVS target(s) within 25 cm of the average locations	Achieved* for both TEMTADS and MPV. Documented in DGQCRs, TPC Checklists and Demonstrator Data.
In-line measurement spacing	Verified for each DU using the Oasis montaj UX-Detect Sample Separation Tool based on monostatic Z coil data positions	100% ≤ 0.20m between successive measurements	Achieved for both TEMTADS and MPV. Documented in Demonstrator Data.
Coverage	Verified for each DU using Oasis montaj UX-Detect Footprint	100% at ≤ 0.5m cross-track measurement spacing (excluding site-specific	Achieved for both TEMTADS and MPV. Documented in

Table 3-1: Dynamic Data MQOs			
Measurement Quality Objective	**Frequency**	**Acceptance Criteria**	**Status**
	Coverage Tool based on monostatic Z coil data	access limitations, e.g., obstacles, unsafe terrain)	Demonstrator Data.
Sensor Tx current	Per measurement	Current must be ≥5.5A (TEMTADs), ≥3.5A (MPV)	Achieved for both TEMTADS and MPV. Documented in Demonstrator Data.
Dynamic detection performance	Evaluated by Property	All blind QC seeds must be detected and positioned within 40 cm radius of ground truth	Not achieved. See NCR Summaries in Section 3.7.
Valid orientation data	Per measurement	Orientation data reviewed and appear reasonable within bounds appropriate to site	Achieved for both TEMTADS and MPV. Documented in Demonstrator Data.

*TEMTADS did not successfully complete the PM (end of day) IVS on August 15, 2016, due to the system overheating. MPV did not successfully complete the PM IVS on September 7, 2016, due to inclement weather. In both instances the AM (start of day) IVS and regular sensor function tests were used to validate the data.

3.4 Effect of Site Noise

Both the MPV and TEMTADS data suggested a large variability in background conditions between and within each property, both geographically and temporally. At 4720 Quebec, the background noise levels ranged from an amplitude of approximately 0.17 mV/A to 0.96mV/A. At 4740 Quebec, they ranged from 0.23 mV/A to 0.79 mV/A. The house at 4733 Woodway was the noisiest ranging from 0.29 mV/A to 3.52 mV/A. The minimum and maximum noise levels observed by each demonstrator are detailed in the Table 3-2.

Table 3-2: Site Noise Levels										
	MPV					**TEMTADS**				
Property	**Min Noise**	**Max Noise**	**Target Selection Threshold**	**Max SNR**	**Min SNR**	**Min Noise**	**Max Noise**	**Target Selection Threshold**	**Max SNR**	**Min SNR**
4720 Quebec	0.17	0.28	1.20	7.06	4.29	0.28	0.96	1.60	5.71	1.67
4733 Woodway	0.29	0.67	1.20	4.14	1.79	1.00	3.52	1.60	1.60	0.45
4740 Quebec	0.23	0.42	1.20	5.22	2.86	0.24	0.79	1.60	6.67	2.03

In general, at the properties, the SNR for the MPV was greater than that for the TEMTADS. Demonstrators also observed noise levels changing temporally. For instance, in one case the TEMTADS team collected acceptable data at a background location early in the day, but when they returned to the same location later that day, the noise was much higher and the data were not acceptable for use as a background.

The principal consequence of higher noise levels is a reduction in the depth of detection and classification of TOI. At the SVFUDS, both small and large TOI are expected to be at depths near the maximum detection range for available industry standard EMI instruments, and therefore is it critical to manage the effect of site noise.

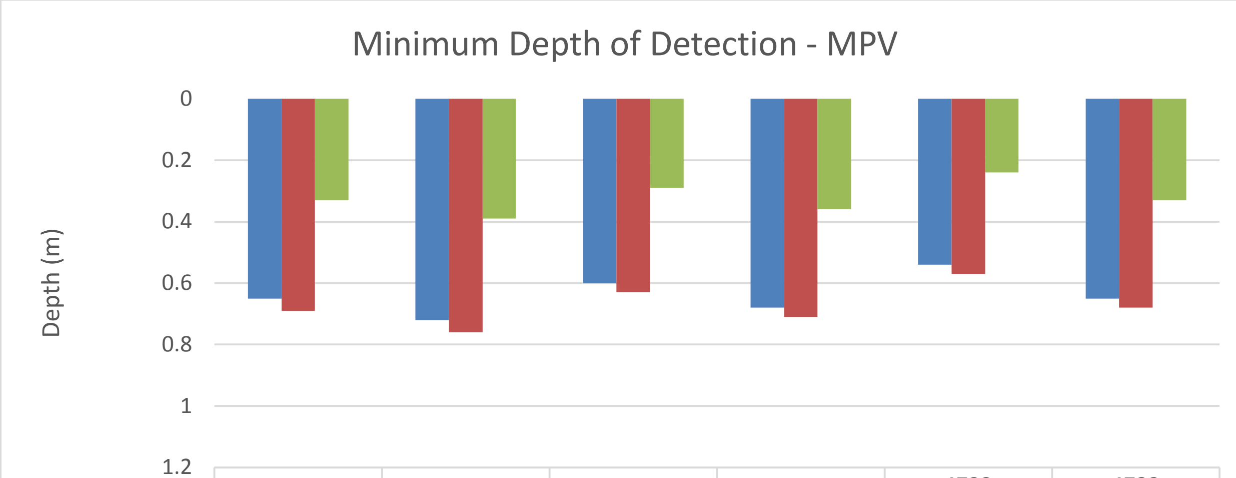
The exact source of the background noise at the Pilot Study properties could not be determined. However, it is likely related, in part, to the large radio tower on the AU campus, to the south east of the properties. The 4733 Woodway property is slightly closer to this tower and also presented the highest noise levels. Other observed sources of noise included underground and above-ground utilities, and HVAC units. Due to the broad range and density of noise sources at these properties it would be very difficult, if not impossible, to eliminate or substantially reduce the noise levels. Consequently, the best chance of increasing the depth of detection is to try to eliminate noise during data processing. Due to time restraints for this Study, the demonstrators were not able to implement any advanced processing techniques that would help to reduce the effect of site noise. However, the TEMTADS team proposed a potential solution in response to NCR002. Because the TEMTADS has two sets of receiver coils that practically follow the same path, it is possible to isolate site noise by subtracting the result of one coil from the other at each coincident location. This process would allow for noise to be filtered more effectively and would result in an increase in the SNR and depth of detection. For future AGC work at the SVFUDS, time and effort should be allotted to perform the processing steps necessary to maximize the depth of detection.

3.5 Depth of Detection

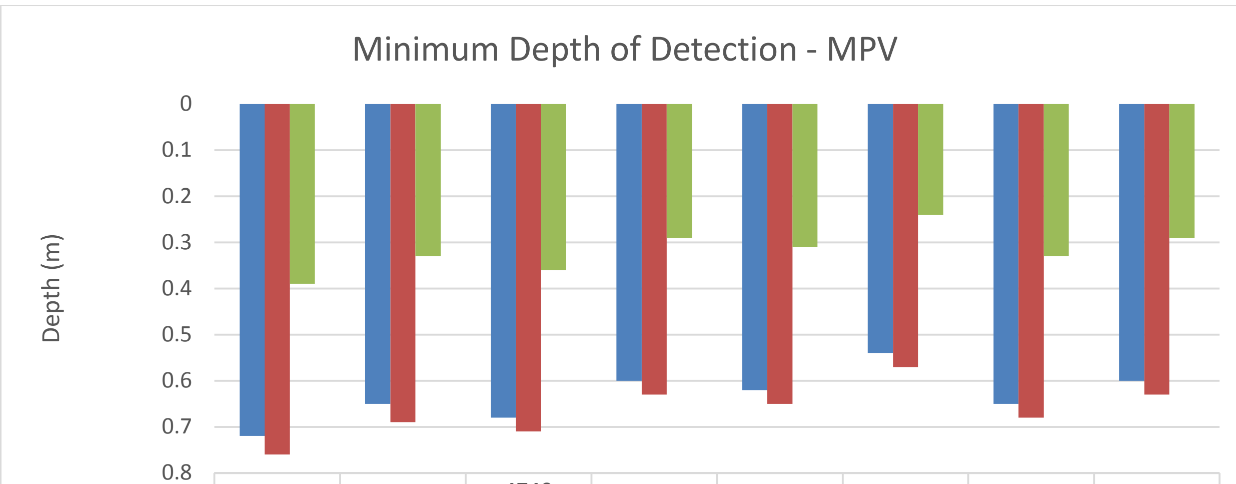
The depth of detection of small and large TOI is predominantly dependent on site-specific noise levels. As discussed in the previous discussions, the site noise for the three Pilot Study properties was variable. Each demonstrator used test stand and physics based models to estimate the minimum depth of detection for the following expected SVFUDS-specific TOI:

- 3” Stokes Mortar
- Livens Projectile
- MkIV Booster (from 75mm)

Modeled and test stand data provided the expected response for each item situated in the least favorable orientation and located at the maximum expected horizontal offset. For the MPV, this offset was ½ the project defined line spacing and for TEMTADS this was in the center of the array. Additionally, the EM61 data collected on each property during the previous investigations were reviewed to determine what level of noise was present in that data. As an example, the noise ranged from approximately 2.5 mV to 3.5 mV at 4720 Quebec. These thresholds were used to determine detection limits using physics based models ("EM61-MK2 Response of Standard Munitions Items, "NRL/MR/6110--08-9155, October 2008). It should be noted that there is no EM61 physics-based model or test stand data available for the Livens Projectile, so a large ISO was used to represent a Livens. Furthermore, the G-858 (also used during the previous investigations) depth of detection is not considered here because physics-based models and/or test stand data are not available. The results for each system are presented in the Exhibits below.

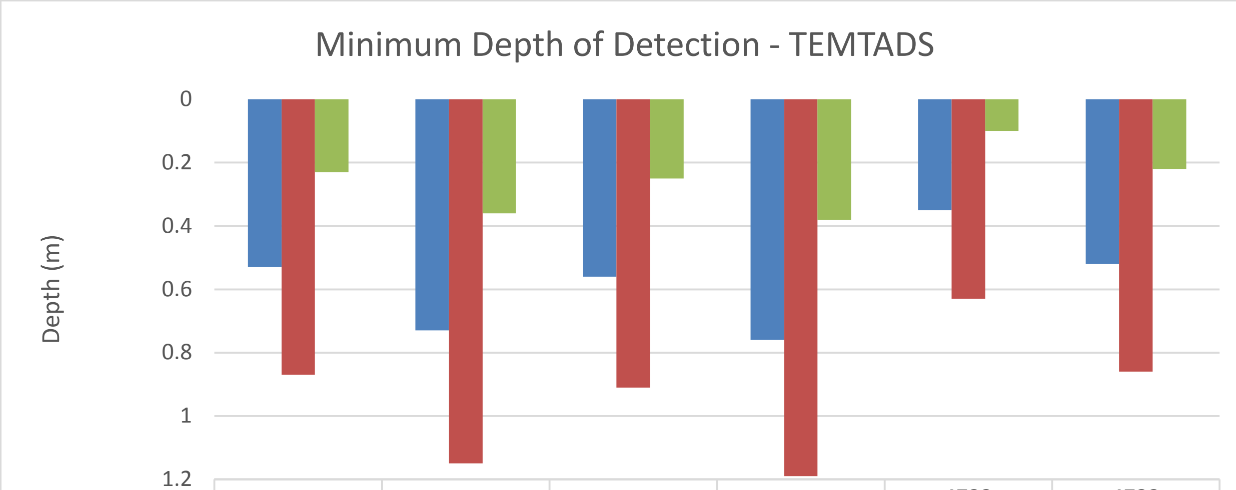


	4720 Quebec Max Noise	4720 Quebec Min Noise	4740 Quebec Max Noise	4740 Quebec Min Noise	4733 Woodway Max Noise	4733 Woodway Min Noise
Stokes	0.65	0.72	0.6	0.68	0.54	0.65
Livens	0.69	0.76	0.63	0.71	0.57	0.68
MKIV Booster	0.33	0.39	0.29	0.36	0.24	0.33



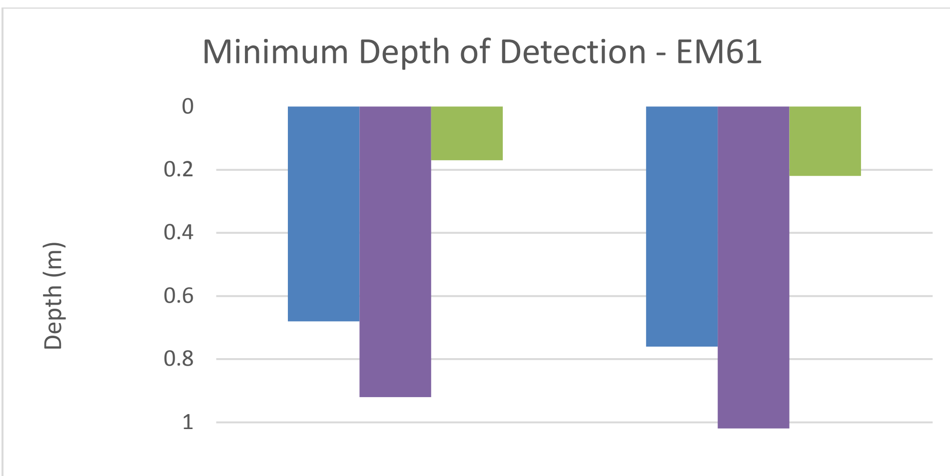
	4720 Quebec front yard	4720 Quebec back yard	4740 Quebec front and east	4740 Quebec back	4733 Woodway front	4733 Woodway east	4733 Woodway back	4733 Woodway west
Stokes	0.72	0.65	0.68	0.6	0.62	0.54	0.65	0.6
Livens	0.76	0.69	0.71	0.63	0.65	0.57	0.68	0.63
MKIV Booster	0.39	0.33	0.36	0.29	0.31	0.24	0.33	0.29

Exhibit 3.1. MPV-Minimum Depth of Detection



	4720 Quebec Max Noise	4720 Quebec Min Noise	4740 Quebec Max Noise	4740 Quebec Min Noise	4733 Woodway Max Noise	4733 Woodway Min Noise
Stokes	0.53	0.73	0.56	0.76	0.35	0.52
Livens	0.87	1.15	0.91	1.19	0.63	0.86
MKIV Booster	0.23	0.36	0.25	0.38	0.1	0.22

Exhibit 3.2. TEMTADS-Minimum Depth of Detection



	Chan 2, High Noise	Chan 2, Low Noise
Stokes	0.68	0.76
Large ISO	0.92	1.02
MKIV Booster	0.17	0.22

Exhibit 3.3. EM61-Minimum Depth of Detection

For each system, the minimum depth of detection is based on 3 times the measured minimum and maximum noise levels as detailed in Table 3-3 below. This represents the depths that these targets could have been detected in this study, however, targets were not selected below the minimum target selection thresholds as defined in Section 3 (1.2mV/A for the MPV and 1.6mV/A for the TEMTADS).

Table 3-3: Percent Coverage – Dynamic Survey

Property	TEMTADS (mV/A)	3x TT	MPV (mV/A)	3x MPV
4720 Quebec Max Noise	0.96	2.88	0.28	0.84
4720 Quebec Min Noise	0.28	0.84	0.17	0.51
4740 Quebec Max Noise	0.79	2.37	0.42	1.26
4740 Quebec Min Noise	0.24	0.72	0.23	0.69
4733 Woodway Max Noise	3.52	10.56	0.67	2.01
4733 Woodway Min Noise	1	3	0.29	0.87

Conclusions based on the data displayed in Exhibits 3.1 through 3.3 above include the following:

- MPV has the greatest depth of detection for small items similar in size to the MkIV Booster.
- TEMTADS has the greatest depth of detection for large items similar in size to the Livens Projectile; however, note that no EM61 response curve was available for a Livens and a large ISO is significantly smaller than a Livens.
- All sensors have a comparable depth of detection for medium items similar in size to a 3” Stokes Mortar.

Note that if advanced processing techniques performed on any dataset resulted in noise reduction, the depth of detection would be increased.

3.6 Target Selection Accuracy

3.6.1 <u>Blind Verification Seed Detection</u>

During the dynamic data collection phase, the blind seeds provide the best measure of target selection accuracy. The offsets for blind seeds are shown in Table 3-4 and Exhibit 3.4. Overall, the MPV detected more seeds than the TEMTADS. The undetected seeds are discussed in Section 3.7. Of note when considering the offsets presented below, is that the MPV performed an extra processing step as described in Section 2.6.1.8. This step should technically increase the accuracy of the target location, and this appears to be the case for the 4720 Quebec and 4733 Woodway properties. However, for 4740 Quebec, the MPV offsets are generally larger than those for the TEMTADS. This seems to be attributed to improved accuracy of TEMTADS targets, rather than diminished accuracy of the MPV targets.

In summary, the MPV detected more seeds and the target selection process for MPV also resulted in greater accuracy of the seed location. However, if this extra advanced processing step was performed on the TEMTADS data it is likely that the accuracy of selected targets would increase as well.

Table 3-4: Dynamic Target Selection Accuracy for Blind Seeds

Property	Blind Seed #	Blind Seed Description	Seed Easting	Seed Northing	MPV Target Easting	MPV Target Northing	MPV Target Offset (m)	TT Target Easting	TT Target Northing	TT Target Offset (m)
4720 Quebec	12	75 mm, Horz.	318547.95	4311927.67	318547.96	4311927.71	0.03	318548.02	4311927.84	0.17
	13	Stokes Mortar, Horz.	318540.52	4311933.93	318540.53	4311934.02	0.08	318540.70	4311933.90	0.19
	14	Small ISO (w.s.) , Horz.	318537.71	4311960.18	318537.60	4311960.25	0.13	318537.70	4311960.30	0.12
	15	M353 TPT projectile, Horz.	318523.20	4311936.80	318523.21	4311936.83	0.03	318523.20	4311936.70	0.10
	16	Large ISO, Horz.	318558.97	4311950.85	NA	NA	NA	NA	NA	NA
4733 Woodway	7	75 mm, Vert.	462787.93	1285625.24	318517.51	4311911.18	0.13	NA	NA	NA
	8	Stokes Mortar, Horz.	462764.08	1285550.97	318494.79	4311904.52	0.03	318494.60	4311904.50	0.17
	9	Small ISO (w.s.), Horz.	462851.46	1285601.60	318510.74	4311930.82	0.04	NA	NA	NA
	10	Small ISO (s.s.), Vert.	462780.07	1285599.99	NA	NA	NA	NA	NA	NA
	11	Medium ISO, Horz.	462791.41	1285559.97	NA	NA	NA	NA	NA	NA
4740 Quebec	17	75 mm, Horz.	462898.40	1285520.91	318486.41	4311945.94	0.28	NA	NA	NA
	18	75 mm proj. part, 45 Deg.	462902.74	1285501.23	318480.56	4311947.20	0.08	318480.50	4311947.10	0.04
	19	Ssmall ISO (w.s.), Horz.	462920.20	1285514.27	NA	NA	NA	318484.40	4311952.50	0.26
	20	Medium ISO, Horz.	462916.60	1285505.65	318481.99	4311951.37	0.05	318482.00	4311951.30	0.03

Coordinates are in NAD83 UTM Zone 18N meters. NA is Not Applicable (NA results discussed in Sections 3.7 and 6.5).

Exhibit 3.4: Blind Seed Offsets

EM61-MK2A data were collected over the blind seeds as described in Section 2.6.3. The offsets for the targets selected from this data are presented in Table 3-5 and Exhibit 3.4. In general the EM61 offsets are greater than those for the MPV and TEMTADS.

Table 3-5: EM61-MK2A Blind Seed Offsets

Property	Blind Seed #	Blind Seed Description	Seed Easting	Seed Northing	EM61 Target Easting	EM61 Target Northing	EM61 Target Offset (m)
4720 Quebec	12	75 mm, Horz.	318547.95	4311927.67	318517.3	4311911.2	0.26
	13	Stokes Mortar, Horz.	318540.52	4311933.93	318494.3	4311904.5	0.45
	14	Small ISO, Horz.	318537.71	4311960.18	318510.2	4311930.9	0.57
	15	M353 TPT projectile, Horz.	318523.20	4311936.80	318509.9	4311908.9	0.14
	16	Large ISO, Horz.	318558.97	4311950.85	318497.1	4311912.7	0.61
4733 Woodway	7	75 mm, Vert.	318517.55	4311911.31	318547.9	4311927.7	0.10
	8	Stokes Mortar, Horz.	318494.76	4311904.54	318540.4	4311933.8	0.16
	9	Small ISO, Horz.	318510.78	4311930.83	318537.5	4311960.6	0.47
	10	Small ISO, Vert.	318509.81	4311909.08	318523.2	4311936.7	0.14
	11	Medium ISO, Horz.	318497.69	4311912.80	318558.4	4311950.8	0.52
4740 Quebec	17	75 mm, Horz.	318486.50	4311945.67	318486.6	4311945.7	0.11
	18	75 mm proj. part, 45 Deg.	318480.53	4311947.12	318480.5	4311947.2	0.11
	19	Small ISO, Horz.	318484.62	4311952.36	318484.4	4311952.3	0.24
	20	Medium ISO, Horz.	318481.97	4311951.32	318481.9	4311951.4	0.13

All blind seeds are inert items.

3.6.2 TOI Detection

One non-seeded TOI (3-inch Stokes Mortar, ultimately determined to be MD, a practice item) was discovered on the 4720 Quebec property (target #129). A post analysis of the dynamic targets selected at the location of this 3-inch Stokes Mortar confirmed the target selection accuracy observed for blind seeds. Additionally, data were collected over this location during the previous investigations (2007-2009) at this site. However, at that time, while no EM61 target was selected at this location, the G-858 magnetic data did identify an anomaly, but it was classified as a Category D target (not indicative of MEC), and was not recommended for intrusive investigation. The offsets for all three datasets are shown in Table 3-6.

Table 3-6: TOI Offset

Stokes Easting	Stokes Northing	Sensor	Target Easting	Target Northing	Target Offset (m)
318555.45	4311944.84	MPV	318555	4311945	0.09
		TEMTADS	318555.2	4311945	0.28
		G-858	318555.45	4311944.84	0.54

3.7 Non Conformance Report (NCR) and Root Cause Analysis (RCA) Summary

Three NCRs were issued during the dynamic data collection phase of the Pilot Study. All NCRs were related to Dynamic Detection Performance Failures. In each instance the demonstrator(s) provided a Root Cause Analysis (RCA) and recommended Corrective Action (CA). The complete RCA/CA documents are provided in Appendix D. Summaries are provided below.

3.7.1 NCR001

Blind seed #16 was not detected by either the MPV or the TEMTADS at the 4720 Quebec property. Seed # 16 is a large ISO at 2.5 ft depth.

3.7.1.1 MPV RCA

The RCA indicated that the data collected over the blind seed were improperly leveled. Leveling is the process of removing the background response (i.e. – signal not related to the target of interest) from the data in order to isolate metallic anomalies. This occurred because the line of data was relatively short (line 297 in Exhibit 3.5 is only approximately two meters long) which resulted in a poor estimation of the background conditions that needed to be subtracted from the data. When the data are properly leveled, the seed is selected using the standard target selection procedure.

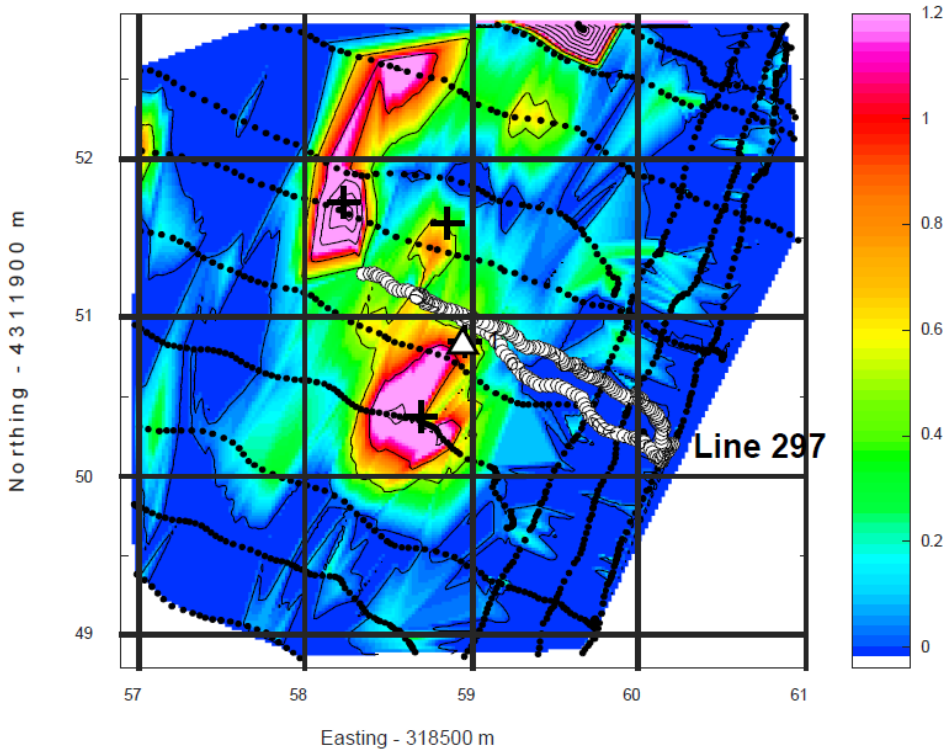


Exhibit 3.5: MPV Data in the Vicinity of Seed #16 (white triangle)

3.7.1.2 MPV CA

The following CAs were recommended by the MPV demonstrators to address the non-conformance:

- The analyst should carefully review each line to determine if negative offsets were introduced due to median filtering artifacts.
- Re-level lines with a modified filtering approach appropriate for shorter lines and lines where the standard filtering may overestimate the background response.
- Repeat the target picking procedure using the newly levelled data.

These corrective actions were implemented and resulted in five additional targets. These targets were added to the cued list and intrusively investigated.

3.7.1.3 TEMTADS RCA

The RCA indicated that while the data met the required MQO, the coverage over the seed item was not sufficient to detect the item (Exhibit 3.6). The seed is located right at the intersection of lines going in two directions and was also located beneath tree branches that interfered with the RTS line of sight. This reduced the data density over the target. The amplitude of the target was also lower than that predicted by physics-based models.

Exhibit 3.6: TEMTADS Paths Shown Relative to Seed #16 (red circle)

3.7.1.4 TEMTADS CA

The following CAs were recommended by the TEMTADS team to address the non-conformance:

- Collect additional data in areas where coverage is sparse.
- Collect cued data over the seed to determine if there are any issues with the specific seed item or location.

Additional data were collected where small data gaps were identified. Cued data were collected over the item and were classified as "Cannot Analyze". This suggests that the item was too deep for the TEMTADS to detect at this site.

3.7.1.5 Additional Considerations

This non-conformance helped to identify a flaw in the development of the DQOs. During the project planning phase, the smallest TOI and required depth of detection was identified, but no focus was given to the largest TOIs. When developing the RCA for this NCR, both demonstrators noted that the target threshold would need to be decreased in order to account for large/deep TOI. To address this issue, demonstrators collected test stand data over a Livens Projectile, one of the largest expected TOI, to determine the depth of detection.

3.7.2 <u>NCR002</u>

Blind seed #17 was not detected by the TEMTADS and seed #19 was not detected by the MPV at the 4740 Quebec property. The missed seed items were an inert 75mm projectile at 1.88 ft depth and a small ISO at 0.6 ft depth, respectively.

3.7.2.1 MPV RCA

The RCA indicated that due to the high number of targets detected above the selection threshold, MPV data processors were initially utilizing size and decay to reduce the number of targets that required cued data collection. The thresholds for size and decay were based on data collected over a small ISO and the MkIV Booster. The dipole source closest to the location of blind seed #19 did not present a decay value greater than the threshold, and therefore was removed from the final cued target list. In general the decay information is difficult to recover in noisy environments.

3.7.2.2 MPV CA

For the CA, targets were reselected for both 4720 Quebec and 4740 Quebec using only size as a discriminator. No decay threshold was implemented. This resulted in 39 additional targets at 4720 Quebec and 69 additional targets at 4740 Quebec. These targets were not cued, but were intrusively investigated.

3.7.2.3 TEMTADS RCA

The RCA indicated that the data met the MQO, but seed #17 was not detected. The physics-based model of the response of a 75mm at this depth indicates that the target should have been detected. Based on a thorough review of the data, the root cause of the failure was not determined.

3.7.2.4 TEMTADS CA

As the root cause of the failure could not be determined, the only corrective action recommended was to collect cued data over the seed to determine if there are any issues with the specific seed item or location. Cued data were collected over the item and a dipole source in the correct location was identified. This source matched a 60mm item and had a fit metric of 0.91 out of 1.0. It was classified as TOI. The fit item suggested that the item was smaller than a 75mm, however the intrusive activities confirmed that the item was an inert 75mm projectile.

3.7.3 NCR003

Table 3-7 shows the blind seeds that were not detected by the respective demonstrators at the 4733 Woodway property:

Table 3-7: Missed Blind Seeds – NCR 003

Seed #	Description	MPV	TEMTADS
7	75mm, vert, 0.7ft	Pass	Fail
9	Small ISO, horz, 0.8ft	Pass	Fail
10	Small ISO, vert, 0.6ft	Fail	Fail
11	Med ISO, horz, 1.5ft	Fail	Fail

3.7.3.1 MPV RCA/CA

Table 3-8 indicates the RCA and CAs recommended by the MPV team for NCR 003:

Table 3-8: Corrective Actions for MPV – NCR 003			
Seed #	**RCA**	**CA**	**QC Comments**
10	Stainless Steel pipe nipple does not produce the same response as the standard black steel.	This seed should be removed from the required verification seed population.	Concur
11	Seed was adjacent to high noise (underground utility) area and the response is masked by the noise.	A larger buffer should be utilized around high noise areas where we do not have a high confidence in successful detection.	Concur. High noise areas could be addressed using mag and dig methods.

3.7.3.2 TEMTADS RCA/CA

Table 3-9 indicates the RCA and CAs recommended by the TEMTADS team for NCR 003:

Table 3-9: Corrective Actions for TEMTADS – NCR 003			
Seed #	**RCA**	**CA**	**QC Comments**
7	Seed was outside of TEMTADS coverage	This seed should be removed from the required verification seed population for TEMTADS.	Concur
9	The signal to noise ratio in this area was too low to detect the seed.	Consider revising the objective depth of detection in noisy areas or perform additional processing (differencing) that will substantially increase the number of targets to be cued.	Concur. Additional analysis should be performed to better define the advantages of utilizing the differencing technique to increase signal to noise.
10	Stainless Steel pipe nipple does not produce the same response as the standard black steel.	This seed should be removed from the required verification seed population.	Concur
11	Seed was adjacent to high noise (underground utility) area and the response is masked by the noise.	A larger buffer should be utilized around high noise areas where we do not have a high confidence in successful detection.	Concur. High noise areas could be addressed using mag and dig methods.

As discussed in Section 3.4, the noise levels were highest at the 4733 Woodway property. This had a significant effect on the ability to detect targets. Other issues that contributed to missed seeds at this property included utilizing stainless steel pipe nipples rather than welded steel and placing seeds outside of the TEMTADS coverage area. It is not clear as to why the stainless-steel pipes are not detectable, however the failure was confirmed by the MPV at the IVS background location. Data were collected over a stainless-steel ISO at the surface and produced a very low amplitude response. As a result, this seed was removed from the required verification population. It is noted that stainless steel seeds should not be used in the future, in order to avoid this issue.

3.8 Dynamic Data Target Synthesis

As described in Section 2.6.2.2, cued targets were selected from dynamic TEMTADS and MPV data by the respective instrument demonstrators. Additionally, several targets remained from the previous investigations (2007-2011) for the three Pilot Study properties. These were either generated from the G-858 magnetometer surveys or the EM61 surveys done at that time.

The three target lists were synthesized to generate the Final Cued Target List (see Appendix F-1) for each property. Targets from all datasets were plotted in Geosoft Oasis montaj and the GPO tool was used to find targets within 0.3m of each other. These targets were then merged to form a single target centered between the original targets. The original target source and ID was carried through the merging process for tracking purposes. The general statistics for each dataset are detailed in Table 3-10.

Maps showing all cued targets for the 4720, 4733, and 4740 properties, are presented as Figures 6, 15, and 24, respectively.

Note, at this stage, these are targets to be cued, not intrusively investigated.

Table 3-10: Dynamic Data Target Synthesis into Cued Targets

Metric	**4720 Quebec**	**4733 Woodway**	**4740 Quebec**
Number of unique targets detected with the EM61	6	0	1
Number of unique targets detected with the G-858	10	0	0
Number of unique targets detected with the TEMTADS	50	61	74
Number of unique targets detected with the MPV	71	76	57
Number of targets detected with both the TEMTADS and MPV	28	55	15
Number of targets detected with both the TEMTADS and G-858	1	0	0
Number of targets detected with the TEMTADS, MPV, and G-858	1	0	0
Number of QC targets added	4	2	0
Total Number of Cued Targets	**171**	**194**	**147**

4.0 CUED SURVEY DATA QUALITY

The MPV cued data collected in the field was processed and analyzed by the BTG team. The TEMTADS cued data collected in the field was processed and analyzed by the NRL team. Each demonstrator's data processing procedures and cued data MQOs are detailed below.

4.1 Background Verification and Correction

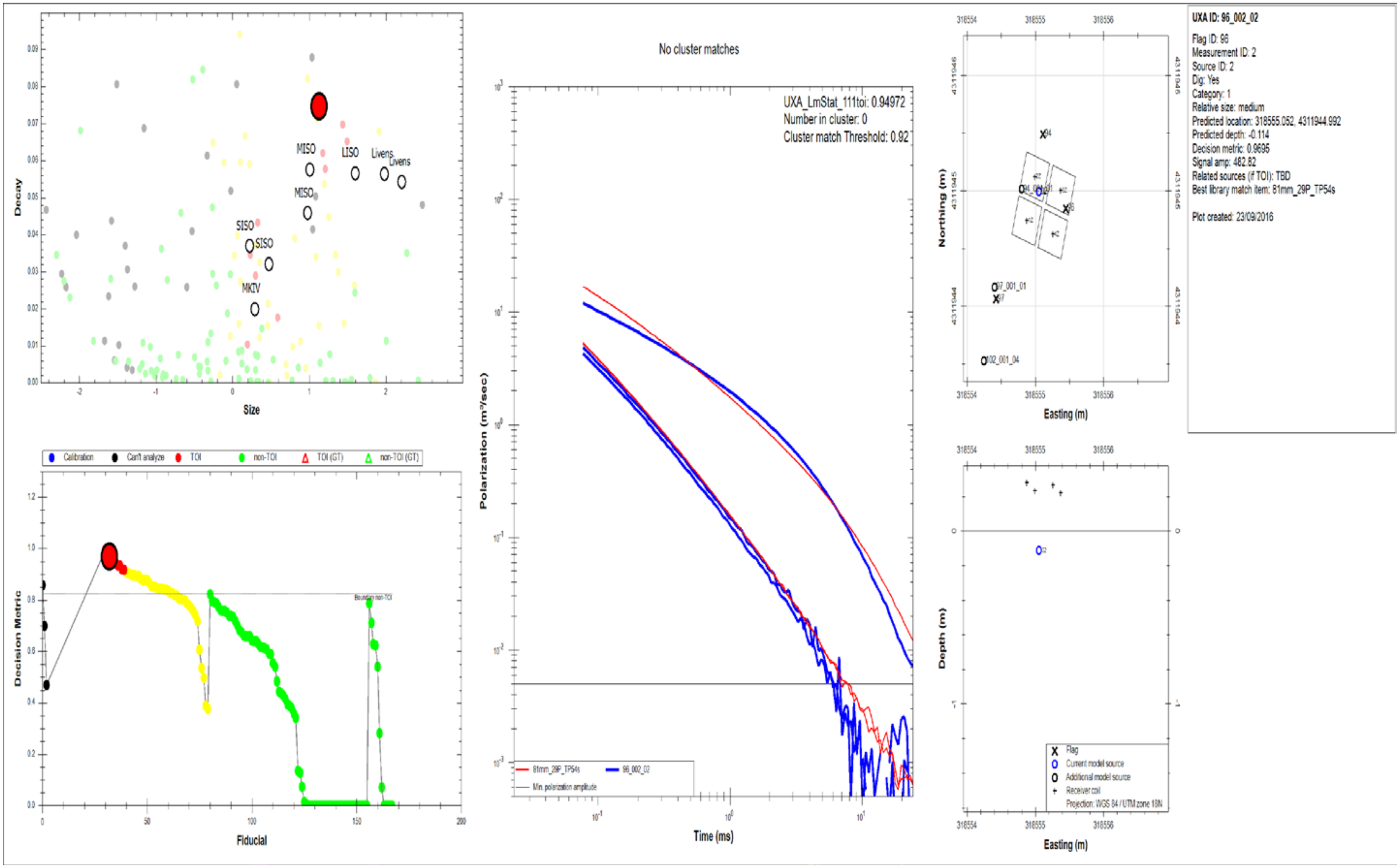
Background corrections were used to remove the instrument response (self-signature) of the MPV and TEMTADS systems and the soil response from the measured anomaly data. Background measurements were taken at locations selected from the dynamic survey data sets. Prior to utilizing these locations for background measurements, they were verified to be devoid of metal by comparing a set of five measurements taken at each selected background location: one measurement at the location and one more with the sensor offset by approximately 0.25 m in each cardinal direction. For the TEMTADS background verification data, the forward model of the most challenging target of interest/depth scenario (MkIV Booster at 12 inches bgs) was added to the center background measurement, and the background was verified by separately subtracting each of the four offset backgrounds and performing a library match to the target of interest. The background location was considered valid if the library match from all four offsets exceeded 0.9. Additionally each individual background measurement was verified as suitable prior to using it for background correction of the target measurement data. For the MPV background verification data, a synthetic seeding approach was not used, however all four offsets were confirmed to be below the project specific threshold to verify background location.

4.2 Intrinsic and Extrinsic Parameters

For both systems, cued data were inverted to estimate intrinsic and extrinsic parameters. These parameters include extrinsic parameters (location and orientation) as well as the intrinsic parameters (principal axis polarizabilities) related to the object size, shape, and composition. The intrinsic parameters [betas (β)] are used for classification. For an axial symmetric object similar to a projectile, the three betas typically present as one primary beta, having the highest amplitude, and two relatively equal, lower amplitude secondary betas.

Exhibits 4.1 and 4.2 show examples of decision plots made by each demonstrator. These plots are generated for every source, and not only show how well the polarizability curves match the library, but also provide visual representations of other extrinsic and intrinsic properties. The TEMTADS Decision Plot includes the following information:

- Top Left: Size and decay feature space. Longer decays are typically associated with thick walls, allowing the analyst to compare the size and thickness of each source with the other targets on the site, as well as site specific library items.
- Bottom Left: Visual representation of the decision metric. Relates to the classification ranking system and the likelihood that a source is a TOI.
- Center: Polarizability curves of the source (blue) compared to the best library match (red). This example matches with a metric of 0.94 out of 1.
- Top Right Figure: Shows cued flag locations and sources relative to the position of the TEMTADS sensor.
- Top Right Text: Summary of the pertinent information.
- Bottom Right: Shows the depth of the source relative to the sensors.

1


2 **Exhibit 4.1: TEMTADS Decision Plot**

The MPV Decision Plot includes the following information:

- Top Left: Summary of pertinent information
- Top Right: Shows the location of the source relative to all other Pilot Study targets.
- Bottom Left: Polarizability curves of the source (red, black, green) compared to the best library match (grey). This example matches with a metric of 0.83 out of 1.
- Bottom Center: Shows the cued flag locations and sources relative to the position of the MPV sensor (top). Shows the target depth (bottom).
- Right Middle: Size and decay feature space. Longer decays are typically associated with thick walls. This feature space allows the analyst to compare the size and thickness of each source with the other targets on the site and the best fit item.
- Lower Right: Visual representation of the decision metric. Relates to the classification ranking system and the likelihood that a source is a TOI.

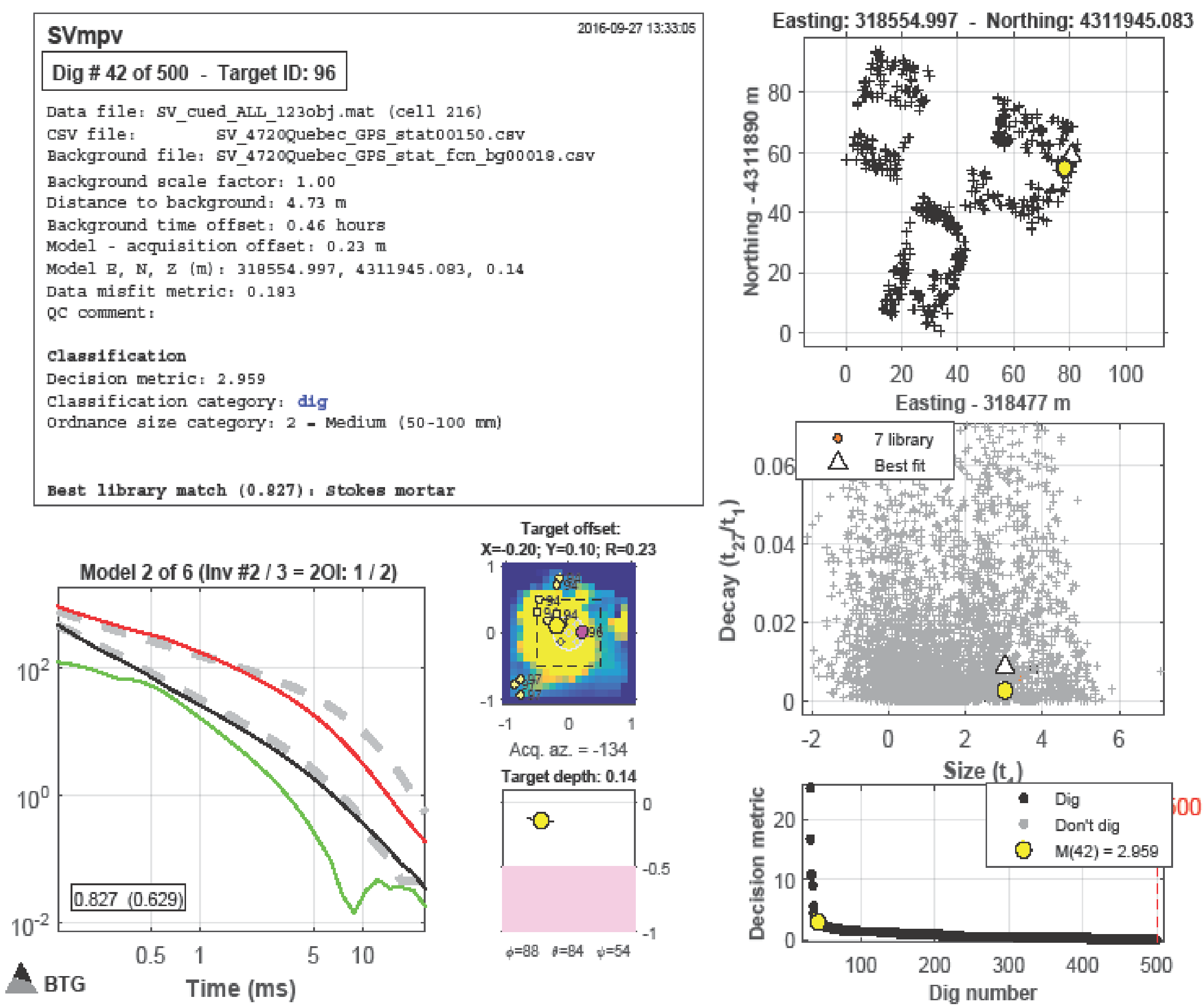


Exhibit 4.2: MPV Decision Plot

Both Exhibit 4.1 and 4.2 are plots for the cued data collected over the native Stokes Mortar TOI found at 4720 Quebec.

4.3 MPV Cued Data Processing

Data processing for the MPV data was performed using UXOLab, software that was developed by BTG. After performing preliminary quality control checks and performing background corrections, the data were inverted and classified. Next, the intrinsic and extrinsic features were estimated for the target anomalies as well as the daily QC measurements collected at the IVS. The data were inverted using a sequential single- and multi-object inversion approach to estimate intrinsic parameters (principal axis polarizabilities) and extrinsic parameters (target location and depth). Polarization tensor models representing a single-object, two-objects and three objects were fit to each cued dataset. All solutions were retained, to consider during the classification process.

4.4 TEMTADS Cued Data Processing

Data processing for the TEMTADS data was performed using Geosoft Oasis montaj, a commercially available software package. Single target and multi-target inversion routines in UXA-Advanced were used to determine the parameters of a target (single-target inversion), or constellations of targets (multi-target inversion), that would produce responses that closely match the observed responses.

As the names suggest, the single-target inversion solves for a single target and the multi-target inversion posits multiple targets. The multi-source solver not only presupposes multiple sources, it will also produce a number of candidate 'realizations' of targets. Each candidate realization proposes a configuration of targets whose modeled response reasonably fits the observed data. For example, one candidate realization may have three targets, while a second candidate realization for the same measurement may have two or four targets. This process reflects the fact that, with an unknown number of potential targets of difference sizes and shapes, a number of different models can closely match the observed data. A separate fit coherence value is derived for each candidate realization as well as for the single solver.

4.5 Cued Data Measurement Quality Objectives

Cued Data MQOs are presented in Table 4-1. Model results were only used for classification if they passed the MQOs, confirming that they support classification.

Table 4-1: Cued Data MQOs

Measurement Quality Objective	Frequency	Acceptance Criteria	Status
Verify correct assembly	Once following assembly	Instrument is correctly assembled	Achieved for both TEMTADS and MPV. Documented on Initial TPC Checklist.
Initial sensor function test (instrument response amplitudes)	Once following assembly	Response (mean static spike minus mean static background) within 25% of predicted response for all monostatic transmit/receive (Tx/Rx) combinations	Achieved for both TEMTADS and MPV. Documented on Initial TPC Checklist and IVS Report.

Table 4-1: Cued Data MQOs			
Measurement Quality Objective	**Frequency**	**Acceptance Criteria**	**Status**
Initial IVS background measurement (five background measurements, one centered at the flag, and one offset at least 35cm in each cardinal direction)	Once during initial system IVS test	All decay amplitudes lower than project threshold (threshold dependent upon soil response and will be defined in the IVS Tech Memo)	Achieved for both TEMTADS and MPV. Documented in TPC Checklists and Demonstrator Data.
Initial derived polarizabilities accuracy (IVS)	Once during initial system IVS test	Library Match metric ≥ 0.9 for each set of inverted polarizabilities	Achieved for both TEMTADS and MPV. Documented in IVS Report and Demonstrator Data.
Derived target position accuracy (IVS)	Once during initial system IVS test	All IVS item fit locations within 0.25m of ground truth locations	Achieved for both TEMTADS and MPV. Documented in IVS Report and Demonstrator Data.
Ongoing IVS background measurements	Beginning and end of each day as part of IVS testing	All decay amplitudes lower than project threshold	Achieved for both TEMTADS and MPV. Documented in Demonstrator Data.
Ongoing derived polarizabilities precision (IVS)	Beginning and end of each day as part of IVS testing	Library Match to initial polarizabilities metric ≥ 0.9 for each set of three inverted polarizabilities	Achieved for both TEMTADS and MPV. Documented in Demonstrator Data.
Ongoing derived target position precision (IVS)	Beginning and end of each day as part of IVS testing	All IVS items fit locations within 0.25m of average of derived fit locations	Achieved for both TEMTADS and MPV. Documented in Demonstrator Data.
Initial measurement of production area background locations (five background measurements: one centered at the flag and one offset at least 35cm in each cardinal direction)	Once per background location	All decay amplitudes lower than project threshold (defined in the IVS Tech Memo)	Achieved for both TEMTADS and MPV. Documented in TPC Checklists and Demonstrator Data.
Ongoing production area background measurements	Background data collected a minimum of every 1.5 hours during production	All decay amplitudes lower than project threshold (defined in the IVS Tech Memo)	Achieved for both TEMTADS and MPV. Documented in TPC Checklists and Demonstrator Data.
Ongoing instrument function test	Minimum 1 every 3 hours and each time instrument is restarted	Response (mean static spike minus mean static background) within 25% of predicted response for all monostatic Tx/Rx combinations	Achieved for both TEMTADS and MPV. Documented in TPC Checklists and Demonstrator Data.
Transmit current levels	Evaluated for each sensor measurement	Current must be ≥5.5A	Achieved for both TEMTADS and MPV. Documented in TPC Checklists and Demonstrator Data.
Confirm all background measurements are valid	Evaluated for each background	Ensure background variation does not impact ability to	Achieved for both TEMTADS and MPV. Documented in

Table 4-1: Cued Data MQOs			
Measurement Quality Objective	**Frequency**	**Acceptance Criteria**	**Status**
	measurement	classify correctly	Demonstrator Data.
Confirm inversion model supports classification (1 of 3)	Evaluated for all models derived from a measurement (i.e., single-item and multi-item models)	Derived model response must fit the observed data with a fit coherence ≥ 0.86	Achieved with few exceptions* for both TEMTADS and MPV. Documented in Demonstrator Data.
Confirm inversion model supports classification (2 of 3)	Evaluated for derived target	Fit location estimate of item ≤ 0.4m from center of sensor	Achieved with few exceptions* for both TEMTADS and MPV. Documented in Demonstrator Data.
Confirm inversion model supports classification (3 of 3)	Evaluated for all seeds	100% of predicted seed positions ≤ 0.25m from known position (x, y, z)	Achieved for both TEMTADS and MPV. Documented in Demonstrator Data.
Confirm reacquisition GPS precision	Daily	Benchmark positions repeatable to within 10 cm	Achieved for both TEMTADS and MPV. Documented in TPC Checklists.

* This metric was not met for some targets with very low signal amplitude. In these cases, the failure does not impact the ability to classify and therefore was not considered a significant failure that needed to be addressed.

4.6 Cued Data Analysis and Classification

After the cued data were inverted and intrinsic and extrinsic parameters were estimated, the data were classified. All targets were ultimately classified as "Dig" or "Do Not Dig", however subcategories for targets that are listed as "Dig" include:

- Training
- Cannot extract reliable parameters
- Likely to be TOI
- Cannot Decide

4.6.1 Library Development

Additional test stand measurements were collected over an MkIV Booster and Livens Projectile provided by USACE to supplement available library data. In general, the following items were considered "site specific" and were required to be included in the demonstrators' primary library:

- 75 mm projectiles
- Fuzes (MK-3 and/or similar)
- 5" projectiles projectile (similar to 4.7" illumination projectiles)
- 3" Stokes mortars
- MkIV Booster (from 75mm)
- Livens Projectiles
- Small, medium and large ISOs

The TEMTADS analysis was based on the standard all-inclusive library included with the UXAnalyze installation, with minor modifications. Because the smallest anticipated TOI was a small ISO/MKIV booster, all smaller items such as 20mm were removed as well as grenades and

T-Bar fuzes. All the seeds and the native Stokes produced library matches of sufficient quality to the actual item to declare a dig except in a couple of instances. There was a small ISO that matched better to a 60mm and a 75mm that also matched to a 60mm.

The MPV utilized an expanded library that included items not expected at this site. This decision was made to provide a conservative approach based on the limited amount of site specific training data that was available. The Stokes Mortar and all blind seeds would have been detected with a site specific library.

Both demonstrators agree that the number of false positives would be decreased if a site-specific library were utilized for final classification. However, both demonstrators also recommend the use of an all-inclusive library to identify possible unanticipated items to be identified during the training phase. In this case, if training digs did not result in a MEC find, then the site-specific library would be acceptable for final classification. Otherwise, if any of the training digs resulted in a MEC item, the library item with the best match to that data would be added to the site-specific library.

4.6.2 Training Data

Training data are select intrusive results provided to the demonstrator prior to receiving their final classified list. These data are meant to provide additional ground truth to help inform classification decisions. Training data were requested by both demonstrators for the Pilot Study. Primary justifications for requesting ground truth for specific targets are as follows:

1. Selected from targets flagged as potential TOI during QC. Some of these may be targets with polarizabilities that have a close match with a library item. These requests will be used for validation purposes.
2. Others may correspond to targets with polarizabilities distinct from all entries in the library. These requests will serve to potentially augment the classification library (if new TOI are found).
3. Cluster analysis is used to automatically find clusters of items with self-similar polarizabilities. The polarizabilities for a cluster may or may not be potential high-likelihood TOI (e.g., horseshoes, small arms projectiles). Representative items from clusters not comprising only models associated with small scrap are commonly requested as training data.

4.6.3 MPV Classification

A classification scheme primarily based on matching polarizabilities with ordnance items in the site-specific library was employed. Each set of cued measurements were inverted using one, two and three dipole source inversions. Inversion results were reviewed by the analyst and only valid models were retained for classification. Models were failed when the associated predicted data had a poor fit with the observed data, or when the predicted source location was too far from the sensor to be considered reliable. If all models/inversions for a target were failed, the target was classified as “cannot extract reliable parameters” and classified as “dig”. There were two exceptions to this process of assigning pass/fail status to models from the inversions:

1. Close target picks: The SVFUDS properties had many instances of close target picks, which often prompted the field operators to collect multiple soundings in an effort to

collect a sounding directly on top of the buried items. Although this process improved the data quality for classification, it also complicated the task of matching source locations and target identity labels, especially when a source would be predicted between two target picks. In this case some models would be manually failed to avoid that the same source location being reported for two targets, and to match the source to the closest target.

2. Empty holes: Soundings collected at locations with no detectable object may generate spurious models or poor fits, which could result in targets being labelled "cannot analyze" and therefore being marked to be dug. For these cases where there was no discernable signal from a metal object present in the data, the analyst ensured that at least one model was passed, even if the data was a poor fit or the location too far, so that a high confidence empty hole would not be prioritized for digging.

Polarizabilities obtained from the IVS measurements of site specific TOI were added to the classification library. Additional information was obtained via training digs selected by the analyst based on their polarizability's matching to potential TOI. A final dig list was generated by sorting the targets according to the library match metric, starting with the targets for which ground-truth information had already been obtained (missed seeds from detection phase and training digs). The stop-dig point was specified where the decision metric indicated a low likelihood of a TOI. The stop dig point is guided by the decision metric which indicates the portion of the ranked dig list where the probability of finding a TOI becomes small. There is no threshold value used, rather the plot of the decision metric produces an L-shaped curve with a region just beyond the "elbow" of that curve where the analyst should consider setting the stop dig point. While the plot of the decision metric suggests the region of the ranked list where the analyst should consider stop digging, the actual stop dig point within this region is determined by the analyst's examination of the polarizability misfits along the ranked dig list and identification of the point where the analyst determines the fits are sufficiently degraded.

4.6.4 TEMTADS Classification

Classification was based primarily on the goodness of fit metric (values from 0.0 to 1.0) generated by UXA during a comparison of the β values estimated for each surveyed target and the β values in the munitions library developed for the project. This comparison was performed via the library match utility in UXA. The goodness of fit metric is a measure of the fit correlation between a target and the library entry that best fits that target, with higher values indicating a better fit between the target and the corresponding item in the library. The library fit analysis matches the following four combinations of βs to those of the candidate library TOIs:

- β1, β1/β2, β1/β3
- β1, β1/β2
- β1/β2, β1/β3
- β1

The confidence metrics for each fit combination were averaged to derive a 'decision metric'.

This library matching process is performed for each single-solver model and every target in each of the multi-source solver models. For each flag position, the best library fit from the single-solver and multi-solver targets is used as the decision metric. This decision metric is used to rank and classify the target list. Values below the analyst's threshold are considered non-TOI. A threshold number of 0.825 for the decision statistic was used as the stop dig point. Due to the noise at the site, a threshold of 0.925 for the "100" library match was used to conservatively add other potential TOI that may have a reduced decision statistic caused by noisy secondary polarizations. The thresholds were initially selected using classification experience from past projects and refined to the final numbers using site specific training data. The stop dig point represents the point where the training data and past experience suggest that no other TOI in the library exists in the remaining items on the dig list.

Individual items that did not match any library items but had βs that indicated an axially symmetric, thick-walled object were conservatively placed on the Dig list.

4.7 Final Cued Target Synthesis

The inverted source locations generated by each demonstrator were synthesized to form the final dig target list. A merge radius of 0.3 m was used to combine targets into a single dig location in the same manner as it was done after the dynamic detection phase. Following cued data processing of MPV and TEMTADS data, the collection of EM61-MK2A data, and any targets selected as part of the corrective action for NCRs 001 and 002, synthesis of the final cued targets into the final dig target list (i.e., which cued targets should be dug) was performed. From this list, the final dig sheets (Appendix E) were generated for use by the UXO intrusive team.

Maps showing final dig target locations for the 4720, 4733, and 4740 properties, are presented as Figures 7, 16, and 25, respectively. The figures indicate whether the target was identified by the MPV only, the TEMTADS only, both MPV and TEMTADS, or by the EM61-MK2A. Appendix F-2 provides the detailed dig target list spreadsheets used to produce the figures.

The final target counts for each property are summarized in Table 4-2.

Table 4-2: Final Cued Target Synthesis

Site	Targets Detected in Dynamic Data		EM61/ Mag/ QC Targets Added	Total Number Cued Targets	Targets Removed during Reacquisition	Targets Cued by Each System		Corrective Action Targets Added	EM61 Targets Added	Targets on Dig List
	TEMTADS	MPV				TEMTADS	MPV			
4720Q	80	100	20	171	5	168	166	39	15	243
4733W	152	193	2	194	3	194	194	0	16	230
4740Q	89	82	1	147	7	123	140	69	20	278

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5.0 INTRUSIVE INVESTIGATION

5.1 Overview

In a typical AGC based investigation or removal activity approach, only those targets classified as 'Dig' would be intrusively investigated. But for this Pilot Study all targets were intrusively investigated, whether the classifiers indicated they should be dug or not.

The intrusive investigation began on September 30, 2016 with the flagging of final dig targets, as presented in the Appendix E dig sheets. These dig sheets represent the actual field team descriptions as targets were excavated; the sheets were later typed for readability for inclusion in the appendix.

The team of UXO technicians began intrusive operations on October 3, 2016, and completed most digs at 4740 Quebec Street and 4733 Woodway Lane by October 7, 2016. Due to the requirements for permitting to dig beneath the public space sidewalks in front of each property, no sidewalk targets were investigated at that time.

Furthermore, due to the presence of other workers and scaffolding at 4720 Quebec Street, the intrusive investigation of that property was further delayed. The UXO dig team remobilized to complete digs at 4720 Quebec Street and all remaining digs on public sidewalks on November 14, 2016 and all digs were completed by November 17, 2016.

5.2 Intrusive Investigation Procedures

5.2.1 <u>Reacquisition</u>

Reacquisition of final targets was accomplished by ERT using the Leica 1200 RTS. Positional accuracy was obtained by resection using control points provided by licensed surveyors, with verification of the rover prism on a third point. As an accommodation of the homeowners, wooden golf tees with plastic flagging were used to mark softscape targets (in grass or soil), and marking paint were used to mark hardscape targets (on concrete or slate driveways, patios, or sidewalks).

On other projects where DGM is employed to map targets of interest, typically the instrument used for the mapping is again used after the target flag is placed in the ground, in order to refine the location of the target by searching for the highest geophysical response, or peak. However, when AGC systems are used, the cued measurement process refines the target location with a high degree of precision, and the instrument does not need to revisit the anomaly.

Furthermore, on AGC projects it is typical that targets where the geophysical data does not seem to match the dig result (such as "no contacts" where nothing is found) may be revisited by the dig team, primarily to ensure that the flag was placed in the correct location. Due to the limited time requirements at these private properties, once all targets were dug, site restoration had to proceed, and there was no opportunity to revisit dig targets. However, due to the small size and abundant cultural site features at the three properties, it is unlikely that any flags would have been placed too far from the correct location without it being noticed by the reacquisition team.

5.2.2 <u>Excavation</u>

The UXO teams consisted of the Senior UXO Supervisor (SUXOS), UXOSO/QCS, a Technician III field team leader, and several Technician IIs and Is. As a matter of logistics, some technicians were dedicated to hardscape anomalies, while others were deployed on softscape targets.

The UXO team completed all excavations using shovels in grass or other softscape, or using power tools (concrete saws, jackhammers) in hardscape. The field dig sheets included an estimated depth based on cued measurements for many targets, as well as a 'Fit item' generated through cued data processing (essentially an estimate of the size and shape of the object). Depth to contact, contact type, and other notes were recorded on the dig sheet.

Any munition debris (MD) was removed and stored in a secure location on site until proper disposal at the end of the project. Cultural debris was either removed or left in place.

Hardscapes were temporarily restored with quick-crete type patching immediately after completion of the excavation. Hardscapes were later permanently restored by ERT's landscape/restoration contractor.

5.2.3 Anomaly Resolution Process

The intrusive investigations were resolved in the field using analog detectors (Schonstedt GA-52Cx magnetometer or White's DFX-300 metal detector). Unless the source was verified and could not be removed, a hole was not considered clear until there was no remaining audible response produced by the analog sensor. For any "no contacts" the intrusive investigation continued until the depth of the hole was 6 inches deeper than the estimated fit depth from the classified data.

Additional anomaly resolution was performed by the QC geophysicist. This process consisted of comparing classified data to the intrusive results to ensure that they were consistent. During this process, the only discrepancies noted were related to low signal targets. It is common for the inversion process to falsely predict large deep objects when there is little to no signal, which was the case with several targets here. As a result, the dig team was not redeployed to re-investigate these targets.

5.3 Intrusive Investigation Findings

5.3.1 4720 Quebec Street

Intrusive work began on November14 and was concluded on November 16, 2016. Complete dig results are shown in Appendix E.

A map of the final dig target locations for 4720 Quebec is presented as Figure 7. The dig sheet detailing the findings is contained in Appendix E. 243 targets were investigated.

This property was the only one where munitions-related items were found during this Pilot Study, as described below.

A native TOI, a 3-inch Stokes Mortar unfuzed practice round, was found at target #129. This item is shown in photo 18 of Appendix G. In accordance with the UFP-QAPP, this item was turned over to the USACE OESS for further processing. The OESS initiated a response from the Fort Belvoir EOD unit, who took control of the item, removing it from the site for further assessment. It was ultimately determined to be a practice round and was properly disposed by the EOD unit. The item appeared completely intact as found; there was no staining of soil or other indications of the need for a soil sample, and therefore, none was collected.

This anomaly had been detected during previous geophysical survey in 2009. The EM61 survey recorded a saturated area and thus no target was picked. The G-858 magnetometer recorded an anomaly. At that time, as it was only selected as a target in the G-858 dataset (i.e., a 'mag-only' target), the procedure was to classify it as a Category D target (not indicative of MEC), and it was not recommended for intrusive investigation.

Targets #94, #201, and #202 were found to be MD. These are shown in photos 17, 19, and 20, respectively, of Appendix G. These items were also taken by the OESS, and following negative results for head-spacing for potential CWM, were properly disposed.

All other items were cultural debris. Nails, screws, and wires were common. One unusual item was target #73 and #74, a steel spike of 1 inch diameter and 26 inch length buried under the sidewalk in front of the property. This is shown in photo 16 of Appendix G.

Note also, as described in Section 1.3.1.1, two MD fragments were found in 2009 during the previous investigations at this property.

5.3.2 <u>4733 Woodway Lane</u>

Intrusive work began on October 6 and most digs were completed by October 7, 2016. Targets beneath the public sidewalk and the slate patio in the backyard were dug on November 16 and 17, 2016.

A map of the final dig target locations for 4733 Woodway is presented as Figure 16. The dig sheet detailing the findings is contained in Appendix E. A total of 230 targets were investigated.

No munitions-related items were found. Nails, wires, and screws were common. Targets #2013 (a tent stake), #2158 (rain gutter embedded in concrete), and #2189 (steel scrap), are shown in photos 24, 25, and 26, respectively, of Appendix G.

5.3.3 <u>4740 Quebec Street</u>

Intrusive work began on October 4 and most digs were completed by October 6, 2016. Targets beneath the public sidewalk were dug on November 16, 2016.

A map of the final dig target locations for 4740 Quebec is presented as Figure 25. The dig sheet detailing the findings is contained in Appendix E. A total of 278 targets were proposed to be investigated, but not all were ultimately dug, as described below.

A group of anomalies were mapped by the MPV in an area of sensitive vegetation in the front of the property; however, as an accommodation to the homeowner, only a subset of these targets was dug. Specifically, targets #1089, #1106, and #1107 were dug because the 'fit item' was listed as a Stokes mortar or 75mm projectile, and it would not be considered reasonable to leave such potential items in the ground to save vegetation. Target #1089 (steel banding) is shown in photo 23 of Appendix G. None of these targets were munitions-related items.

Another group of targets (#1210 to #1278, inclusive), designated 'MPV Extras', were added to the dig list based on the proposed corrective action for NCR 002, where a blind seed had been missed. With concurrence from USACE, it was decided to dig some percentage (at least 25%) of the targets initially, with more to be dug based on the findings. The result was that 19 of the 67 targets were dug, with no significant findings, and therefore, none of the remaining targets were dug in this group.

Overall at this property, no munitions-related items were found. Except as noted above, all remaining targets were dug. Nails, steel scrap, and wires were common, especially lawn staples, as shown in photo 21 of Appendix G.

Table 5-1 summarizes the munitions-related finds from the Pilot Study.

Table 5-1: Pilot Study Munitions-Related Finds

Site	Target #	Depth (cm)	Description
4720 Quebec	94	30.5	MD, fragment, 8 inches long
	129	7.6	MD, 3-inch diameter intact Stokes Mortar practice round
	201	20.3	MD, fragment, 6 inches long
	202	20.3	MD, fragment, 4 inches long

6.0 CLASSIFICATION RESULTS

Due to the small number of TOI found during in the Pilot Study, the classification results were analyzed for all properties combined, rather than individually. Receiver Operating Characteristic (ROC) Curves, clutter rejection rates, and correct classification of TOI and non-TOI were analyzed for each demonstrators' classification process.

6.1 ROC Curves

ROC curves are plots of the true positive rate against the false positive rate as a means to compare diagnostic tests. In general, for these Pilot Study data, the ROC curves show how well the data were classified. The ROC curves for each demonstrator are shown in Exhibits 6.1 and 6.2.

In the best-case scenario, the red line would go straight up the y-axis and then the green line would go horizontal at the total number of TOI. This would mean that the classifier correctly identified all TOI and all clutter. In most cases, however, some clutter will look like TOI, and as a result, the stop dig point will be offset from the axis by the number of clutter items that were incorrectly classified. In the ROC curves below, the different line colors represent different categories of targets:

- Blue represents Training Digs (ground truth for targets requested by the demonstrator to help improve and/or verify their classifier).

- Grey represents 'Cannot Analyze' targets: The processor deemed the data quality of these targets to be too poor to confidently classify.

- Red represents High Confidence Digs: These targets <u>are</u> likely TOI.

- Yellow represents Lower Confidence Digs: These targets <u>could be</u> TOI.

- Green represents High Confidence Do Not Dig: These targets <u>should not be</u> TOI.

Also displayed in the figures are a red 'Stop Dig' symbol, a black star to indicate the position of the native (not an emplaced seed) TOI, and an orange cross symbol to indicate a missed TOI.

Please note that two separate TEMTADS Target IDs were associated with the native Stokes Mortar. One of these was selected as a training dig and the other was selected as a TOI. This is the reason for the two black stars as well as the count of 14 total TOI in the TEMTADS ROC curve (Exhibit 6.2).

It is evident, based on the differences in the ROC curves, that the demonstrators approached the classification of the data very differently. The MPV classifier was relatively more aggressive and only classified one target as 'Cannot Analyze'. The TEMTADS classifier, on the other hand, placed 164 targets into the 'Cannot Analyze' category, meaning the processor didn't trust that the SNR was high enough to make an informed decision, due to the power line noise combined with many small amplitude targets. The processor stated that it is likely that the small amplitude targets are nothing, but could not reliably classify them as such because of uncertainty in the inversion results due to the noise.

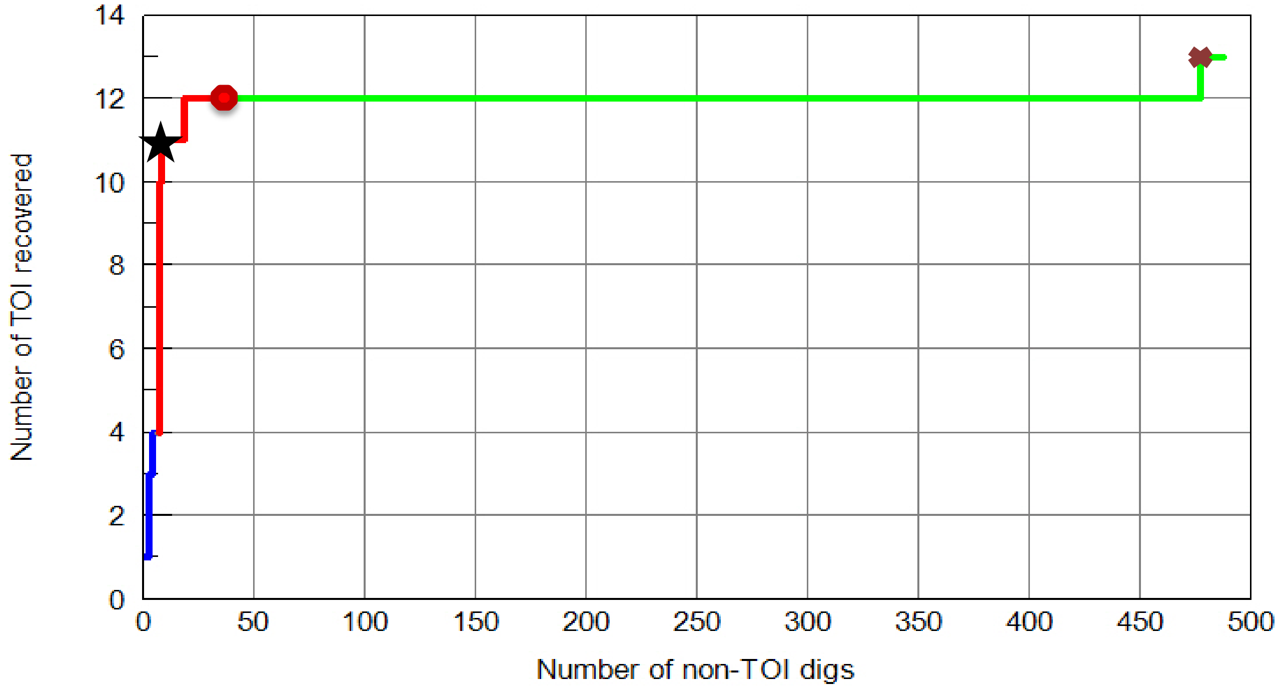

Exhibit 6.1: MPV ROC Curve for the Pilot Study

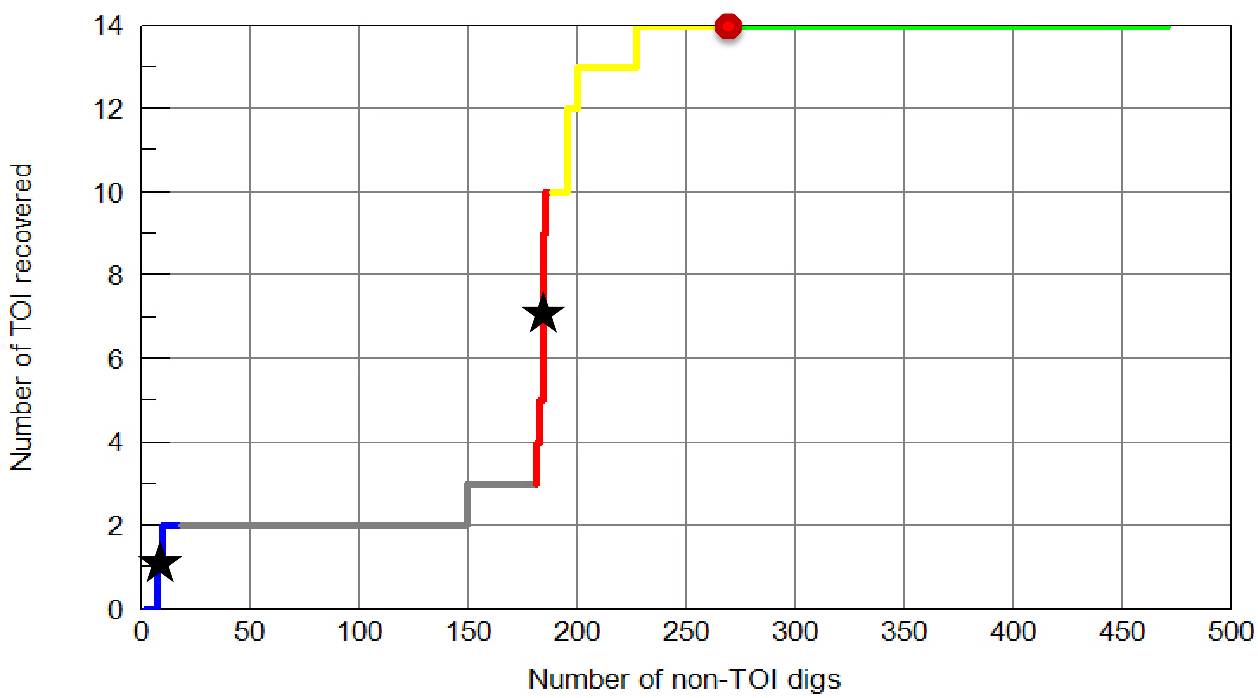

Exhibit 6.2: TEMTADS ROC Curve for the Pilot Study

The MPV classifier was not as conservative on this point and classified many of these targets as non-TOI. Even if the number of 'Cannot Analyze' targets is ignored, the TEMTADS classifier takes more digs to get to the stop dig point. TEMTADS includes 101 targets classified as high or low confidence digs, while MPV only classified 40 targets as such.

The MPV missed one blind seed. The RCA for this failure is summarized in Section 6.5, and is supported by the location of the item in the ROC curve (Exhibit 6.1). A failure closer to the stop dig point would likely be a symptom of an overly aggressive classifier, but because the item is almost at the end of the classified and ranked list, it indicates that there is more likely an issue with the data, than there is with the classifier.

6.2 Clutter Rejection

The ROC curves also provide a visual representation of the clutter rejection percentage based on the Pilot Study. This relates to the number of non-TOI that could be confidently left in the ground. The clutter rejection percentages for each AGC classifier are detailed in Table 6-1. The primary differentiator between the two datasets is the presence of 'Cannot Analyze' targets.

Table 6-1: Clutter Rejection Rates

System	Number of Cued Targets	Number of TOI	Number of Clutter	Stop Dig Point	Clutter Rejection Percentage
MPV	500	13	487	50 digs	90%
TEMTADS	485	13	472	285 digs	41%*

* See Section 6.2.1.

6.2.1 Cannot Analyze Targets

Additional analysis was performed to determine if a high percentage of the targets that resulted in 'Cannot Analyze' conclusions for the TEMTADS cued data were only detected by the MPV during the dynamic detection phase. The intent of this analysis is to provide a more accurate representation of the 'Cannot Analyze' rate that may be expected for a TEMTADS only survey. In this case, 46% of the TEMTADS 'Cannot Analyze' targets were not selected from the TEMTADS dynamic data, suggesting that the clutter rejection percentage would likely increase if TEMTADS were not responsible for cueing targets detected by the MPV.

If the TEMTADS 'Cannot Analyze' targets were instead classified as non-TOI, the clutter rejection rate for this dataset would increase to 77%. However, in this scenario there may be a greater chance that small TOI could be missed in high noise areas. The same may also be true for the low SNR targets within the MPV dataset.

6.3 Classification Accuracy for Blind Verification Seeds

From the cued data, TEMTADS correctly classified all blind seeds, while the MPV incorrectly classified one detected item (Seed 16 was not detected and could not be correctly classified). A comprehensive RCA for this failure is included in Appendix D, and a summary is provided below in Section 6.5.

The classification results for blind seeds are detailed in Tables 6-2 and 6-3. The two most difficult targets were Seeds 16 and 17. Both are large deep objects, at or beyond, the depth of detection defined in Section 3.5. This provides additional verification that the observed amplitude of the site specific noise results in limits to the depth of detection and classification.

The "Best Fit" items listed in the tables below represent the library item with the best fit to the cued data. Both demonstrators were using different cued data sets and different library data for this Pilot Study. Therefore, the "Best Fit" items for each dataset may be different from each other, and while these items may not be consistent with the nomenclature of the seed item, they are considered to be equivalent if they are of similar size and if the target was classified as 'Dig'. With the exception of the difficult targets, the average horizontal and vertical offsets for both demonstrators are approximately 9 cm.

Table 6-2: MPV Classification of Blind Seeds												
Property	**Blind Seed #**	**Blind Seed Description**	**Seed Depth (m)**	**Detection Phase**	**MPV Target ID**	**MPV Target Easting**	**MPV Target Northing**	**MPV Target Offset (m)**	**MPV Target Depth (m)**	**Depth Offset (m)**	**MPV Best Fit**	**MPV Category**
4720Q	12	75 mm	0.30	Detected	SV-168	318547.89	4311927.76	0.11	0.25	0.05	75 mm	Dig
	13	Stokes Mortar	0.41	Detected	SV-135	318540.53	4311933.97	0.04	0.4	0.01	Medium ISO	Dig
	14	Small ISO	0.1	Detected	SV-25	318537.68	4311960.16	0.04	0.09	0.01	Small ISO	Dig
	15	M353 TPT projectile	0.30	Detected	SV-120	318523.14	4311936.76	0.07	0.3	0.00	75 mm	Dig
	16	Large ISO	0.91	Missed by TT, MPV	SV-80	318559.44	4311951.45	0.76	0.59	0.32	BDU33	Training
4733W	7	75 mm	0.28	Missed by TT	SV-2162	318517.53	4311911.25	0.06	0.36	-0.08	81mm Mortar	Training
	8	Stokes Mortar	0.41	Detected	SV-2047	318494.9	4311904.64	0.17	0.38	0.03	2.75in Rocket	Training
	9	Small ISO	0.20	Detected	SV-2120	318510.68	4311930.9	0.12	0.29	-0.09	Small ISO	Dig
	10	Small ISO	Not Required. Stainless steel pipe nipple is not detectable.									
	11	Medium ISO	Not Required. Item is too close to an underground utility.									
4740Q	17	75 mm	0.66	Missed by TT	SV-1076	318486.44	4311945.78	0.13	0.23	0.43	37mm	Do Not Dig
	18	75 mm proj. part	0.08	Detected	SV-1084	318480.55	4311947.2	0.08	0.23	-0.15	90mm	Dig
	19	Small ISO	0.15	Missed by MPV	SV-1094	318484.66	4311952.47	0.12	0.11	0.04	MkIV booster	Training
	20	Medium ISO	0.18	Detected	SV-1090	318481.94	4311951.29	0.04	0.3	-0.12	Medium ISO	Dig

All blind seeds are inert items.

Table 6-3: TEMTADS Classification of Blind Seeds

Property	Blind Seed #	Blind Seed Description	Seed Depth (m)	Detection Phase	TT Target ID	TT Target Easting	TT Target Northing	TT Target Offset (m)	TT Target Depth (m)	Depth Offset (m)	TT Best Fit	TT Category
4720Q	12	75 mm	0.3	Detected	SV-168	318547.97	4311927.77	0.10	0.25	0.05	105mm	Dig
	13	Stokes Mortar	0.41	Detected	SV-135	318540.51	4311933.95	0.02	0.47	0.06	Stokes Mortar	Dig
	14	Small ISO	0.1	Detected	SV-25	318537.73	4311960.23	0.05	0.07	0.03	Small ISO	Dig
	15	M353 TPT projectile	0.3	Detected	SV-120	318523.16	4311936.75	0.06	0.3	0.00	3 inch Proj	Dig
	16	Large ISO	0.91	Missed by TT, MPV	SV-80	318558.73	4311950.52	0.41	0.69	0.22	NA	Cannot Analyze
4733W	7	75 mm	0.28	Missed by TT	SV-2162	318517.58	4311911.23	0.09	0.33	0.05	3 inch Proj	Cannot Decide, Dig
	8	Stokes Mortar	0.41	Detected	SV-2047	318494.87	4311904.61	0.13	0.4	0.01	105mm	Training
	9	Small ISO	0.20	Detected	SV-2120	318510.76	4311930.8	0.04	0.27	0.07	Small ISO	Cannot Decide, Dig
	10	Small ISO	Not Required. Stainless steel pipe nipple is not detectable.									
	11	Medium ISO	Not Required. Item is too close to an underground utility.									
4740Q	17	75 mm	0.66	Missed by TT	SV-1076	318486.48	4311945.63	0.04	0.45	0.21	60mm	Cannot Decide, Dig
	18	75 mm proj. part	0.08	Detected	SV-1084	318480.52	4311947.21	0.09	0.21	0.13	3 inch Proj	Dig
	19	Small ISO	0.15	Missed by MPV	SV-1094	318484.62	4311952.35	0.01	0.4	0.25	3 inch Proj	Cannot Decide, Dig
	20	Medium ISO	0.18	Detected	SV-1090	318481.93	4311951.27	0.06	0.28	0.10	75mm	Dig

All blind seeds are inert items.

6.4 Classification of Native TOI

Both demonstrators correctly classified the Stokes Mortar found at 4720 Quebec. The MPV Fit Item is listed as a BDU33 bomb which falls into the same size category as a 3-inch Stokes Mortar. The MPV data processor also confirmed that the polarizabilities are a good match to a Stokes, however the best match was to the BDU33. This is still considered to be a successful classification of the item. Table 6-4 summarizes the findings.

Table 6-4: Classification of Native TOI

Target #	Stokes Depth (m)	System	Cued Target ID	Target Easting	Target Northing	Target Offset (m)	Target Depth (m)	Depth Offset (m)	Best Fit	Category
129	0.08	MPV	94	318555.08	4311945.04	0.14	0.2	0.12	BDU33	Dig
		TEMTADS	96	318555.1	4311944.99	0.11	0.11	0.03	3" Stokes	Dig

6.5 Classification Measurement Quality Objectives

As indicated in Table 6-5, only one MQO was specifically related to the classification of cued data.

Table 6-5: Cued Classification MQO

Measurement Quality Objective	Frequency	Acceptance Criteria	Status
Classification performance	Evaluated for all seeds	100% of QC and validation seeds placed on dig list	Achieved for TEMTADS. MPV missed one seed. NCR004 and RCA documented in Appendix D.

One NCR was issued during the cued data analysis and classification phase. The MPV demonstrator provided an RCA and recommended CA. The complete RCA/CA documents are provided in Appendix D, however a summary of this NCR is provided below.

6.5.1 <u>NCR004</u>

Blind seed #17 was incorrectly classified by the MPV. Seed # 17 is an inert 75mm at 1.88 ft depth, placed at the 4740 Quebec property. Exhibit 6.3 below shows the locations of various sources or “fits” derived from the cued data for targets #1077 and #1076. The seed itself was closer to #1076 and is indicated by the black cross. The polarizability curves (red, black and pink) with the best match to a 75mm (grey) are shown on the left. This is considered to be a very poor fit.

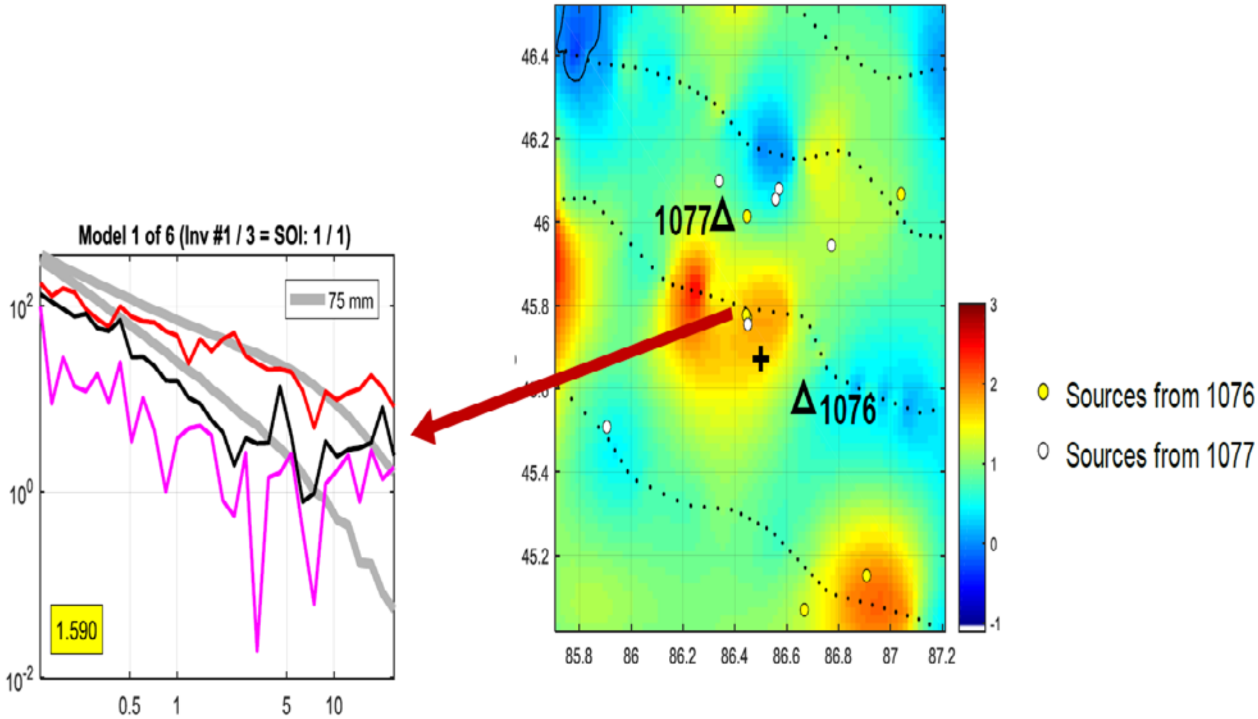

Exhibit 6.3: MPV Misclassified Blind Seed Data

The root-cause of the missed seed (inert 75mm) classification was that the elevated noise values at the 4740 Quebec property were too high to reliably detect and classify a 75mm target at 57 cm with the MPV. It should be noted that 57 cm was the depth measured when the seed was emplaced, however, the depth measured during intrusive investigation was closer to 66 cm (this may have been the result of soft soil and sinking of the item from the original surveyed depth of 57 cm). The MPV estimated depth of detection for a 3-inch Stokes (similar in size to a 75mm) in the high noise conditions at this property, is 60 cm. Assuming that the depth of detection and the depth of classification are roughly equivalent, this data supports the RCA for this failure. The only applicable corrective action in this case is to revise the DQOs to be more representative of site specific detection and classifications limits.

Note that this seed also gave the TEMTADS problems during the detection phase and this root cause is consistent with that presented by the TEMTADS in response to NCR002.

6.6 Final Target Classifications

The final target classifications for the TEMTADS and MPV data, showing 'Dig' or 'Do Not Dig' determinations at various levels of confidence, are shown in the detailed Appendix F-3 spreadsheets.

Maps showing final TEMTADS target classification locations for the 4720, 4733, and 4740 properties, are presented as Figures 8, 17, and 26, respectively. Maps showing final MPV target classification locations for the 4720, 4733, and 4740 properties, are presented as Figures 9, 18, and 27, respectively.

Maps showing the combination of the MPV and TEMTADS final recommendations for the 4720, 4733, and 4740 properties, are presented as Figures 10, 19, and 28, respectively. These figures provide a useful picture of the recommended digs from both methods on a single figure, and also indicate where both instruments recommended a target be dug. The objective of these figures is to show the final targets recommended for digging, by each instrument, if this were an actual AGC project as opposed to this Pilot Study where all targets were dug.

Finally, figures 11, 20, and 29, provide a snapshot of selected targets, indicating what was predicted by each instrument, and what was actually found. These figures were developed by showing targets that both instruments recommended be dug (figures 10, 19, and 28 as discussed above), plus other significant targets (such as munitions-related items and blind seeds), whether they were recommended for digging or not.

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7.0 COMPARATIVE ANALYSIS OF AGC METHODOLOGIES

The Pilot Study assessed the performance of AGC methodologies using MPV and TEMTADS systems with a primary objective of evaluating whether AGC methodologies could be used to effectively meet the RAOs for the SVFUDS. The Study indicates that AGC methods were successfully used at the SVFUDS at three private properties, where 200+ targets per property were detected, classified, and intrusively investigated. Section 8.0 discusses the overall success of the Pilot Study with regard to the primary objective, providing a more detailed comparative analysis of AGC vs the traditional DGM methods historically performed at the SVFUDS using an EM61 and G-858 magnetometer.

A secondary objective of the Study was to determine which AGC system might be most effective for future remedial actions at the SVFUDS. The following discussions provide a comparative analysis of MPV and TEMTADS methodologies based on the SVFUDS Pilot Study findings. However, it is acknowledged that some of the differences observed in the detection and classification results may be due to analyst judgment or data processing methods and software used, as opposed to instrument performance. Therefore, the comparison is qualitative in nature because of the difficulty in separating out these factors. As provided in the approved UFP-QAPP DQOs, one of the goals of data collection was to answer the following question:

- What AGC sensor platform (TEMTADS or MPV) is most effective for remediating the residential properties at the SVFUDS?

7.1 Advantages and Disadvantages of Each AGC Method

A comparative analysis of MPV and TEMTADS methodologies, describing primary advantages and disadvantages of the two AGC methods, is summarized in Table 7-1. Following the table, additional discussion detailing Pilot Study specific findings and observations, is presented.

Table 7-1: MPV and TEMTADS Comparative Analysis

Considerations	Criterion	MPV	TEMTADS
Technical	Detection of Small Items	▪ MPV can detect small items deeper than TEMTADS	▪ Not as effective as MPV
	Detection of Large Items	▪ Not as effective as TEMTADS	▪ Can detect large items deeper than MPV
	Reducing Number of Digs	▪ On average, MPV produced a 90% clutter rejection rate (e.g., only 10 of 100 targets would be recommended for intrusive investigation, the rest being 'clutter')	▪ TEMTADS resulted in only a 41% clutter rejection rate (59 of 100 targets would be recommended for intrusive investigation)
	Signal to Noise Ratio	▪ MPV provided a higher signal to noise ratio (strength of target signal relative to interference or noise-higher ratio is better) at the properties	▪ Generally provided a lower signal to noise ratio at the properties than the MPV

Table 7-1: MPV and TEMTADS Comparative Analysis

Considerations	Criterion	MPV	TEMTADS
	False Positives	▪ Mapped significantly higher numbers of anomalies in dynamic survey (many were verified to be noise related)	▪ Fewer targets caused by noise
	Blind Seed Detection	▪ 13 of 14 blind seeds detected during Dynamic survey ▪ Blind seeds were mapped with lesser offset distances than TEMTADS	▪ Only 9 of 14 blind seeds detected during Dynamic survey ▪ Blind seeds were mapped with greater offset distances than MPV
	Blind Seed Classification	▪ Missed one blind seed (categorized as "do not dig") based on cued data	▪ All blind seeds categorized as "dig" based on cued data
Logistical/ Practical	Field Preparation Time	▪ Generally requires that ropes and tapes be set up to ensure coverage	▪ More efficient than MPV, can be operated using paint markers or bean bags as guides
	Field Duration/ Efficiency	▪ MPV Dynamic survey duration was 6 days ▪ Minimum 3 field personnel are required for efficiency	▪ TEMTADS Dynamic survey duration was slightly faster (5 days) ▪ 2 field personnel can do the survey efficiently
	Maneuverability/ Instrument Coverage	▪ Achieves greater coverage in and around vegetation and other obstacles	▪ Coverage is lesser than MPV, limited to spaces where a sensor that is approximately 0.8m wide can fit.
	Property Impacts	▪ Significantly less vegetation needs to be impacted (plants removed/transplanted) relative to TEMTADS	▪ TEMTADS requires more cleared acreage to operate relative to MPV
	Availability of Equipment and Software	▪ There are only 2 MPV units available (additional ones would need to be built) ▪ Processing software was developed by BTG. Thus, there are few experienced processors and BTG may have to be part of the classification team.	▪ There are 4 TEMTADS units available and the new MetalMapper 2x2 equivalent is now available commercially. ▪ Software is commercially available and there are several experienced processors within the industry
	Cost	▪ The MPV is estimated to cost \$80,000-\$100,000	▪ The TEMTADS/MetalMapper 2x2 is approximately \$100,000-\$150,000

7.1.1 Detecting Deep TOI

Exhibits 3.1 and 3.2 indicate how depth of detection varies with site noise. Overall, the MPV demonstrated the ability to detect small TOI such as the MkIV Booster deeper than the TEMTADS, or the EM61. Considering the site noise levels ranged from 0.17 mV/A to 2 mV/A, the minimum depth of detection of the MkIV Booster can range from 0.24m to 0.39m. However, if the TEMTADS data could be processed to reduce the effect of site noise, it is possible that it could achieve detection depths equivalent to that demonstrated by the MPV.

The depth of detection with any system is related to the amount of site noise; however, the TEMTADS demonstrated the greatest depth of detection for large, deep objects. Based on the range of noise observed during the Pilot Study, the minimum depth of detection can range from 0.6m to 1.2m. If the orientation of the projectile is more favorable it can be seen deeper than these depths. If it is necessary to detect large objects deeper than this, the G-858 magnetometer, used in combination with an AGC instrument would be recommended. In this situation, rules would need to be developed to describe to process for dealing with magnetic and EM anomalies. For example, it would have to be determined whether it would be acceptable to leave magnetic anomalies in the ground, if the AGC data classified the item as a non-TOI.

7.1.2 Minimizing the Number of Intrusive Investigations

During this Pilot Study, the 90% clutter rejection rate (e.g., only 10 of 100 targets would be recommended for digging) for the MPV data was superior to the 41-77% clutter rejection rate for the TEMTADS. Based on this data point alone, the MPV would require significantly less intrusive work on a property, reducing time on site and the associated costs of additional digging.

However, the TEMTADS analysis was very conservative and considered targets that were in high noise areas as 'Cannot Analyze', to ensure nothing was missed. As the more aggressive MPV process may not have accounted for the risk of missing small TOI in areas of high noise in the same manner as the TEMTADS, the upper end of the TEMTADS clutter rejection rate, 77%, was used for comparative purposes for this Study (the more conservative TEMTADS classification procedure could likely be modified to increase the clutter rejection rate based on the Pilot Study data). Note that since the MPV had lower noise levels, it would not likely have had as many 'Cannot Analyze' determinations as the TEMTADS, and so the MPV is still considered much more favorable with regard to minimizing the number of digs.

7.1.3 Blind Seed Detection and Classification

The MPV detected 13 of the 14 blind seeds during the Dynamic survey, and they were mapped with lesser offset distances than the TEMTADS, which only detected 9 of the 14 blind seeds. However, the MPV missed one blind seed (i.e., categorized it as "do not dig") based on the Cued data. This is described in detail in NCR 004 (Section 6.5 and Appendix D). The TEMTADS categorized all blind seeds as "dig" based on Cued data.

7.1.4 Instrument Coverage and Property Impacts

As a function of acreage covered by the instrument, with minimal disturbance to the existing property, the MPV is significantly better than the TEMTADS (see Table 2-10 for instrument coverage of each property). The MPV is able to obtain data much closer to obstacles and allows the operator to situate the positioning sensor and maximize coverage with a single RTS setup. The MPV can maneuver between close trees and low-lying vegetation without harming them, producing a significant advantage with regard to vegetation and landscaping impacts. The TEMTADS requires more cleared acreage to operate. Based on the experience of the Pilot Study, this could be a significant factor for the full scale future remediation of the SVFUDS.

7.1.5 Availability of Equipment and Trained Processors

At this time, there are only two MPV systems in existence, both owned by BTG. It is assumed that additional systems could be built, particularly if a commitment was made by USACE, but the details are not certain. There are at least four TEMTADS units in existence similar to the one used during this Pilot Study; however, the commercial model produced by Geometrics (MetalMapper 2x2) has recently become available. It is assumed that the quality of the new MetalMapper 2x2 will be greater than or equivalent to the TEMTADS used for the Study.

The only software capable of processing MPV data at this time is UXOLab, software that was developed by BTG. While UXOLab has been made available to industry and USACE personnel, the number of experienced MPV processors available is limited, and BTG may have to be associated with future remedial activities using the MPV. TEMTADS data can be processed using the Geosoft Oasis montaj UX-Analyze Advanced extension. At this time the tools required to process dynamic data are not available, but are expected to be released by early 2017. There are several geophysicists in the industry that have been trained to process TEMTADS data, however it is unclear how many companies will be accredited to perform this work.

7.1.6 Cost and Level of Effort

The Pilot Study incorporated the efforts of five separate contractors. As a result, the level of effort (LOE) and cost could not be tracked consistently for all phases of work and the ability to provide a quantitative cost analysis was limited. The MPV, with a cost estimated at $80,000-$100,000, is likely to be less expensive than the commercially available MetalMapper 2x2 (TEMTADS equivalent), at approximately $100,000-$150,000. These costs are estimated and are not based on quotes from vendors. However, the future remedial activities at the SVFUDS would not necessarily require a large number of units as the amount of production work that could be done concurrently will be limited by the need to obtain Rights-of-Entry for individual properties. That is, an economy of scale discount for these units is unlikely to be supported.

7.1.6.1 AGC Data Collection, Processing, Classification LOE

The MPV requires more setup time for dynamic data collection, relative to the TEMTADS, because ropes must be laid out to guide the operator. This extra time may be recovered based on the MPV instrument's ability to maximize coverage from a single RTS setup. Based on observations made during the Pilot Study, the TEMTADS required more RTS setups than the MPV. Each RTS setup takes approximately 20 to 30 minutes; therefore, the ability to minimize the number of times the system must be taken down and setup again is significant. For cued data collection, the LOE for both systems is very similar, assuming the targets have been reacquired ahead of time. The MPV instrument's ability to reacquire in real time is advantageous if single target flags have been lost or removed, as happened during the Study, because it can eliminate the need for reacquisition. The MetalMapper 2x2 may also have this capability.

Summarizing information from Section 2.6, on average, for properties the size of those in the Pilot Study, it is estimated that 2 to 4 days will be required to complete dynamic and cued data collection using either system. This is likely similar to the production rate for collecting data using both the EM61 and G-858 instruments on each property.

In general, the dynamic source selection process utilized by the MPV processors took longer than the amplitude selection process utilized by the TEMTADS processors. However, this increase in LOE is justified based on the increased accuracy and potential reduction in cued target locations for the MPV. The data processing LOE for AGC data can be much greater than that for traditional DGM methods. Cued data processing is typically performed using scripts and can be streamlined, however, the final classification decisions will take additional time. This amount of time will vary depending on the classification process. Another important consideration for AGC data processing is that time must be allotted for Data Usability Assessments (DUAs) between phases of work to ensure that the DQOs are being achieved.

7.2 Comparative Analysis Conclusions

Comparative analysis of both AGC instruments indicates that there is no strong preference for one method over the other. As Table 7-1 indicates, of the 13 criteria examined, seven favored the MPV and six favored the TEMTADS. However, assessing favorability for some criteria was dependent on certain assumptions about future actions and it is not known whether those assumptions will ultimately be supported. In addition, some criteria were considered more impactful than others. Thus, an informal qualitative weighting of some of the criteria was used to help differentiate between the methods.

Of the seven criteria under 'Technical' considerations, the MPV was favorable for four of them. One of those, "Reducing the number of digs" was considered to carry more weight than the others, and the MPV significantly reduced the number of digs that would be required on a given property, relative to the TEMTADS. Of the six 'Logistical/Practical' criteria, three were favorable for the MPV and three were favorable for the TEMTADS. Two of the six criteria, "Property Impacts" and "Availability of Equipment" were considered to carry more weight than the others. The MPV significantly minimizes the overall negative impact on a property relative to the TEMTADS by reducing the amount of vegetation removal, an advantage significant beyond the cost savings, as fewer home owner meetings, less landscaper planning, fewer unknowns regarding the success of transplanted vegetation, and less time overall occupying a given property, will be required. This will ultimately contribute to community goodwill across a large-scale project that may take several years to complete.

The fact that the TEMTADS (or MetalMapper 2x2) is more commercially available and has readily available software was also a significant factor. However, for this Study, it was assumed that the necessary number of MPV units would become available, and that an accommodation of software or processor personnel needs would be made, should USACE committed to this approach for full-scale remediation of the SVFUDS, i.e., these disadvantages could be overcome by a USACE commitment to use the MPV for remediation purposes.

In summary, while the MPV technology appears to have a slight advantage over the TEMTADS based on the above analysis, given the lack of a clear preference for one methodology over the other and the unknowns associated with the various assumptions that could impact the choice, it is concluded that either technology could be effectively utilized to meet the RAOs for the SVFUDS.

With regard to the need to detect larger items at greater depths than either AGC method could achieve, the G-858 magnetometer, historically used at the SVFUDS to investigate for the presence of pits and trenches, could continue to be deployed to supplement the AGC technology. The G-858 has a relatively small footprint (similar to the MPV) and significantly better maneuverability than the traditional EM61.

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8.0 CONCLUSIONS AND RECOMMENDATIONS

The Pilot Study assessed the performance of AGC methodologies using MPV and TEMTADS systems with a primary objective of evaluating whether AGC methodologies could be used to effectively meet the RAOs for the SVFUDS. This section discusses the overall success of the Pilot Study with regard to the primary objective, providing a more detailed comparative analysis of AGC vs the traditional DGM methods historically performed at the SVFUDS using an EM61 and G-858 magnetometer.

As provided in the approved UFP-QAPP DQOs, the primary goal of data collection was to answer the following question:

- Can classification be used effectively to meet the RAOs for the SVFUDS?

The success of the Pilot Study with regard to answering this question is assessed relative to achievement of the DQOs and MQOs.

8.1 Data and Measurement Quality Objectives

The approved decision rules for drawing conclusions from the study findings were as follows:

- If the data quality of both the detection and cued data are verified and validated, and the demonstrator's classified and ranked dig list results in a reduction in the number of unnecessary intrusive investigations without incorrectly classifying a TOI, then AGC technology will be considered a potentially effective tool for the SVFUDS.

- If the quality of either the detection or cued data cannot be verified or validated, or if the demonstrator incorrectly classifies TOI, an RCA will be performed.

- If the RCA results in a finding that site-specific conditions prevented the data quality from being acceptable, or prevented the TOI from being correctly classified, then AGC technology may not be an effective tool for the SVFUDS.

8.1.1 <u>DQO and MQO Achievement</u>

Sections 3.7 and 6.5 discuss challenges to achieving MQOs during the Pilot Study. The RCA and proposed corrective actions are discussed in these sections. With the exception of NCR001 (resolved by modifying procedures), the primary causes for the non-conformances were depth of detection limitations combined with site and sensor specific noise. Site-specific conditions did prevent some TOI from being detected and correctly classified in these cases; the implications are further analyzed below to determine if AGC technology should be considered an effective tool for future SVFUDS remedial actions.

The depths of detection for various munitions (for each instrument) based on the site specific noise observed during this demonstration, are detailed in Exhibits 3.1, 3.2, and 3.3. The DQO for depth of detection was based on detecting a MKIV Booster at a depth of 1 foot below ground surface. (Note that there was no DQO related to larger items, but this is recommended for future work). The MPV achieves this depth of detection metric in the minimum noise environments on all properties, however fails to meet this metric in the maximum noise environments at 4733 Woodway and 4740 Quebec. This is also true for the TEMTADS, but additionally, this metric was not met in the minimum noise conditions for this system at 4733 Woodway (the noisiest property). Based on these results, in order for AGC technology to be considered effective at SVFUDS, the following actions must occur:

1. The DQOs must be modified to better define the detection limitations of the AGC sensors in the variable noise conditions present at SVFUDS.
2. A secondary sensor (e.g., the G-858) must be utilized to detect TOI deeper than the AGC sensors, and rules must be developed to determine how this secondary dataset will be used in coordination with the AGC data.

It is concluded that although site-specific conditions did present challenges to the effective use of AGC, these challenges can be overcome by implementing the suggested actions above.

8.2 AGC Methods Compared to Traditional Geophysical Methods

As an initial step in developing recommendations for future remedial activities at the SVFUDS, a brief review of how AGC methods, in general, compare to the traditional DGM methods, is provided. The Pilot Study assessed the performance of AGC methodologies using MPV and TEMTADS systems. Traditional DGM at the SVFUDS historically was performed using an EM61 and G-858 magnetometer.

The primary objective was to evaluate whether AGC provides distinct advantages, relative to traditional DGM, to effectively meet the RAOs for the SVFUDS. The advantages and disadvantages of using AGC methods rather than traditional EM61 and G-858 methods are detailed in Table 8-1.

Table 8-1: Advantages of AGC Methodology Over Traditional DGM Methodology

Advantage	Disadvantage
▪ Multiple receiver cubes allow for greater resolution of detected anomalies, and combined with more advanced positioning systems, result in improved accuracy of detected target positions.	▪ The amount of time required for data collection and processing is greater for AGC than for traditional methods (but this may be offset but the reduction in time spent on intrusive investigation).
▪ Depth of detection for smaller items may be greater.	▪ A magnetometer (a traditional approach), such as the G-858, will be able to see large items deeper than the AGC (or EM61) systems.
▪ As much as 90% of clutter can confidently be left in the ground, drastically reducing the damage to properties and the renovation costs.	▪ Cost of acquiring AGC systems is greater than that for acquiring traditional systems.
▪ Affords increased data density and quality, which results in higher confidence in the removal action if verification and validation procedures are implemented.	▪ More sophisticated processing software and personnel are required for AGC systems.
▪ Advance processing techniques may result in the ability to reduce the effect of site-specific noise.	
▪ Comparing intrusive results to modeled sources for all targets increases the confidence in the process.	

8.2.1 AGC Advantages

As Table 8-1 shows, AGC provides advantages over the traditional DGM methodologies used at the SVFUDS in terms of higher resolution sensors, greater positional accuracy, and better survey metrics using tighter spacing. Large anomaly sources such as utilities and buildings lead to saturated responses that are generally reduced with AGC. These factors result in improved accuracy of detected target positions and will provide an overall higher confidence level in removal actions.

8.2.1.1 Stokes Mortar Example

An example illustrating the advantages AGC methods relative to traditional methods is seen in the Stokes Mortar TOI find at 4720 Quebec during the Pilot Study (Section 3.6.2). The Stokes Mortar was also detected (by both the EM61 and G-858) during the previous investigations (2007-2009). However, the EM61 survey recorded a saturated area and thus, no target was picked. The G-858 magnetometer recorded a distinct anomaly, but at that time, as it was considered a 'mag-only' target, it was classified as 'not indicative of MEC', and it was not recommended for intrusive investigation. It is acknowledged that the objectives for the previous investigation were not the same as those for a removal action, and that if the traditional methods were applied to a removal action, all detected anomalies would likely be investigated, and the Stokes would have been recovered back then.

Nevertheless, based on the accuracy of the demonstrator's classification of this target, where both the MPV and TEMTADS correctly classified the Stokes Mortar for this Pilot Study, it is clear that the confidence in the ability to detect and identify this TOI is much higher using AGC technology, and it can be concluded that the AGC methods provide higher quality data than traditional methods. The AGC advantages are primarily due to the increase in data resolution and positional accuracy that is afforded by the AGC sensors used in conjunction with the RTK/RTS. The buildings, utilities and other sources of noise present throughout the SVFUDS introduce saturated response areas that make detection of individual targets difficult. In these types of environments data resolution and positional accuracy are critical for increasing the likelihood of detecting TOI.

The 2007-2009 data for the EM61 and G-858 relative to the Stokes Mortar is shown in Exhibit 8.1. When these data are compared to the data for the two AGC systems shown in Exhibit 8.2, the difference in target resolution is evident.

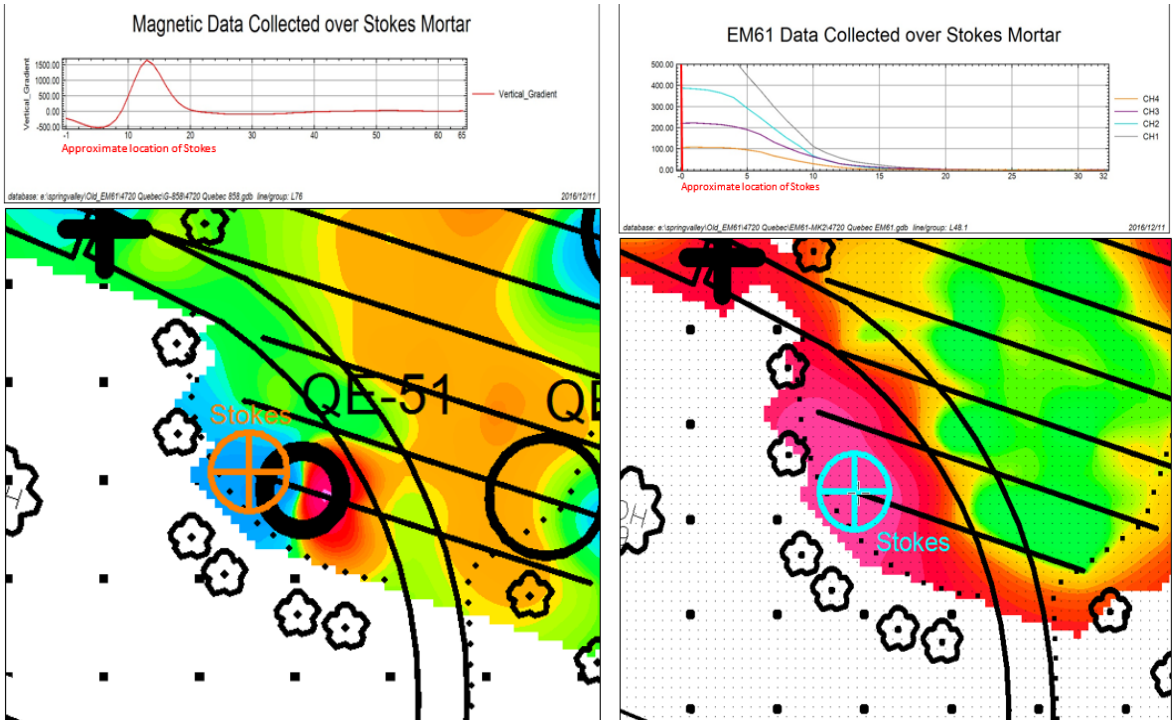

Exhibit 8.1: Stokes Mortar Data – G-858 (left) and EM61

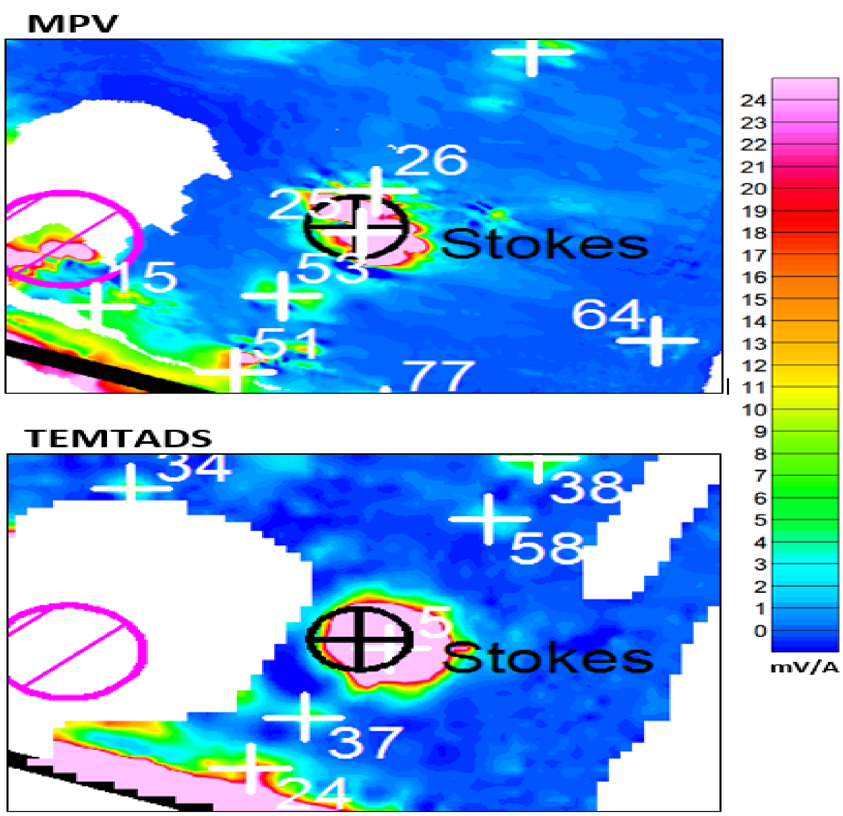

Exhibit 8.2: Stokes Mortar Data – MPV and TEMTADS

8.3 Lessons Learned

While the findings of the Study indicate that AGC technology can be advantageous for future remedial actions within the SVFUDS, this discussion highlights some of the larger challenges that were encountered; it does not include discussion of every technical/logistical hurdle that had to be negotiated to complete the work, such as equipment failures or details of all permitting requirements or home owner involvement with vegetation clearance or landscape impacts.

8.3.1 Acceptance of Leaving Metallic Items in the Ground

Since one of the primary objectives of AGC is to reduce the number of intrusive investigations (digs) required, AGC will leave more metal in the ground than traditional methods where most if not all metallic anomalies are dug. This is a key issue with regard to stakeholder acceptance, whether regulators or the community. To ensure that the methods for determining which items are not intrusively investigated are acceptable to all involved parties, clear DQOs, as well as the verification and validation processes, must be developed in coordination with all stakeholders. While there are limits to any technology, as discussed in this report, AGC technology ultimately provides increased confidence in the ability to detect and classify TOI such that items left in ground can be assumed to be innocuous metallic items.

8.3.2 Site Preparation

Civil property surveys must be obtained earlier in the process, to properly identify fence ownership, border plant ownership, etc. The surveys should be completed before or in conjunction with arborist appraisal, and the surveyor may need multiple mobilizations to support accessible areas determinations and landscape removal decisions (i.e., some could not be made until property lines were clearly delineated) and to survey blind seeds.

Agreement with the property owner and Partners, relative to minimum accessibility DGM survey coverage of the property, must be established

Sufficient time must be allotted for permitting of DC public spaces (required for sidewalks in front of the properties, as applicable).

Utilities (underground and overhead) must be thoroughly mapped early on, not just prior to intrusive work. This may help evaluate interference effects.

8.3.3 Survey System

With regard to establishing location, an important issue was the use of the appropriate survey system, RTS vs RTK GPS. The Pilot Study showed that either system can work, but obviously properties with less open space will present more problems for RTK GPS.

It will also be critical to ensure there are sufficient points to establish location. Based on the Pilot Study, for RTK GPS, a minimum of two points per property is recommended, while for RTS three points in the front yard and three in the backyard of each property is a reasonable minimum for efficient RTS operation.

8.3.4 Geophysical System Verification

IVS items should be placed at reasonable depths of detection. The purpose of the IVS is not to determine the depth of detection, but rather to confirm that the AGC system is working correctly.

ISOs are recommended for verification and validation blind seeds. The standard black steel pipe nipples defined in the ESTCP Guidance "Geophysical System Verification (GSV): A Physics-Based Alternative to Geophysical Prove-Outs for Munitions Response, Addendum – September 24, 2015" should be utilized to avoid detection issues based on material properties. Stainless steel seeds should not be utilized

Potential interference effects should be evaluated before placing blind seeds; making them hard to find may improve performance, but too hard to find may reduce data confidence.

8.3.5 Noise

The site noise observed during the Pilot Study had the greatest impact on the quality of the AGC data. The site noise was found to vary spatially and temporally. As a result, flexibility should be introduced into project DQOs and MQOs to allow for variable site conditions. Target selection thresholds should be defined to maximize depth of detection based on the site specific noise for each property. Additional processing steps should also be explored to determine if the noise can be reduced digitally.

8.4 Recommended Procedures for Future Work

In order to obtain the highest quality classification results, the following suggestions or procedures may need to be implemented for the future SVFUDS remedial work based on lessons learned during the Pilot Study. Some of these are specific to one instrument, but most apply to AGC procedures in general:

- Project DQO's should consider the variable depth of detection for small and large TOI based on site specific noise.
- The UFP-QAPP Guidance should be followed for blind seeding.
  - Blind seeds should be placed shallower than the minimum depth of detection.
  - Blind QC seeds must be detectable as defined by the DQOs and located throughout the horizontal and vertical survey boundaries defined in the DQOs.
  - Blind QC seeds should be distributed such that the field team can be expected to encounter between one and three seeds per day per team.
  - Based on production rates observed during this Pilot Study there should be at least 2 blind seeds per property.
  - Variable rate QA seeding should also be implemented on each property.
  - Stainless steel seeds should not be used for classification.
- Dynamic data should be positioned with RTS or RTK GPS rather than fiducially.
- Line spacing should be maintained at 0.5m for MPV and no greater than 0.6 m for the TEMTADS as measured from the center of the sensor (not each receiver cube).
- Additional consideration should be given to processing techniques that may result in increased SNR in the dynamic data.
- Processors should consider selecting amplitude targets on gridded data, rather than on profiles, to eliminate duplicate picks.

- Advanced source selection is recommended to improve the accuracy of cued flag locations and eliminate targets that do not meet conservative size requirements.
- The process for determining which cued data fall into the "Cannot Analyze" category should be well defined, and the limits to the decisions should be made clear to all stakeholders.
- Data Usability Assessments: DUAs should be written and approved after each phase of work. This will ensure that the data are acceptable for achieving the project DQOs and will prevent unnecessary rework in the event of a failure.

8.4.1 <u>Verification/Validation</u>

Verification/Validation: Verification/validation should be developed with stakeholders and regulators and performed in accordance with the UFP-QAPP guidance. The level of effort and cost for verification and validation of the data will be greater for AGC methods compared to traditional DGM, as a result of using more complex processes. Implementing these processes will impact cost and schedule and must be considered during project planning. Verification/Validation processes recommended for future efforts, include the following:

- Verification/validation Seeding: Verification Seeds describe seeds placed by the contractor performing the work. These serve as an internal QC check. Validation Seeds are seeds emplaced by the government or a third party. These serve as a QA check, and have more serious consequences if one is missed. For this Pilot Study only Verification Seeds were utilized.
- Verification/Validation Digs: These are additional intrusive investigations that are performed beyond the "stop dig" point on the classified and ranked list. While it is common within the industry for the next 50 to 200 targets to be investigated to verify that the classifier was not too aggressive, these numbers are too large to be used on a property by property basis. Due to the size of the properties and the expected number of targets, a reasonable verification and validation approach would be to utilize percentages of detected anomalies. Regulators and Stakeholders should provide input when defining the percentage of required verification/validation digs; this can be further refined in the UFP-QAPP development planning stages. However the following percentages are recommended:
    - Verification digs should consist of 10% of the total cued target population. The highest ranking non-TOI should be investigated to verify the stop dig threshold.
    - Validation digs should consist of 5% of the total cued target population. These should be randomly selected from the non-TOI population and the relative size and shape of the intrusive results should be compared to the classification results to ensure they are consistent.
    - USACE should consider developing rules to prevent Verification and Validation digs from unnecessarily increasing the costs. For example, consider that no verification/validation digs will be selected in hardscape locations.

8.5 Accreditation

It is understood that ISO 17025 Accreditation will be required for AGC work starting in 2017. Accredited companies will have demonstrated capability to successfully implement procedures that align with the government's interpretation of the ISO standard. Accreditation is not instrument specific, but it does require all subcontractors to fall under the quality management system of the accredited company. The requirements for ISO 17025 include stop work requirements that may impact project schedule and cost. This will need to be considered when planning the future remedial actions for the SVFUDS.

8.6 Conclusions

AGC methods employing MPV and TEMTADS systems were successfully used at the SVFUDS. For three private properties, 200+ targets per property were detected, classified, and intrusively investigated. Four MD items, including one intact Stokes Mortar (determined to be an unfuzed practice round), were found. As a Pilot Study, all targets were dug, regardless of the final AGC classification of the item.

In general, while there were challenges with noise in an urban environment, the findings of this Pilot Study support the implementation of AGC methods over the traditional DGM methods for future SVFUDS remedial actions. With regard to performance of the individual AGC methodologies, while the MPV technology appears to have a slight advantage over the TEMTADS, given the lack of a strong preference for one system over the other, it is concluded that either technology could be effectively utilized to meet the RAOs for the SVFUDS.

Finally, with regard to the need to detect larger items at greater depths than either AGC system could achieve, AGC methodologies could be supplemented by traditional DGM technology, such as the G-858, to address deeper targets.

8.7 Recommendations

The findings of this Pilot Study support the implementation of AGC methods over traditional DGM methods for future SVFUDS remedial actions. The specific AGC methodology to be implemented should be refined through the planning process, considering the recommended procedures presented in Section 8.4, as well as input from project stakeholders.

9.0 REFERENCES

USACE, 2007. *Site-Wide Work Plan for the SVFUDS*, Final, March 2007.

USACE, 2010. *Site Specific Anomaly Investigation Report for 4720 Quebec Street*. Prepared by Parsons. September.

USACE, 2011a. *Site Specific Anomaly Investigation Report for 4740 Quebec Street*. Prepared by Shaw Environmental, Inc. April.

USACE, 2011b. *Site Specific Anomaly Investigation Report for 4733 Woodway Lane*. Prepared by Shaw. November.

USACE, 2015. *Site-Wide Remedial Investigation Report for the SVFUDS*, Final, June.

USACE, 2016a. *Site-Wide Feasibility Study Report for the SVFUDS,* Final, January.

USACE, 2016b. *Site-Wide Proposed Plan for the SVFUDS,* Final, June.

USACE, 2016c. *Advanced Geophysical Classification for Munitions Response Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) for Munitions Response,* Final March.

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Appendix A: Figures

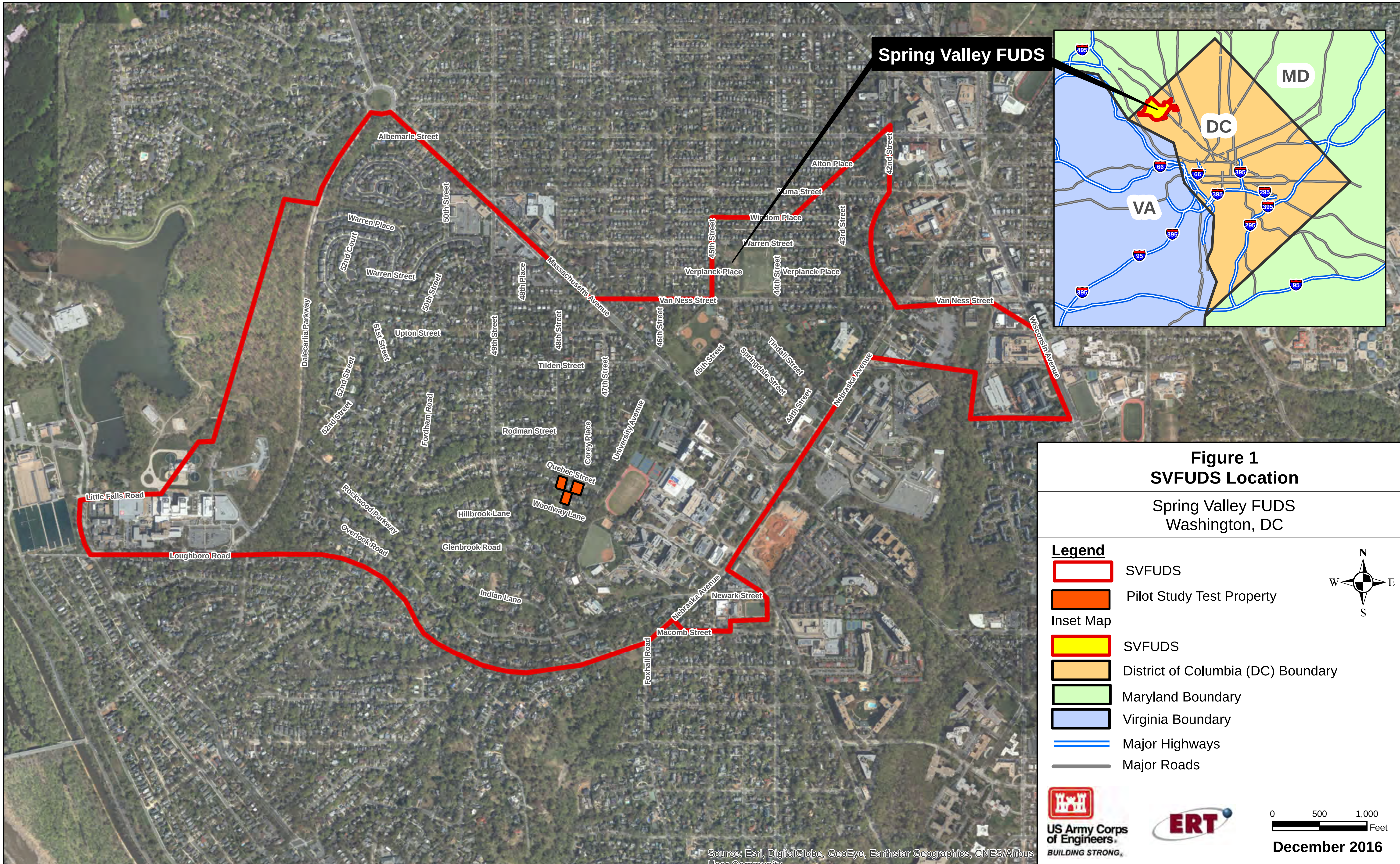

Figure 1
SVFUDS Location

Spring Valley FUDS
Washington, DC

December 2016

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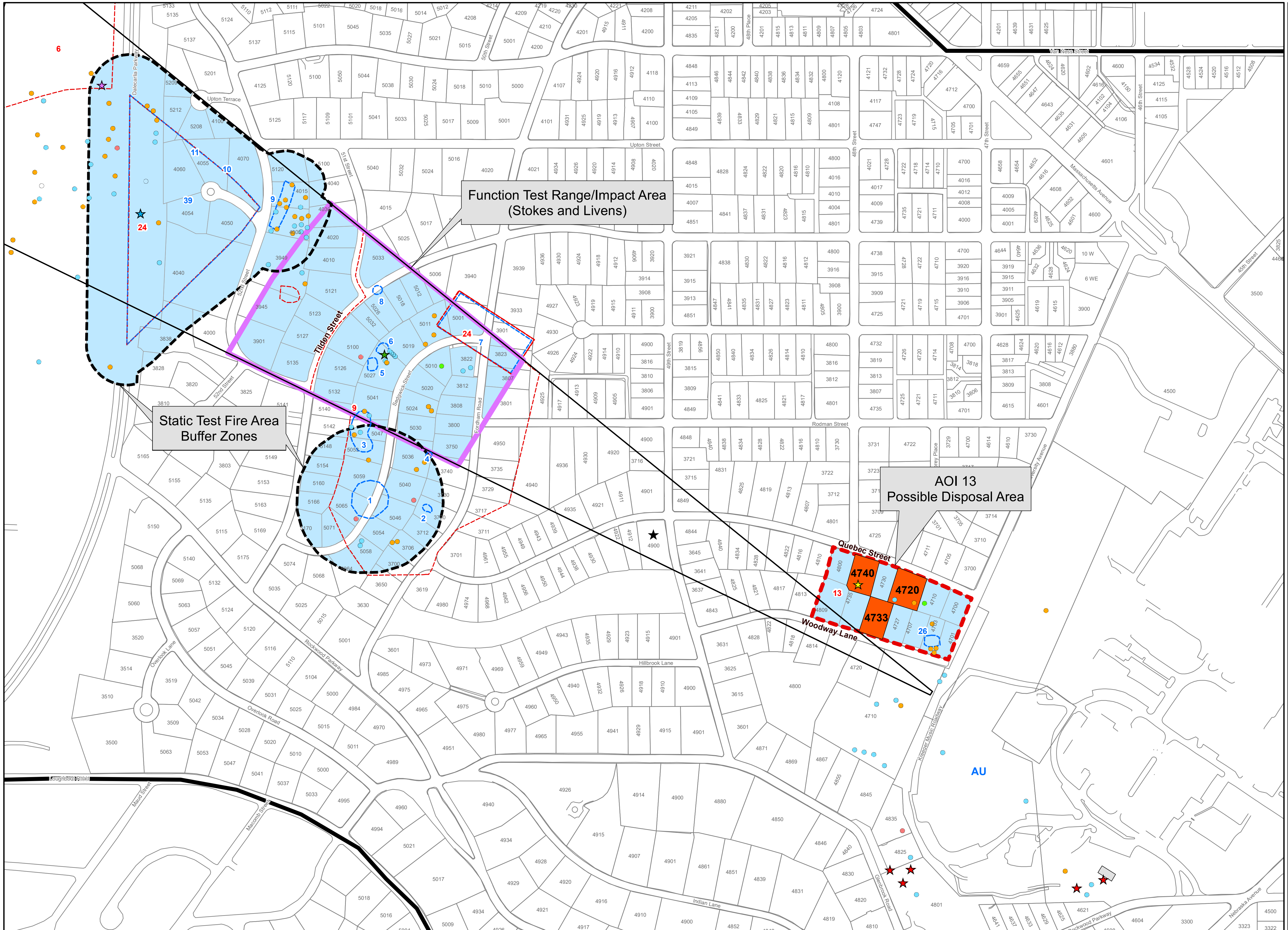

Figure 2
Pilot Study Properties

Spring Valley FUDS
Washington, DC

Legend

- Pilot Study Property
- Areas for Evaluation in the FS
- Buffer Zone (150 FT) of Statically Fired Testing Areas
- Function Test Range/Impact Area (Stokes and Livens)
- Area of Interest (AOI)
- Point of Interest (POI)
- Range Fan
- Parcels
- FUDS Boundary

Items

- Livens Projectile (MEC)
- Stokes Mortar (MEC)
- 75 mm Projectile (MEC)
- Thermite Grenade (MEC)
- Pipe with Explosives (MEC)
- Disposal Area (MEC/CWM)
- 75 mm MD
- Livens MD
- Stokes Mortar MD
- MD (miscellaneous)
- Non-AUES MD

N W E S

0 250 500 Feet

December 2016

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Legend

✕ TEMTADS Dynamic Targets

Surveyed Property Line

Property Features

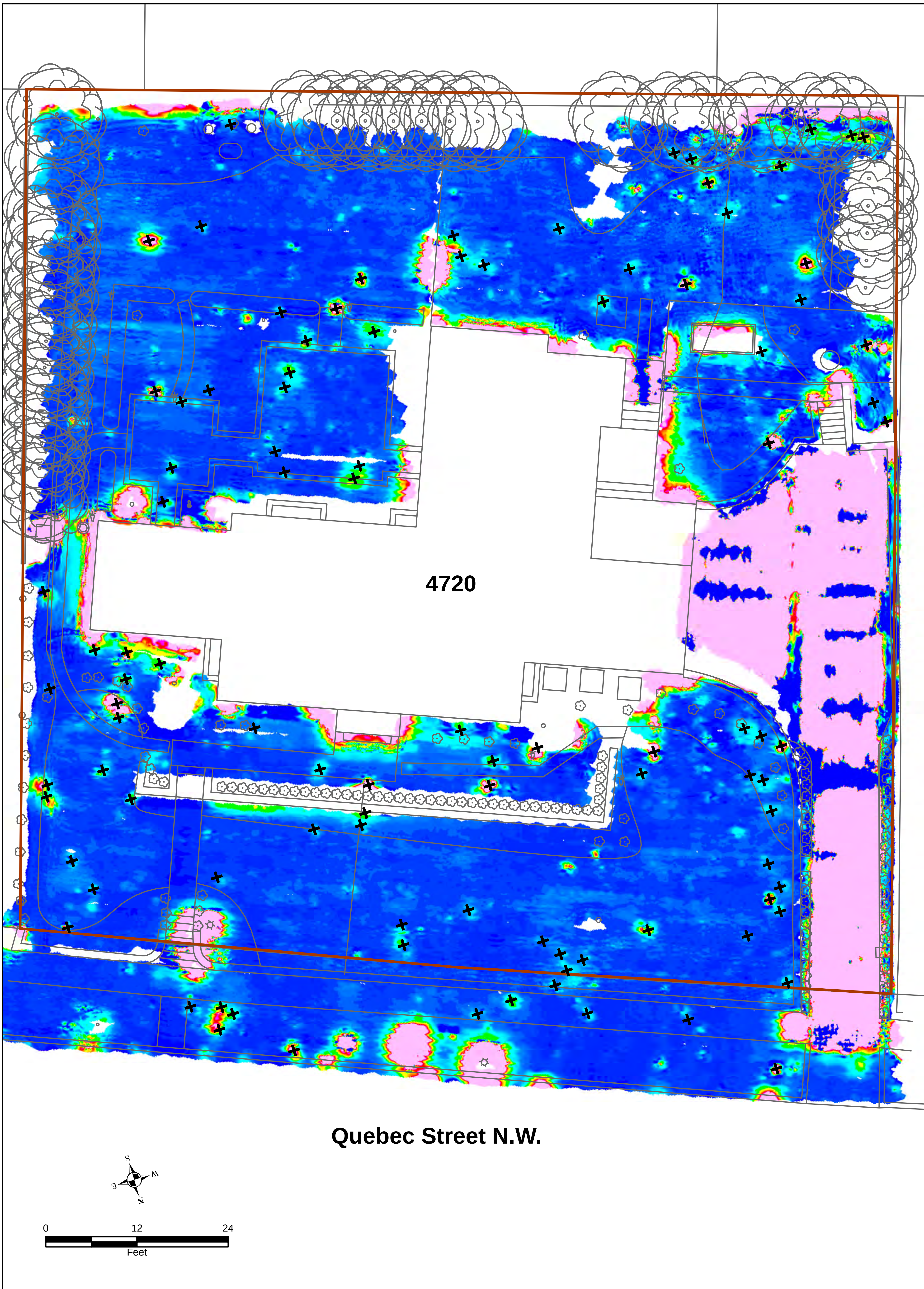
TEMTADS Response (millivolts per amp)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Figure 3
TEMTADS Dynamic Data Targets
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016



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Legend

+ MPV Dynamic Targets
Surveyed Property Line
Property Features

MPV Response
(millivolts per amp)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Figure 4
MPV Dynamic
Data Targets
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016

2016 EM61 coverage of areas not previously surveyed by the EM61.

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EM61 Targets

Surveyed Property Line

Property Features

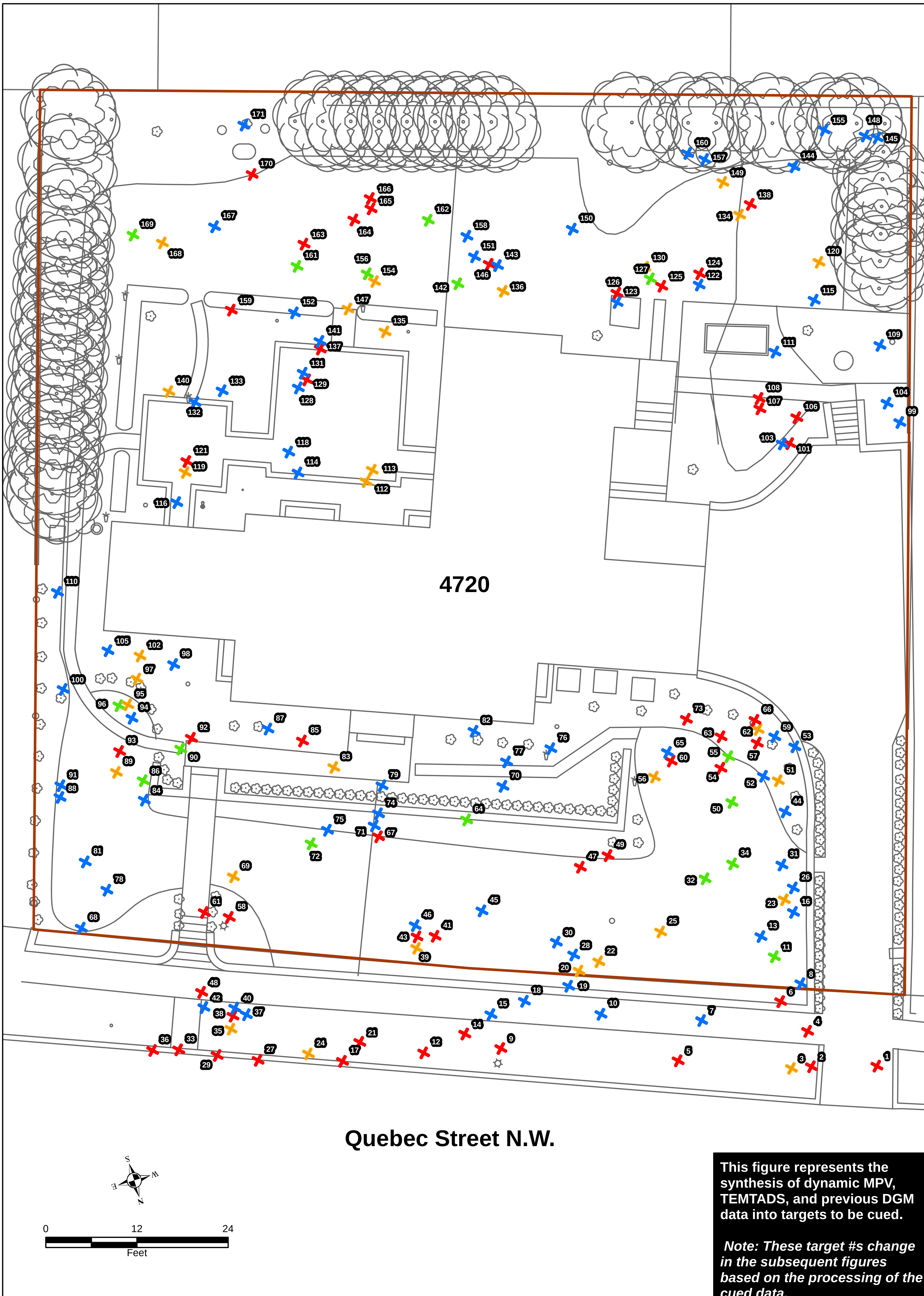
EM61 Response (millivolts)

0 5 10 18 26 34 42 50 58 66 74

Figure 5
Supplemental EM61 Data
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016



This figure represents the synthesis of dynamic MPV, TEMTADS, and previous DGM data into targets to be cued.

Note: These target #s change in the subsequent figures based on the processing of the cued data.

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Legend

- MPV and TEMTADS Cued Targets
- MPV Cued Targets
- TEMTADS Cued Targets
- EM61 and/or G-858 (Previous Data) Cued Targets
- Surveyed Property Line
- Property Features

Figure 6
Targets That Were Cued
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016

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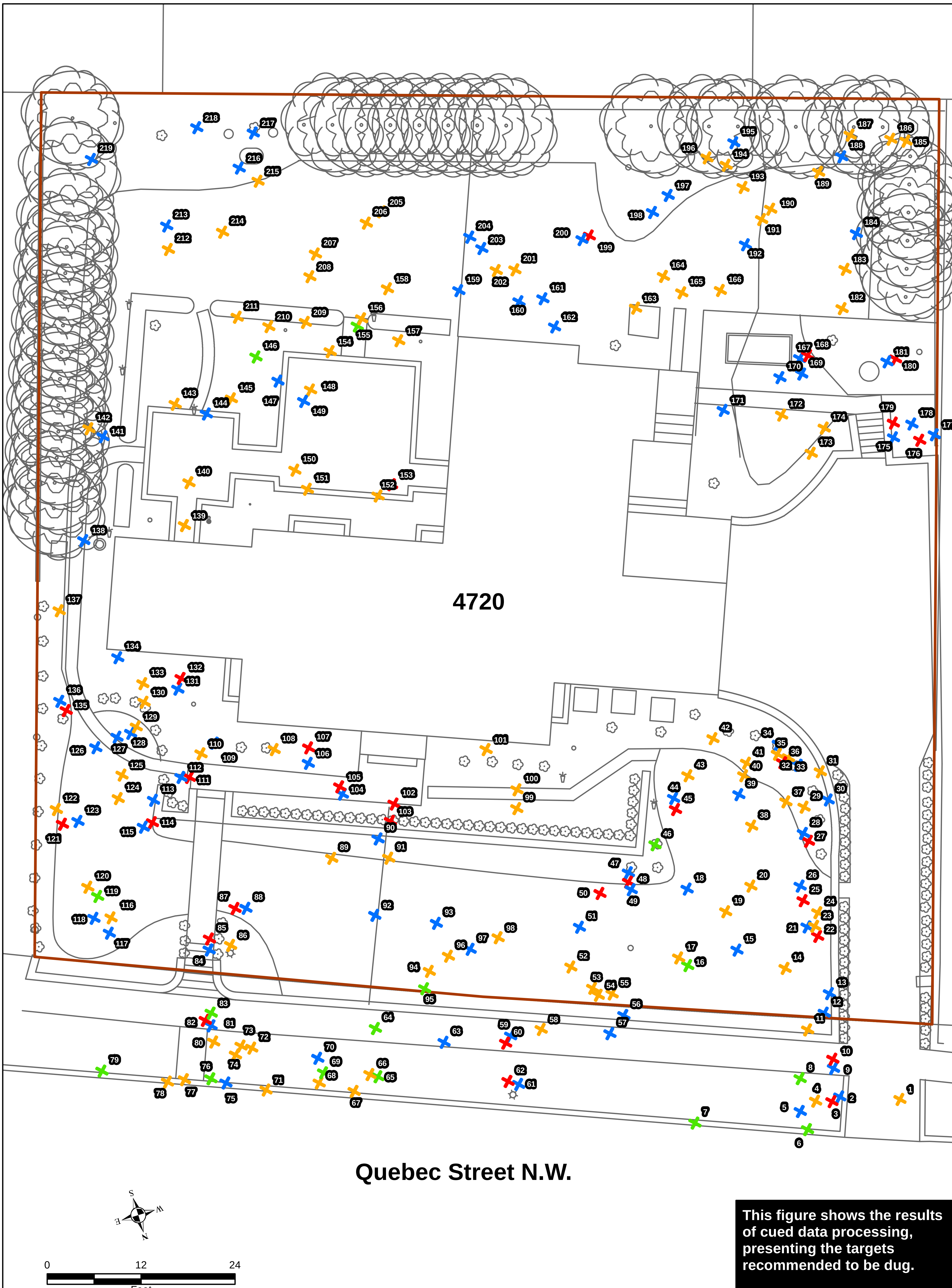

This figure shows the results of cued data processing, presenting the targets recommended to be dug.

Note: Some targets are based on corrective actions (i.e., not the result of cuing).

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Legend

(by Instrument)

- MPV and TEMTADS
- MPV
- TEMTADS
- EM61 and/or G-858 (Previous Data)
- Surveyed Property Line
- Property Features

Figure 7
Final Dig Targets
(by Instrument)
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016

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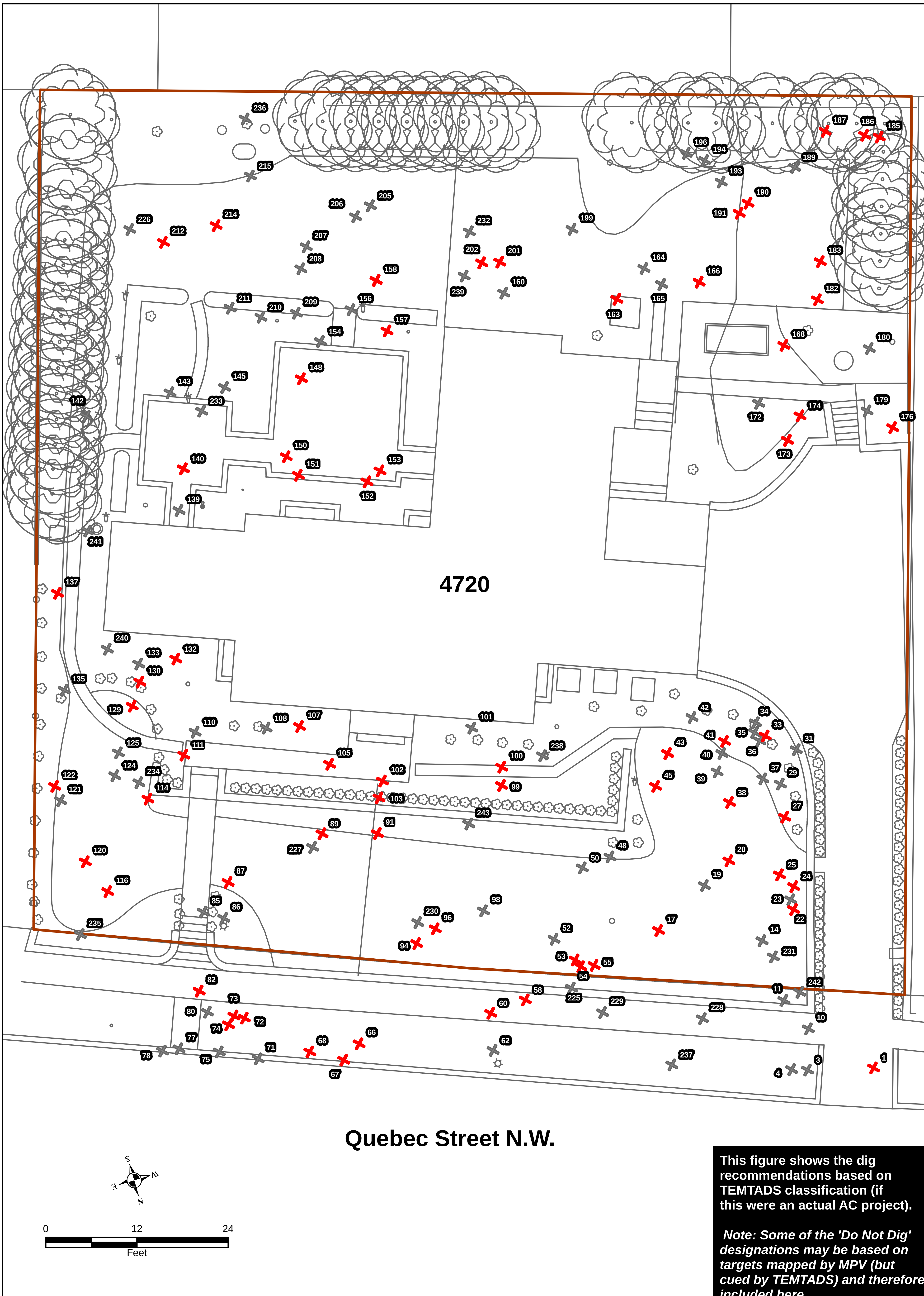

This figure shows the dig recommendations based on TEMTADS classification (if this were an actual AC project).

Note: Some of the 'Do Not Dig' designations may be based on targets mapped by MPV (but cued by TEMTADS) and therefore included here.

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Legend

TEMTADS-only Targets

Decision

- TEMTADS - Dig (Dig High or Low Confidence, Cannot Analyze)
- Do Not Dig
- Surveyed Property Line
- Property Features

Figure 8
TEMTADS Classification of Targets
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016

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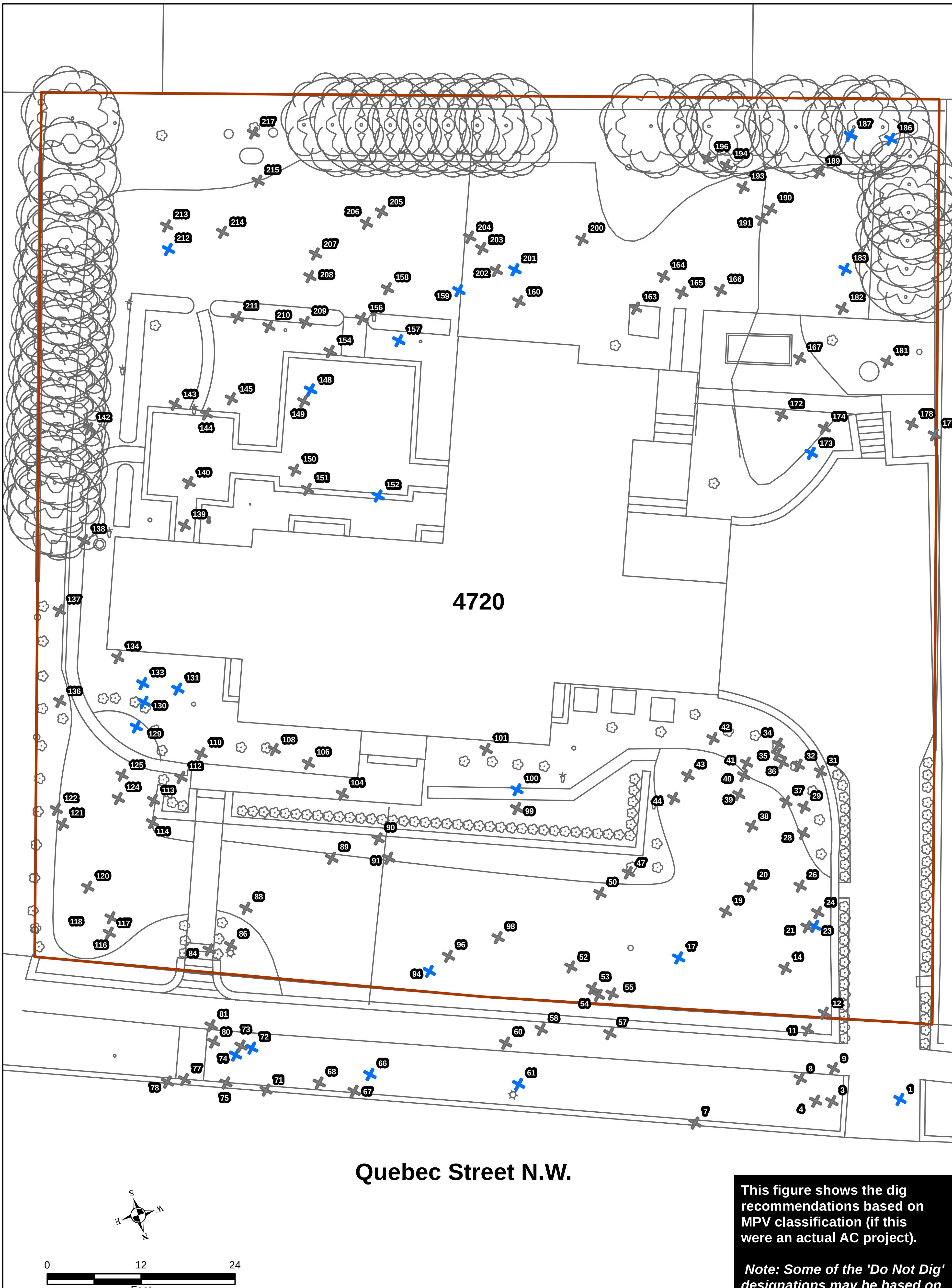

This figure shows the dig recommendations based on MPV classification (if this were an actual AC project).

Note: Some of the 'Do Not Dig' designations may be based on targets mapped by TEMTADS (but cued by MPV) and therefore included here.

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Legend

MPV-only Targets

Decision

- MPV- Dig (Dig, Cannot Analyze)
- Do Not Dig

Surveyed Property Line

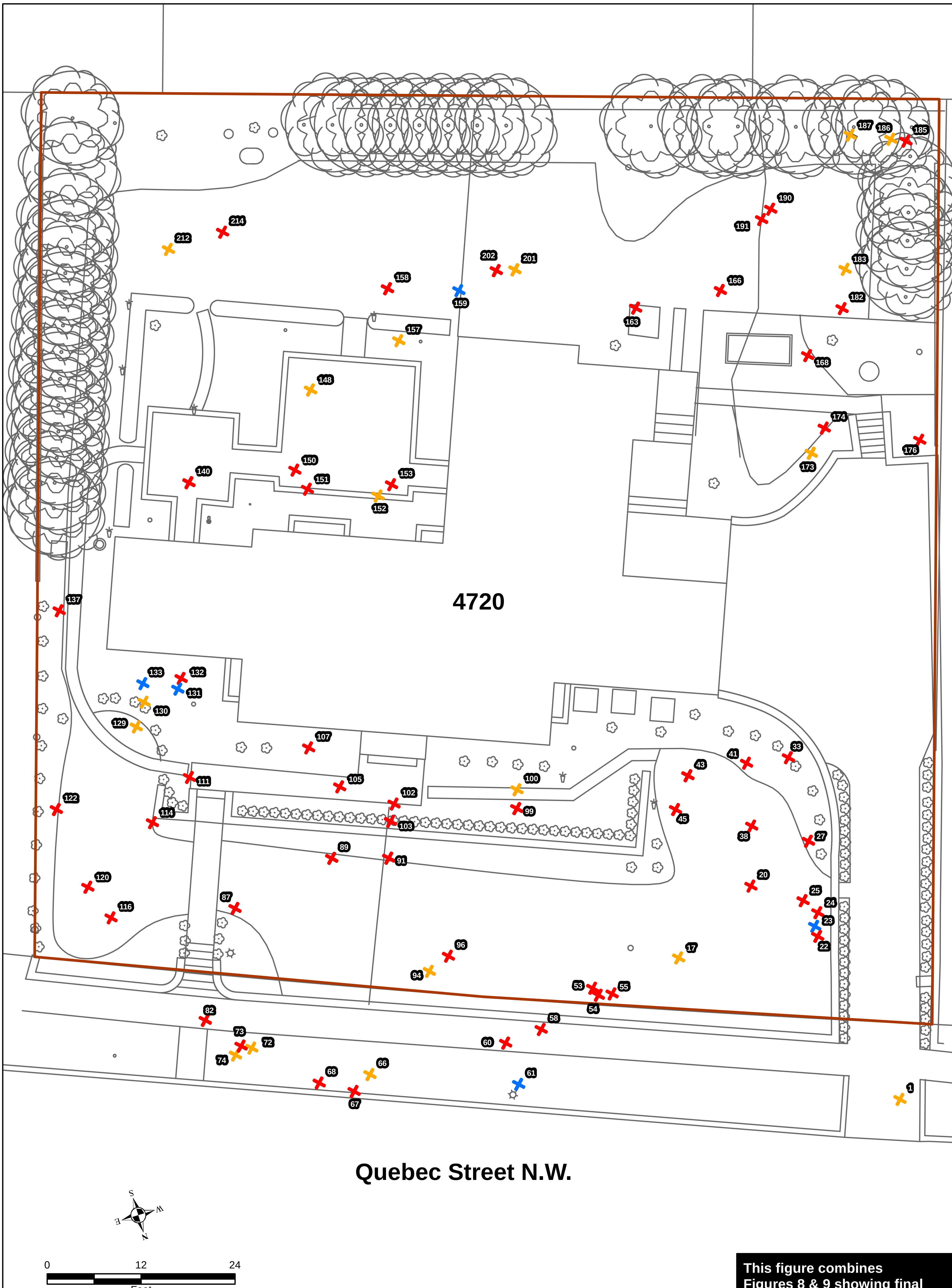
Property Features

Figure 9
MPV Classification of Targets
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016

Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\MPVDig4720Quebec.mxd



This figure combines Figures 8 & 9 showing final recommendation of digs (if this were an actual AC project).

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Legend

MPV and TEMTADS Targets

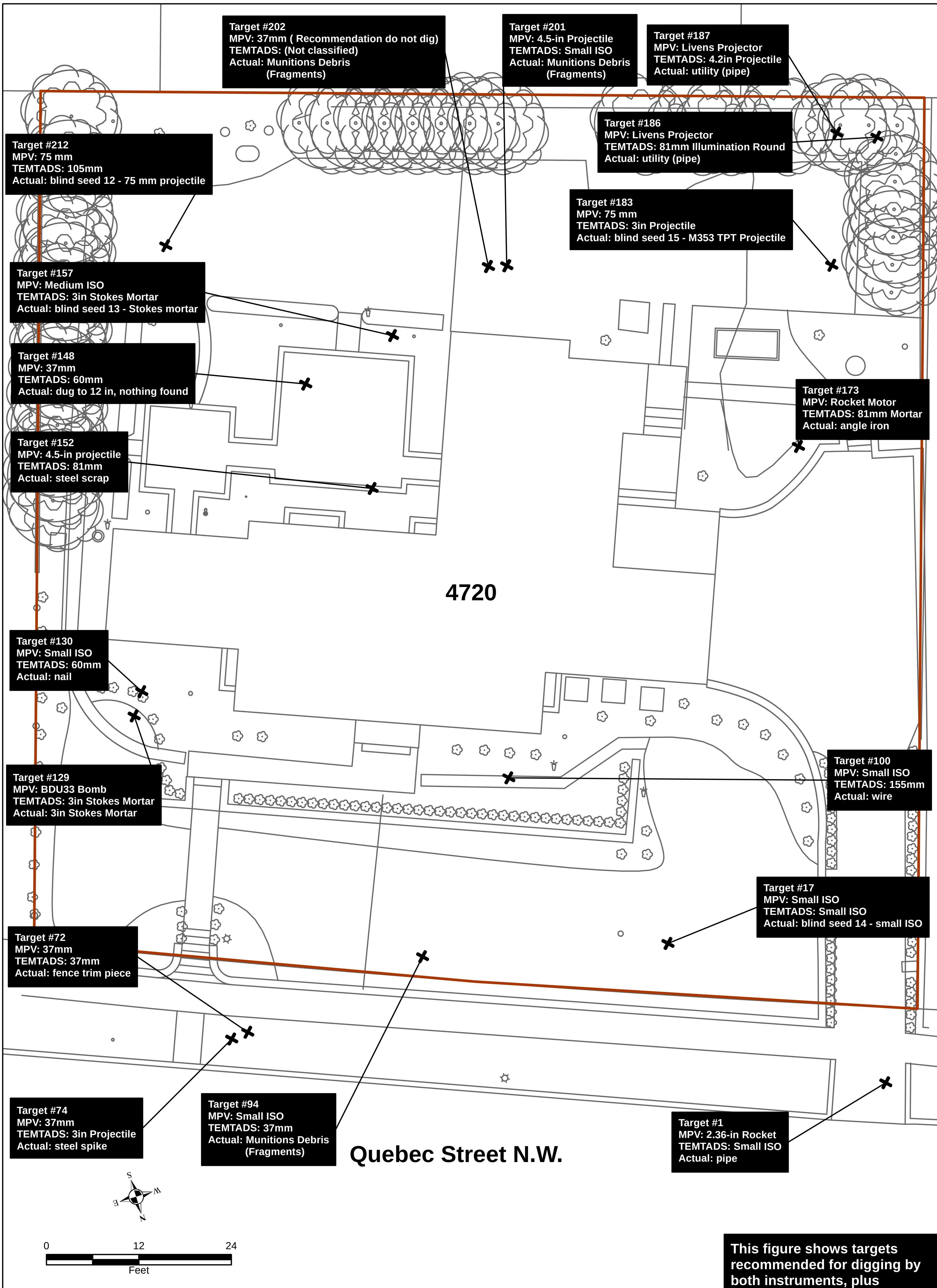
- MPV and TEMTADS - Dig
- MPV - Dig (Dig, Cannot Analyze)
- TEMTADS - Dig (Dig High or Low Confidence, Cannot Analyze)
- Surveyed Property Line
- Property Features

Figure 10
MPV and TEMTADS Classification of Targets
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016

Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\Summation4720Quebec.mxd



This figure shows targets recommended for digging by both instruments, plus munitions-related finds (if any), plus blind seeds.

Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\ImportantFinds4720QuebecRev1.mxd

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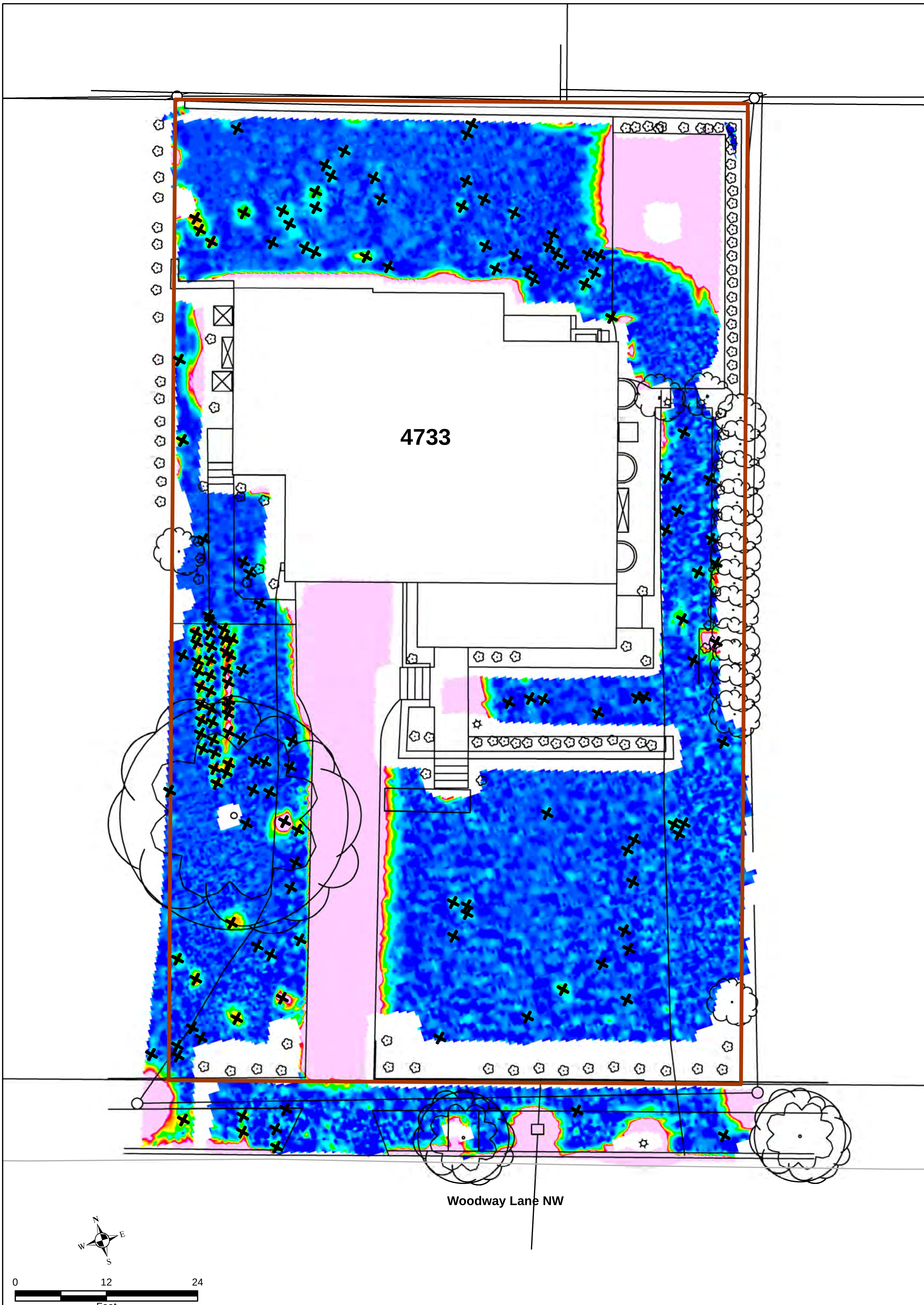
Legend

- ✖ Selected Targets
- Surveyed Property Line
- Property Features

Figure 11
Summary of Selected Targets
4720 Quebec Street

Spring Valley FUDS
Washington, DC

December 2016



Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\TEMTADS_4733Woodway.mxd

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Legend

- TEMTADS Dynamic Targets
- Surveyed Property Line
- Property Feature

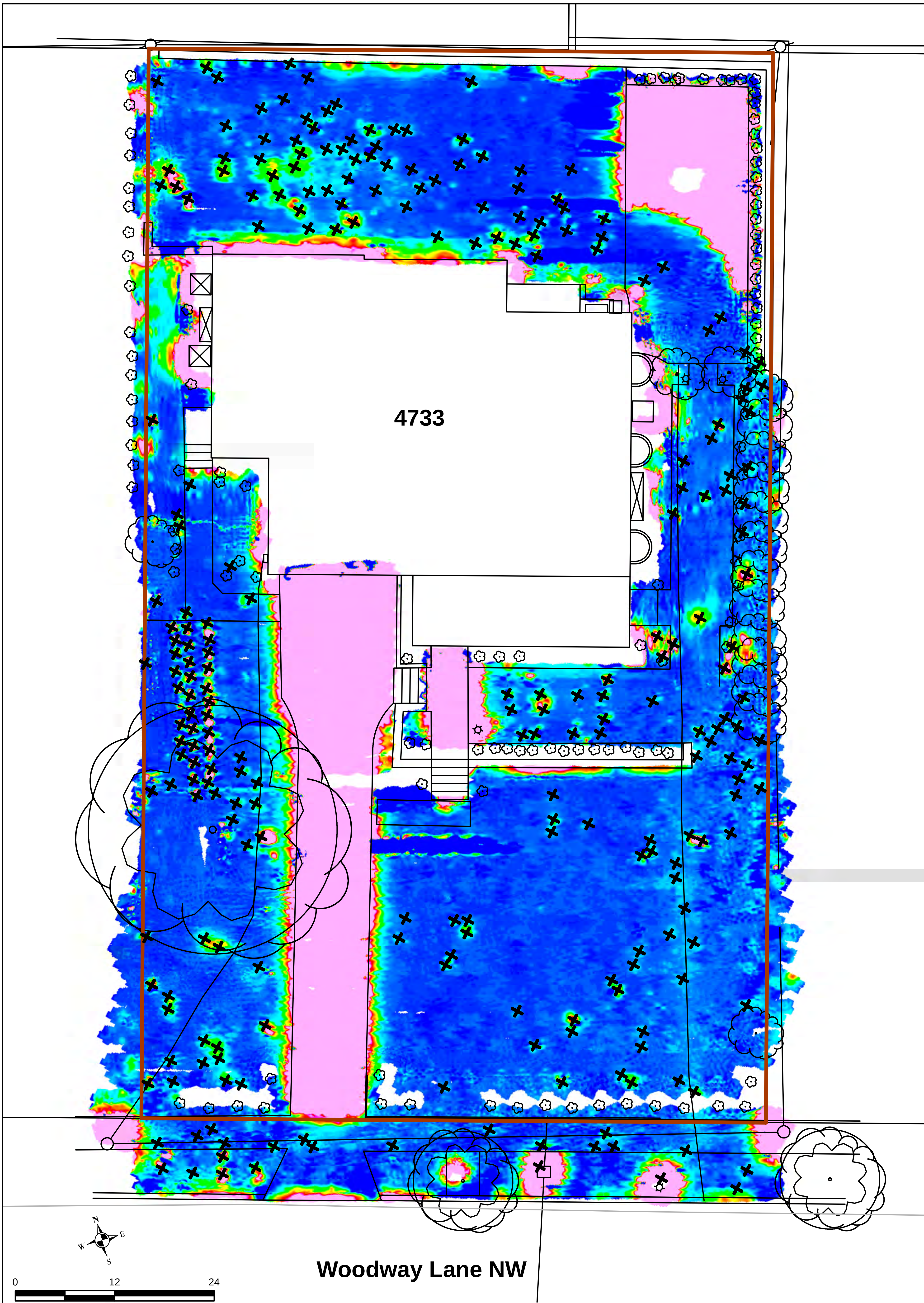
TEMTADS Response (millivolts per amp)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Figure 12
TEMTADS Dynamic DataTargets
4733 Woodway Lane

Spring Valley FUDS
Washington, DC

December 2016



Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\MPV_4733Woodway.mxd

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Legend

✖ MPV Dynamic Targets

Surveyed Property Line

Property Feature

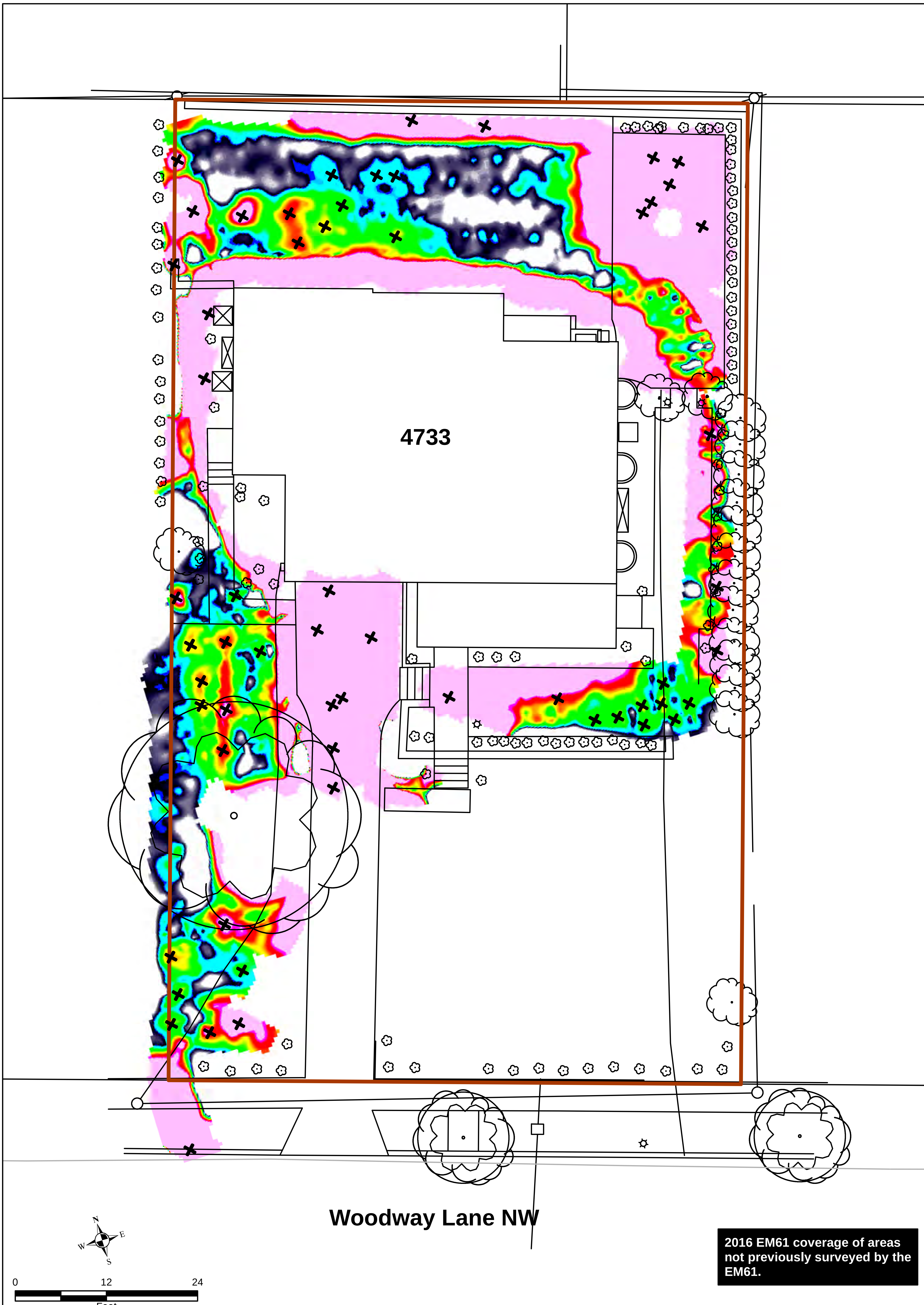
MPV Response (millivolts per amp)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Figure 13
MPV Dynamic DataTargets
4733 Woodway Lane

Spring Valley FUDS
Washington, DC

December 2016



Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\EM61_4733Woodway.mxd

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Legend

✕ EM61 Targets

Surveyed Property Line

Property Feature

EM61 Response (millivolts)

0 5 10 18 26 34 42 50 58 66 74

Figure 14
Supplemental EM61 Data
4733 Woodway Lane

Spring Valley FUDS
Washington, DC

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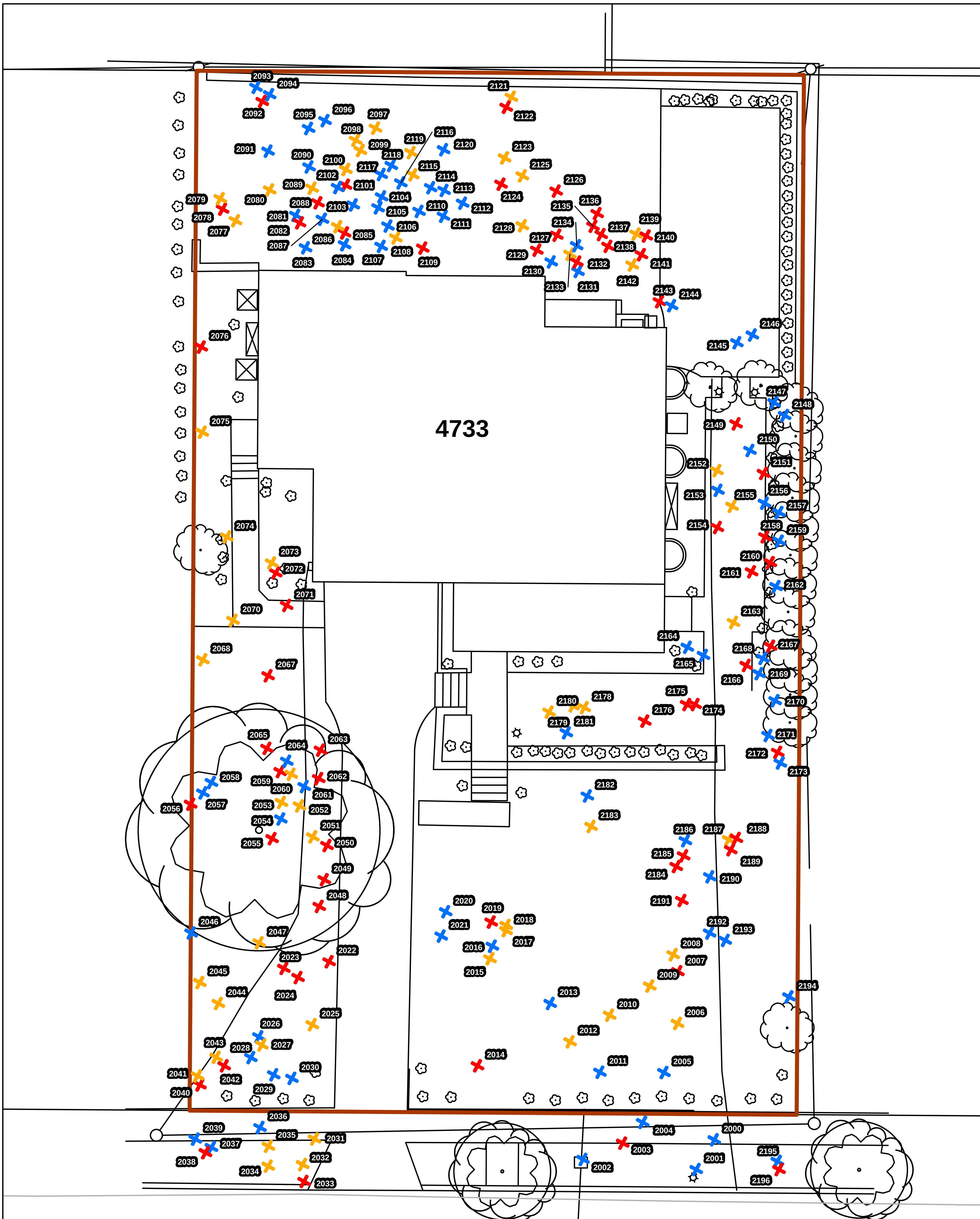

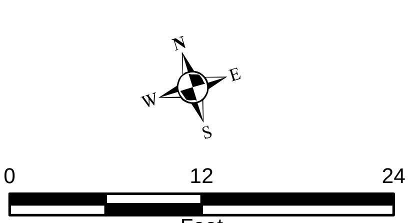

This figure represents the synthesis of dynamic MPV, TEMTADS, and previous DGM data into targets to be cued.

Note: These target #s change in the subsequent figures based on the processing of the cued data.

Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\Cued_Targets4733Woodway.mxd

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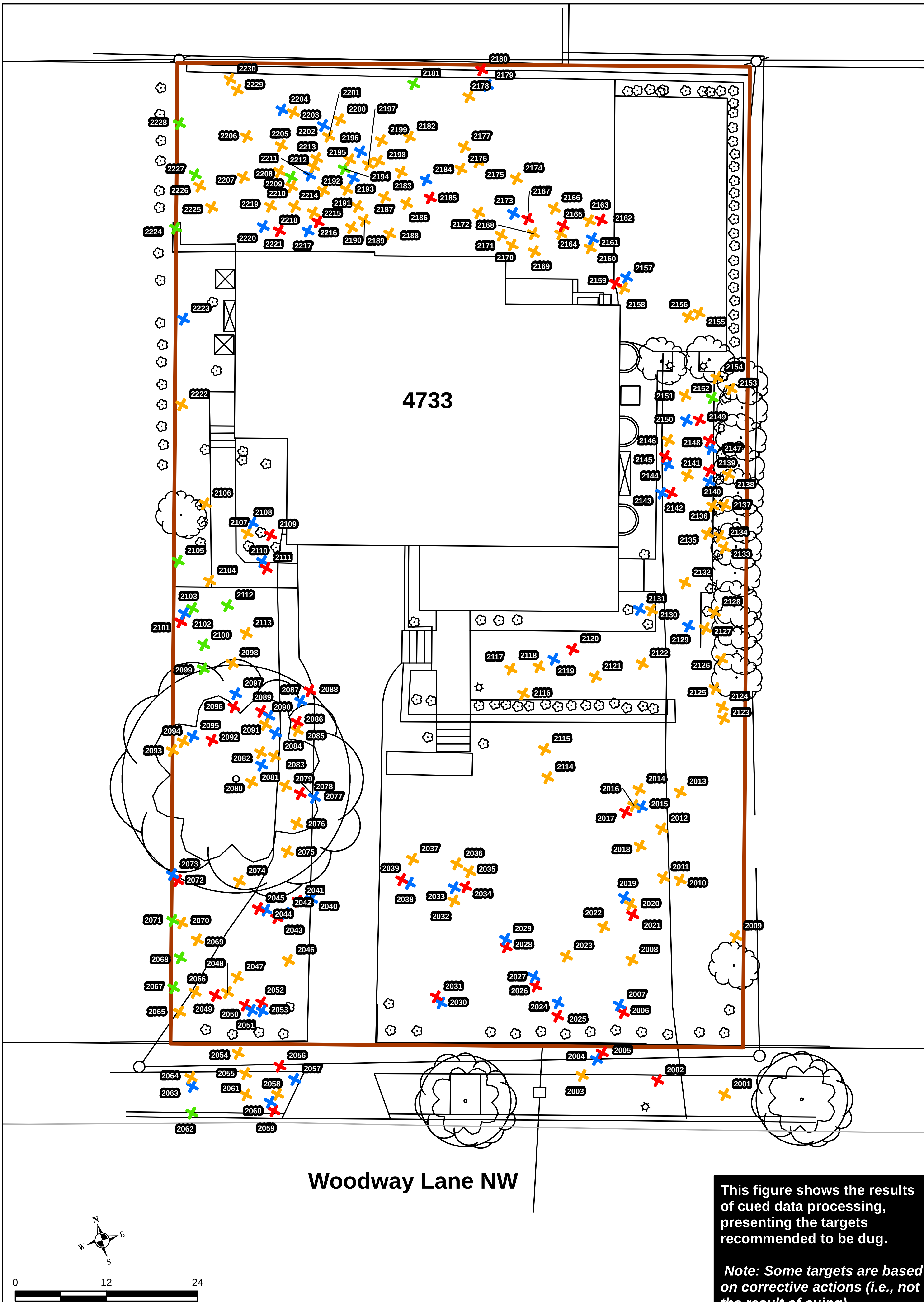
Legend

MPV and TEMTADS Cued Targets	Surveyed Property Line
MPV Cued Targets	Property Feature
TEMTADS Cued Targets	

Figure 15
Targets That Were Cued
4733 Woodway Lane

Spring Valley FUDS
Washington, DC

December 2016



This figure shows the results of cued data processing, presenting the targets recommended to be dug.

Note: Some targets are based on corrective actions (i.e., not the result of cuing).

Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\FinalDigTargets4733Woodway.mxd

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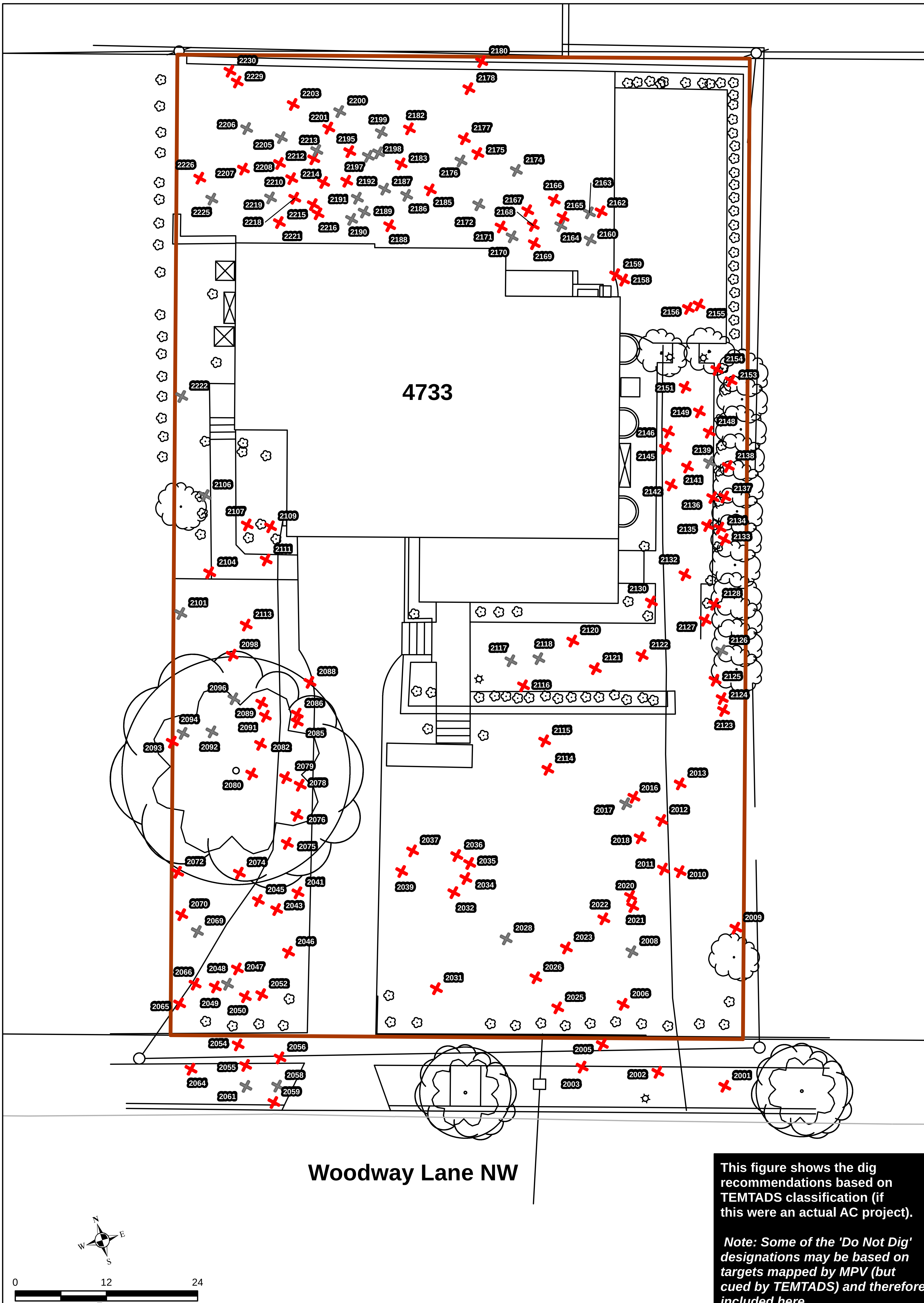
Legend

MPV and TEMTADS	Surveyed Property Line
MPV	Property Feature
TEMTADS	
EM61 and/or G-858 (Previous Data)	

Figure 16
Final Dig Targets
(by Instrument)
4733 Woodway Lane

Spring Valley FUDS
Washington, DC

December 2016



This figure shows the dig recommendations based on TEMTADS classification (if this were an actual AC project).

Note: Some of the 'Do Not Dig' designations may be based on targets mapped by MPV (but cued by TEMTADS) and therefore included here.

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Legend

TEMTADS-only Targets

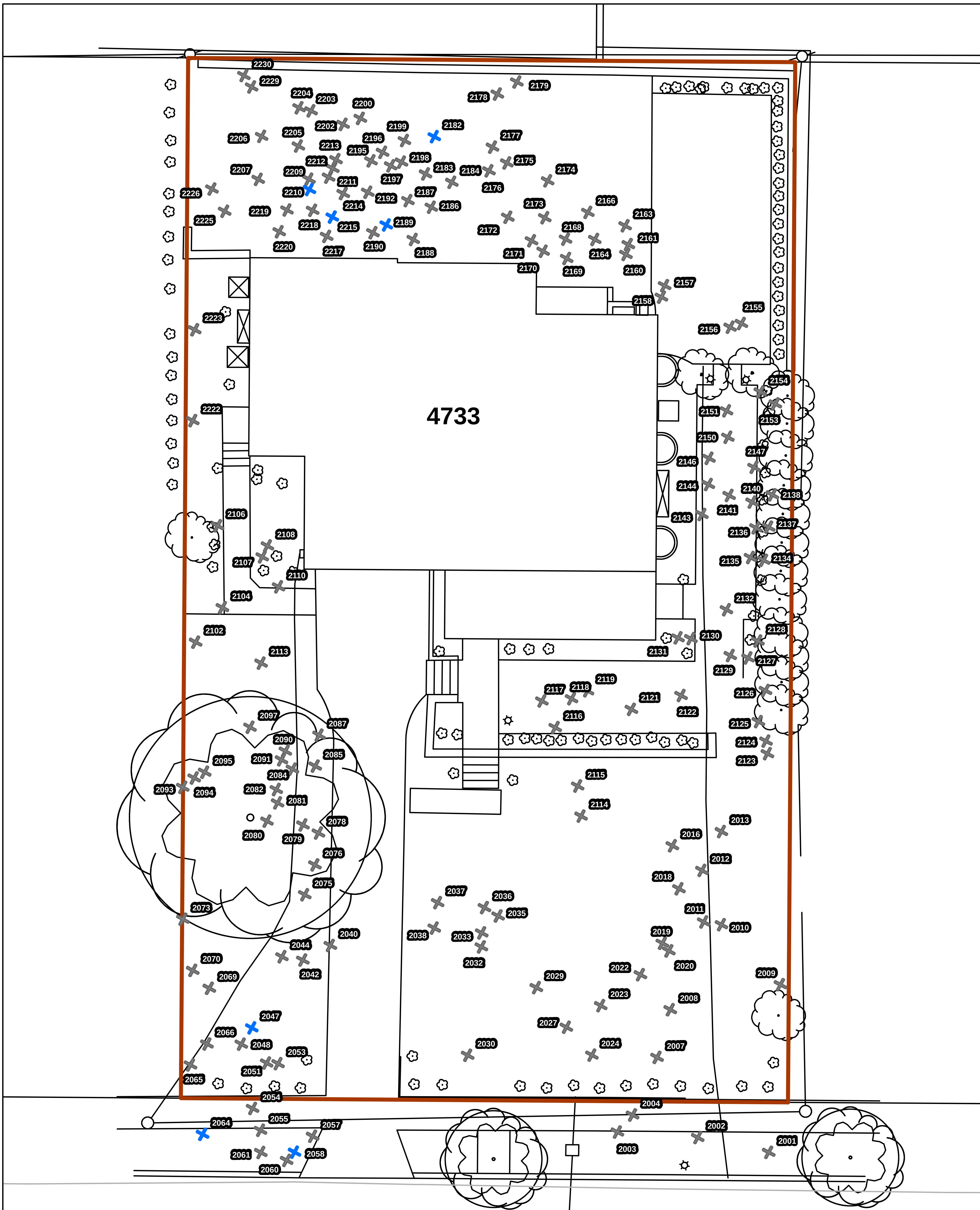
Decision

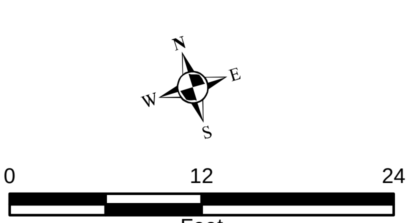
- TEMTADS - Dig (Dig High or Low Confidence, Cannot Analyze)
- Do Not Dig
- Surveyed Property Line
- Property Feature

Figure 17
TEMTADS Classification of Targets
4733 Woodway Lane

Spring Valley FUDS
Washington, DC

December 2016





This figure shows the dig recommendations based on MPV classification. (if this were an actual AC project).

Note: Some of the 'Do Not Dig' designations may be based on targets mapped by TEMTADS (but cued by MPV) and therefore included here.

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Legend

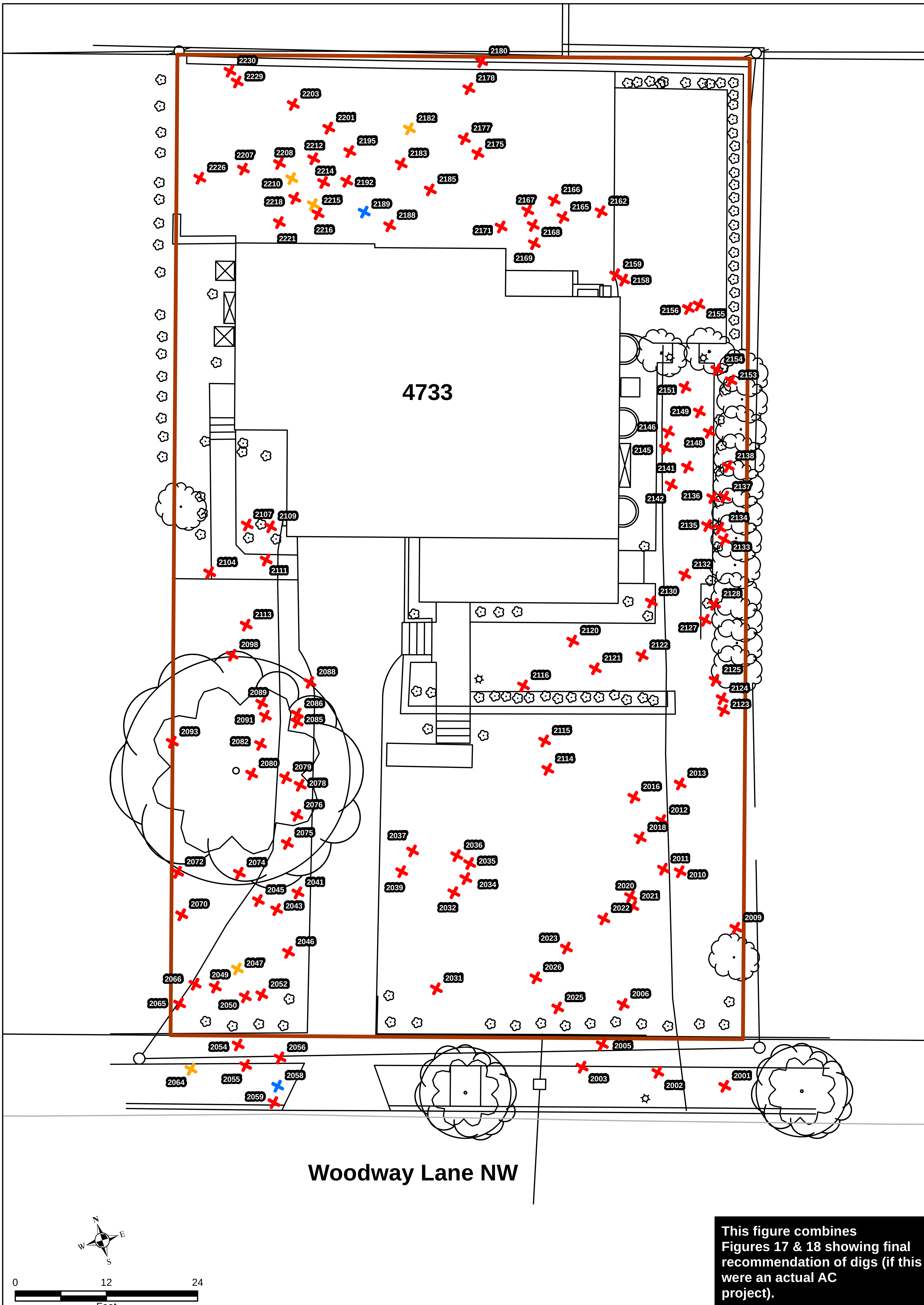
MPV_Catego

- MPV- Dig (Dig, Cannot Analyze)
- Do Not Dig
- Surveyed Property Line
- Property Feature

Figure 18
MPV Classification of Targets
4733 Woodway Lane

Spring Valley FUDS
Washington, DC

December 2016



This figure combines Figures 17 & 18 showing final recommendation of digs (if this were an actual AC project).

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Legend

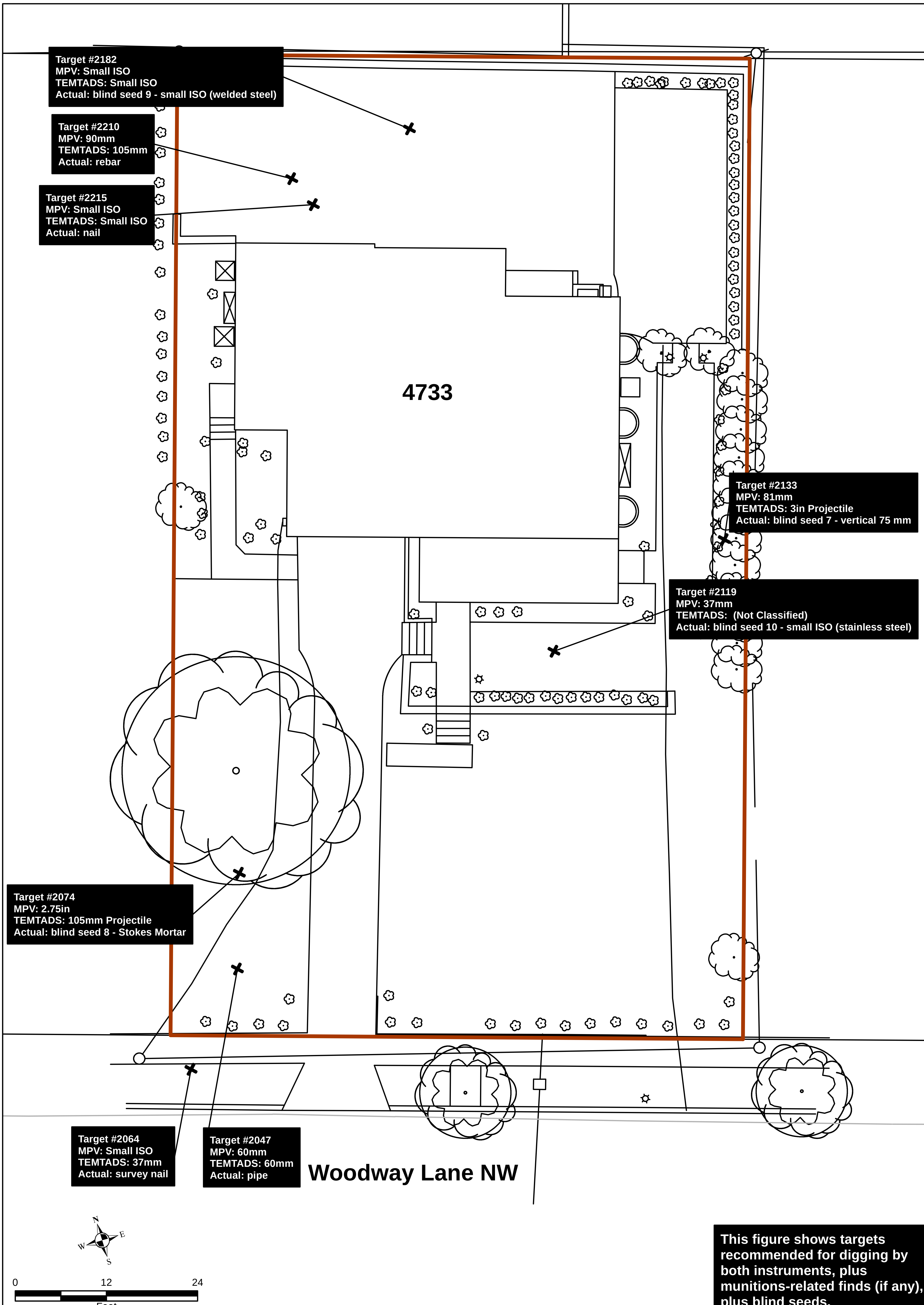
MPV and TEMTADS Targets

- MPV and TEMTADS - Dig
- MPV - Dig (Dig, Cannot Analyze)
- TEMTADS - Dig (Dig High or Low Confidence, Cannot Analyze)
- Surveyed Property Line
- Property Feature

Figure 19
MPV and TEMTADS Classification of Targets
4733 Woodway Lane

Spring Valley FUDS
Washington, DC

December 2016



This figure shows targets recommended for digging by both instruments, plus munitions-related finds (if any), plus blind seeds.

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Legend

- Selected Targets
- Surveyed Property Line
- Property Feature

Figure 20
Summary of Selected Targets
4733 Woodway Lane

Spring Valley FUDS
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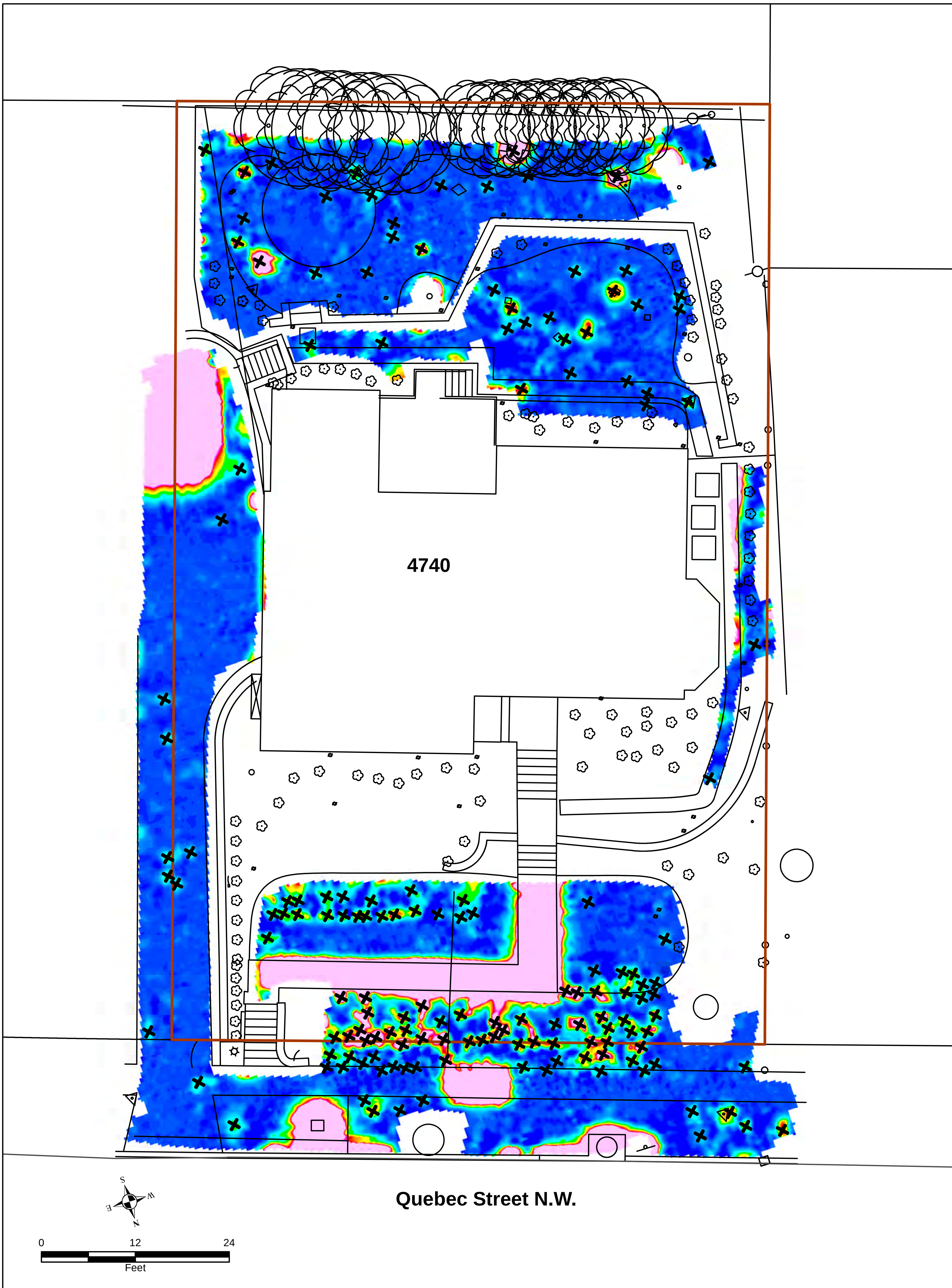
Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\ImportantFinds4733Woodway.mxd



Legend

TEMTADS Dynamic Targets

Surveyed Property Boundary

Property Features

TEMTADS Response (millivolts per amp)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

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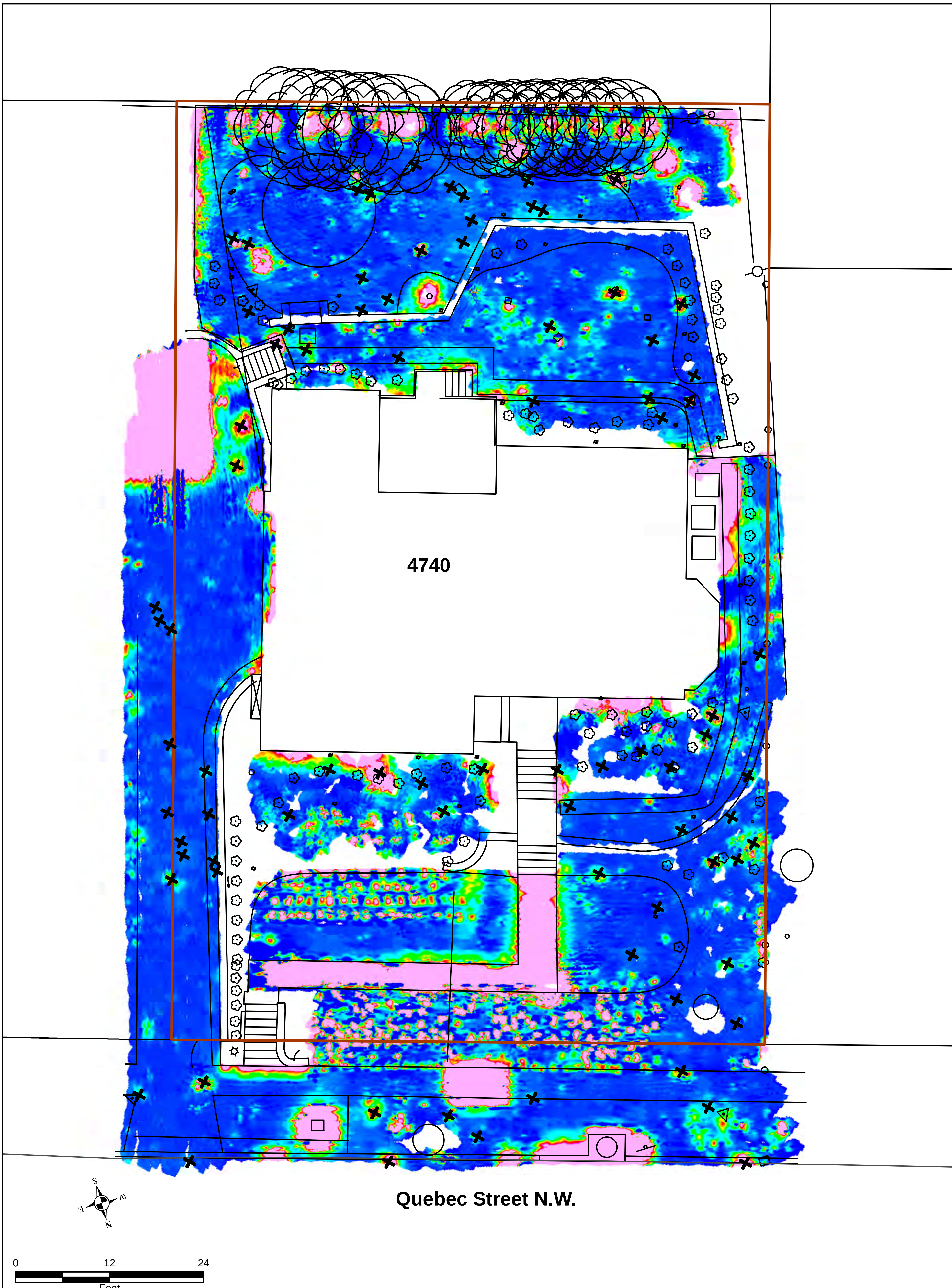
Figure 21
TEMTADS Dynamic Data Targets
4740 Quebec Street N.W.

Spring Valley FUDS
Washington, DC

December 2016

Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\TEMTADS_4740Quebec.mxd



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Legend

- MPV Dynamic Targets
- Surveyed Property Boundary
- Property Features

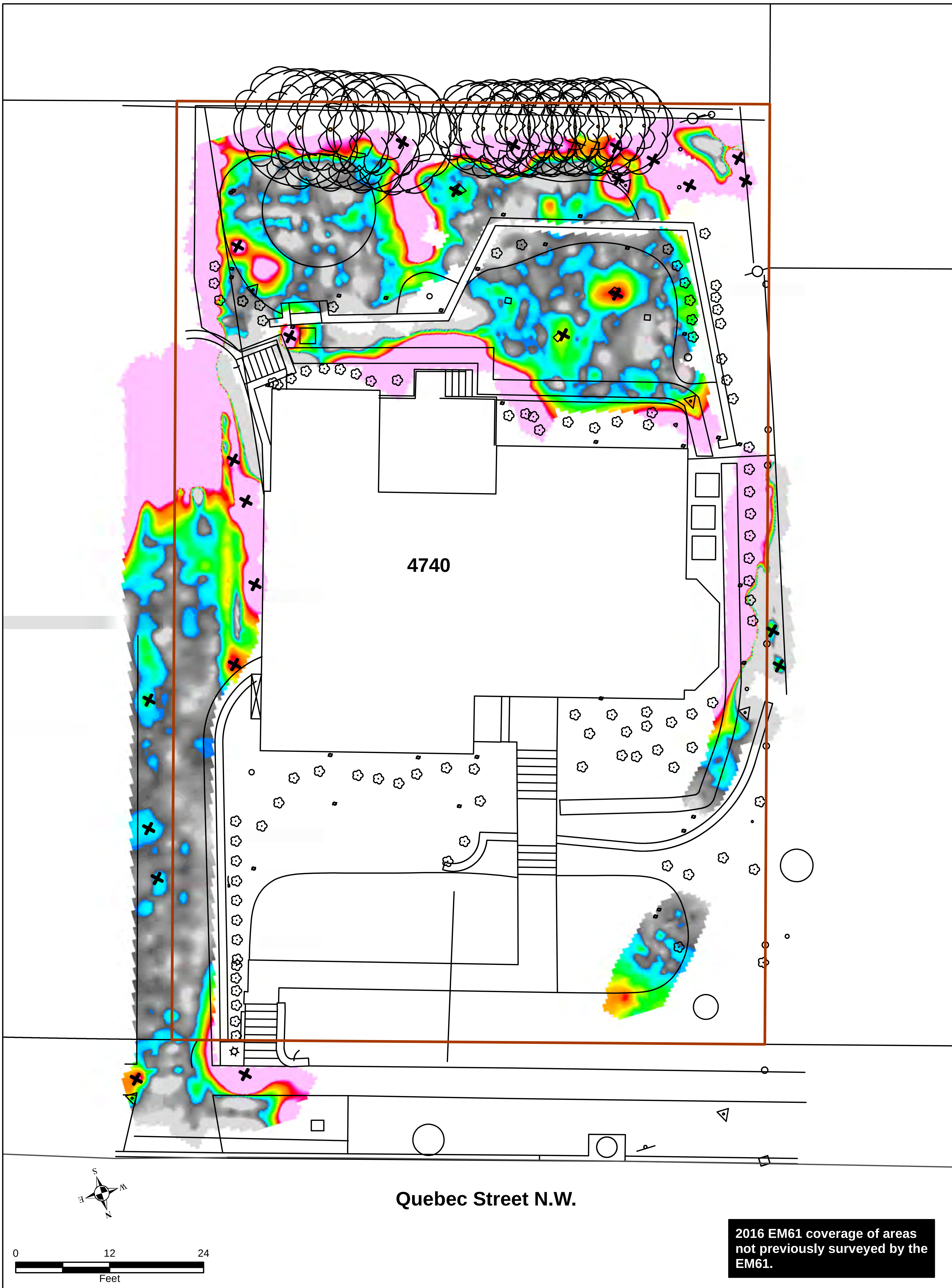
MPV Response (millivolts per amp)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Figure 22
MPV Dynamic Data Targets
4740 Quebec Street N.W.

Spring Valley FUDS
Washington, DC

December 2016



Legend

- ✖ EM61 Targets
- Surveyed Property Boundary
- Property Features

EM61 Response (millivolts)

0 5 10 18 26 34 42 50 58 66 74

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Figure 23
Supplemental EM61 Data
4740 Quebec Street N.W.

Spring Valley FUDS
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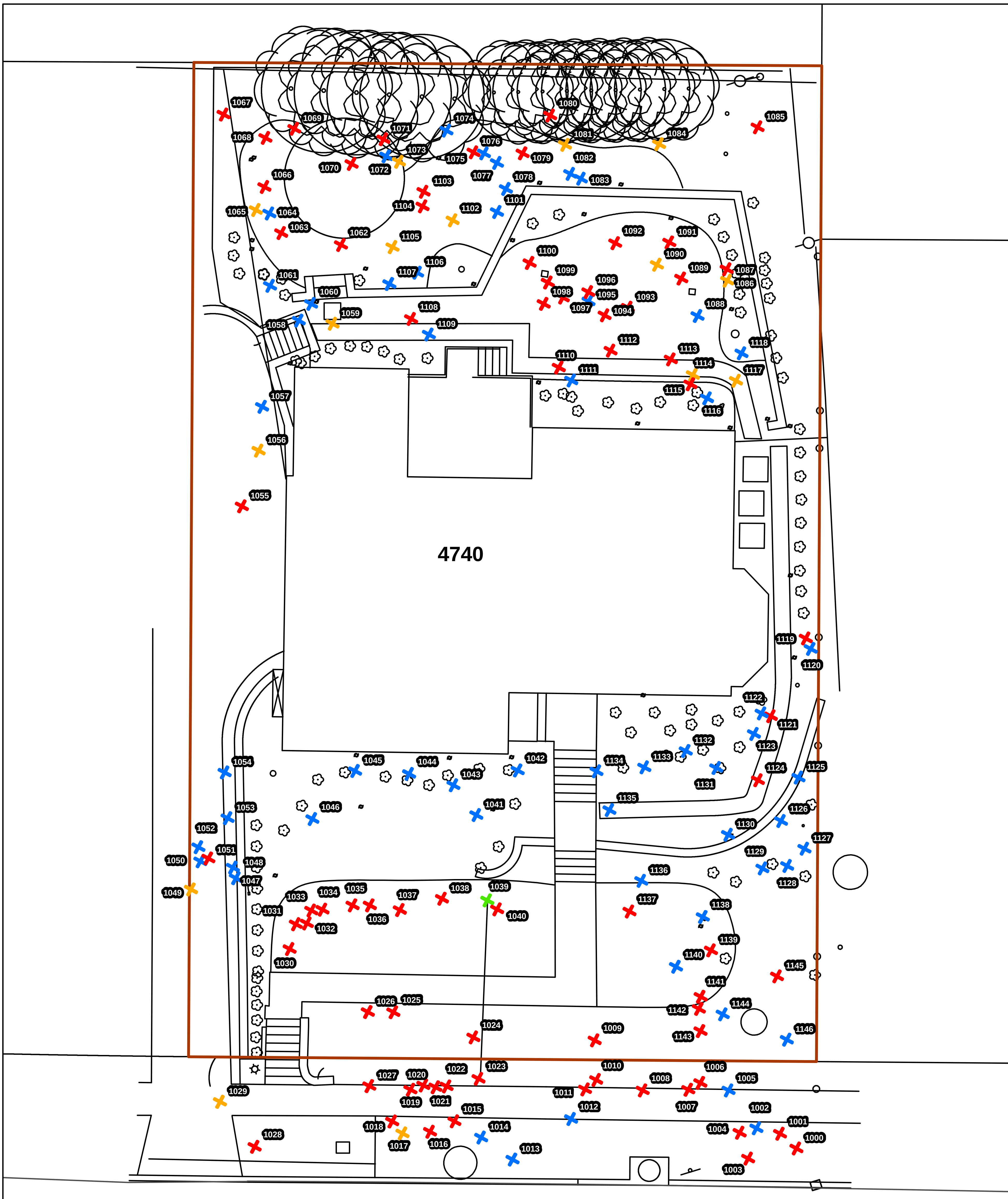
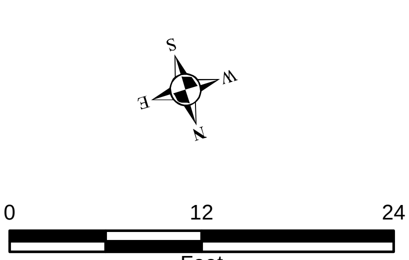
Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\EM61_4740Quebec.mxd





This figure represents the synthesis of dynamic MPV, TEMTADS, and previous DGM data into targets to be cued.

Note: These target #s change in the subsequent figures based on the processing of the cued data.

Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\Cued_Targets4740Quebec.mxd

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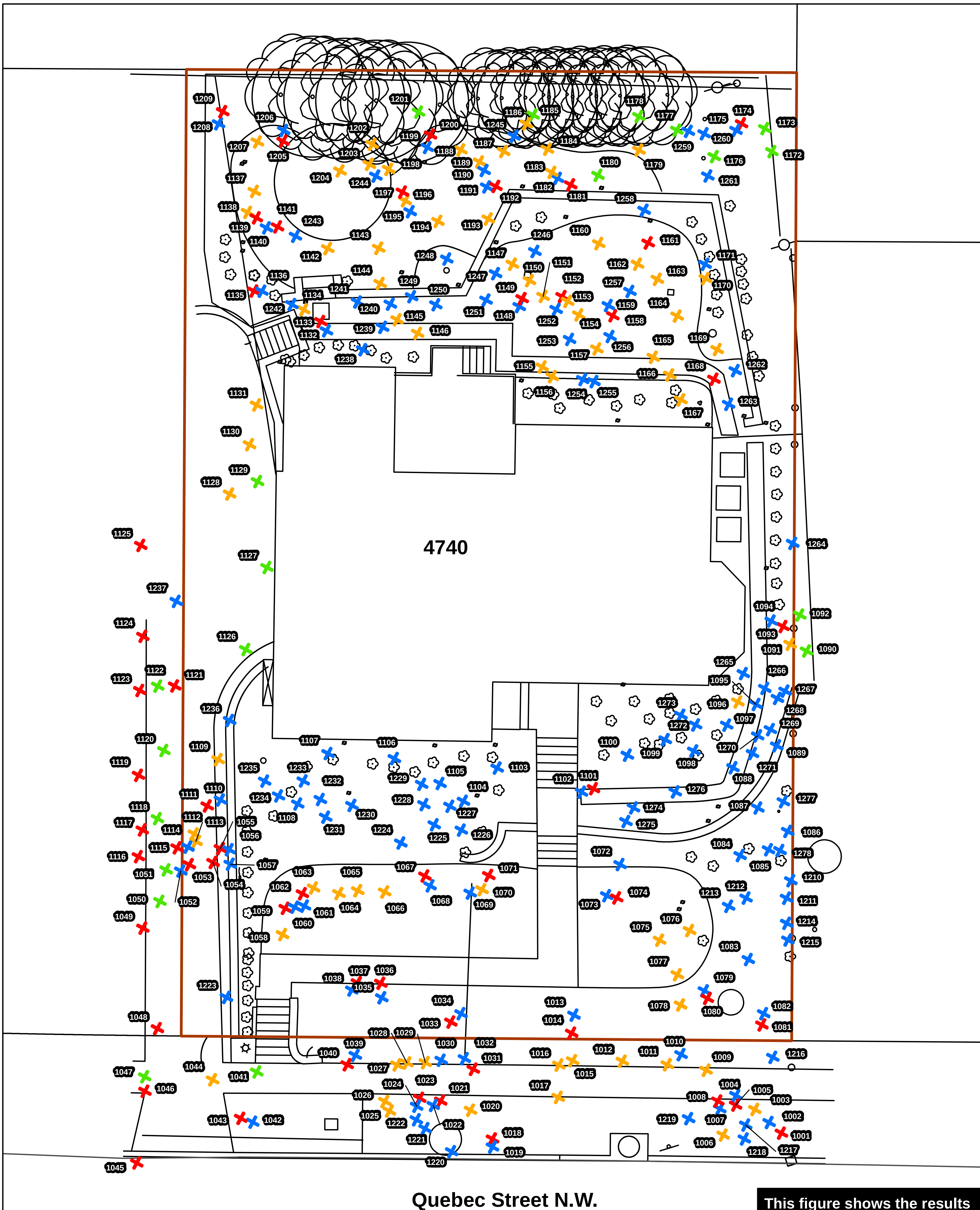
Legend

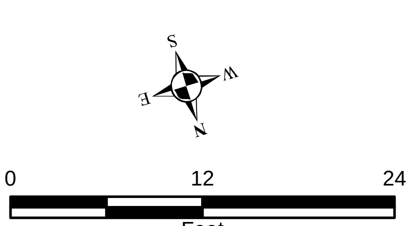
- MPV and TEMTADS Cued Targets
- MPV Cued Targets
- TEMTADS Cued Targets
- EM61 and/or G/858 (Previous Data) Cued Targets
- Surveyed Property Boundary
- Property Features

Figure 24
Targets That Were Cued
4740 Quebec Street N.W.

Spring Valley FUDS
Washington, DC

December 2016





This figure shows the results of cued data processing, presenting the targets recommended to be dug.

Note: Some targets are based on corrective actions (i.e., not the result of cuing).

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Legend

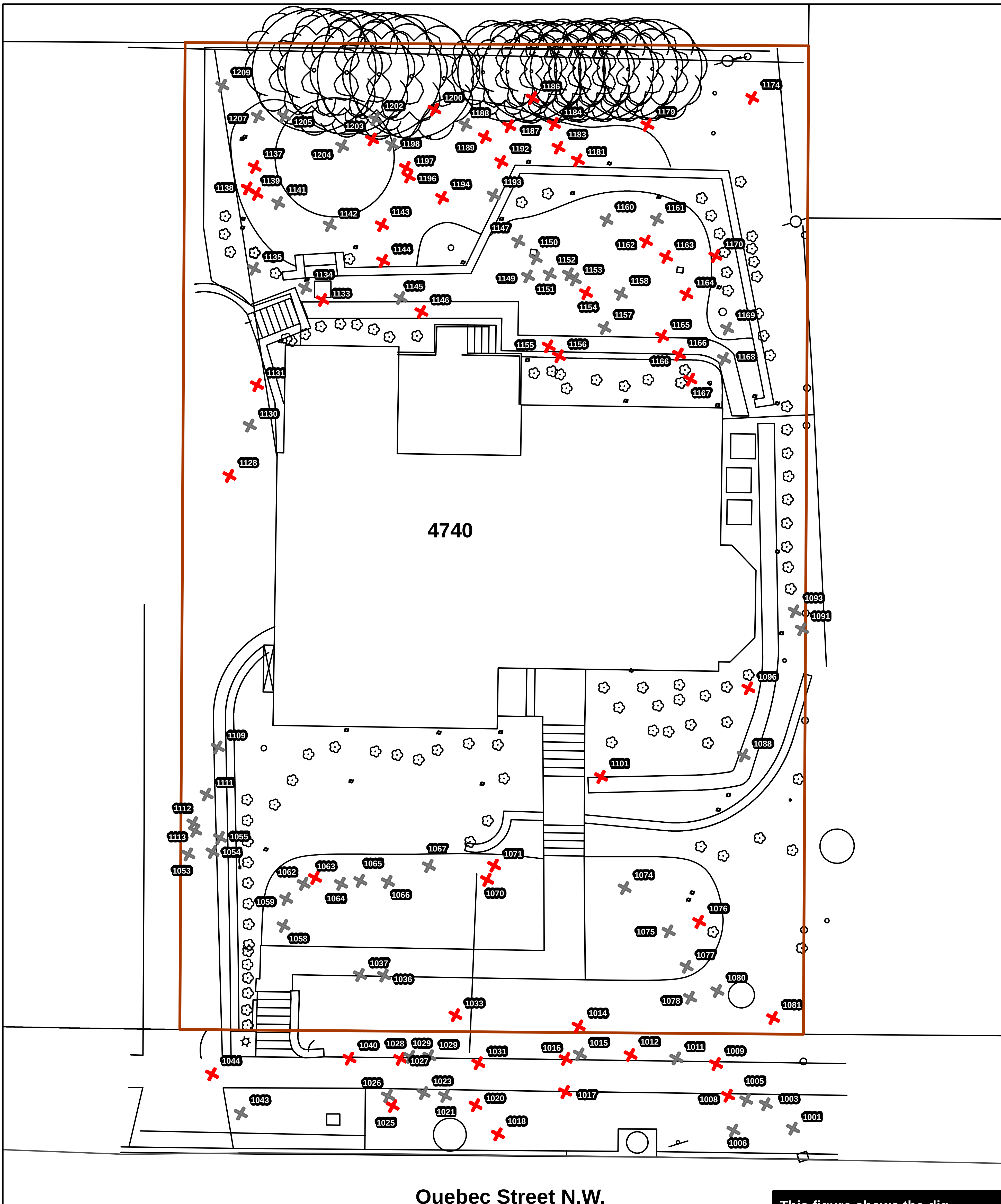
- MPV and TEMTADS
- MPV
- TEMTADS
- EM61 and/or G-858 (Previous Data)
- Surveyed Property Boundary
- Property Features

Figure 25
Final Dig Targets
(by Instrument)
4740 Quebec Street N.W.

Spring Valley FUDS
Washington, DC

December 2016

Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\FinalDigTargets4740Quebec.mxd



0 12 24
Feet

This figure shows the dig recommendations based on TEMTADS classification (if this were an actual AC project).

Note: Some of the 'Do Not Dig' designations may be based on targets mapped by MPV (but cued by TEMTADS) and therefore included here.

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Legend

TEMTADS-only Targets

Decision

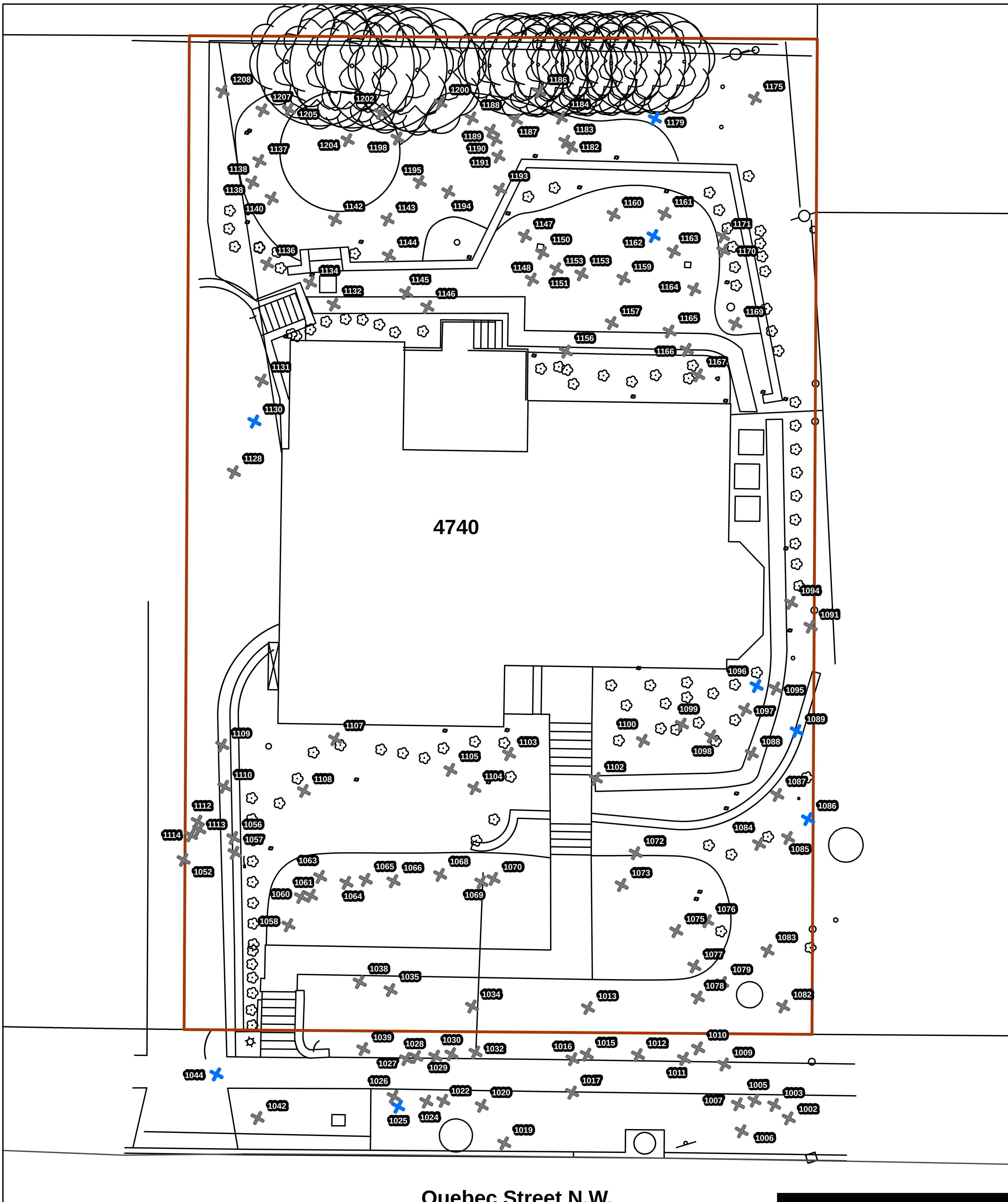
- TEMTADS - Dig (Dig High or Low Confidence, Cannot Analyze)
- Do Not Dig
- Surveyed Property Boundary
- Property Features

Figure 26
TEMTADS Classification of Targets
4740 Quebec Street N.W.

Spring Valley FUDS
Washington, DC

December 2016

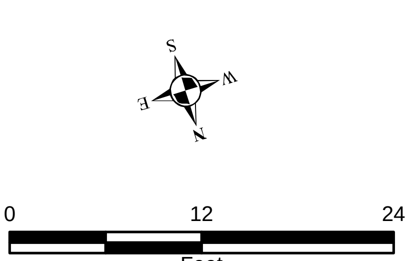
Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\TEMTADSDigS4740Quebec.mxd



This figure shows the dig recommendations based on MPV classification (if this were an actual AC project).

Note: Some of the 'Do Not Dig' designations may be based on targets mapped by TEMTADS (but cued by MPV) and therefore included here.

Document Path: N:\GIS\Northeast\Washington\DC\SpringValley\MXD\Report\MPVDigS4740Quebec.mxd



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Legend

MPV-only Targets

Decision

- MPV- Dig (Dig, Cannot Analyze)
- Do Not Dig

Surveyed Property Boundary

Property Features

Figure 27
MPV Classification of Targets
4740 Quebec Street N.W.

Spring Valley FUDS
Washington, DC

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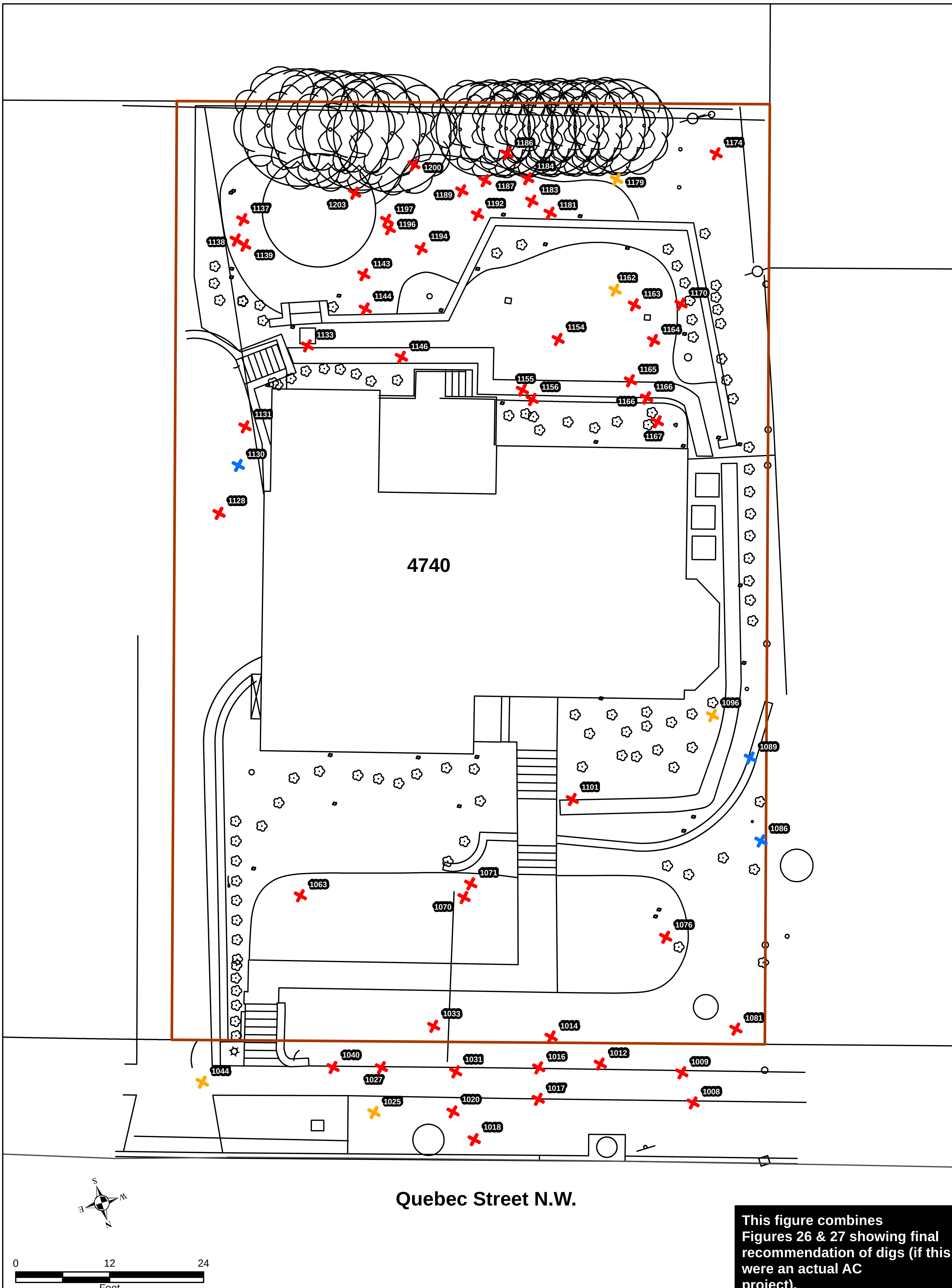

This figure combines Figures 26 & 27 showing final recommendation of digs (if this were an actual AC project).

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Legend

- MPV and TEMTADS - Dig
- MPV - Dig (Dig, Cannot Analyze)
- TEMTADS - Dig (Dig High or Low Confidence, Cannot Analyze)
- Surveyed Property Boundary
- Property Features

Figure 28
MPV and TEMTADS Classification of Targets
4740 Quebec Street N.W.

Spring Valley FUDS
Washington, DC

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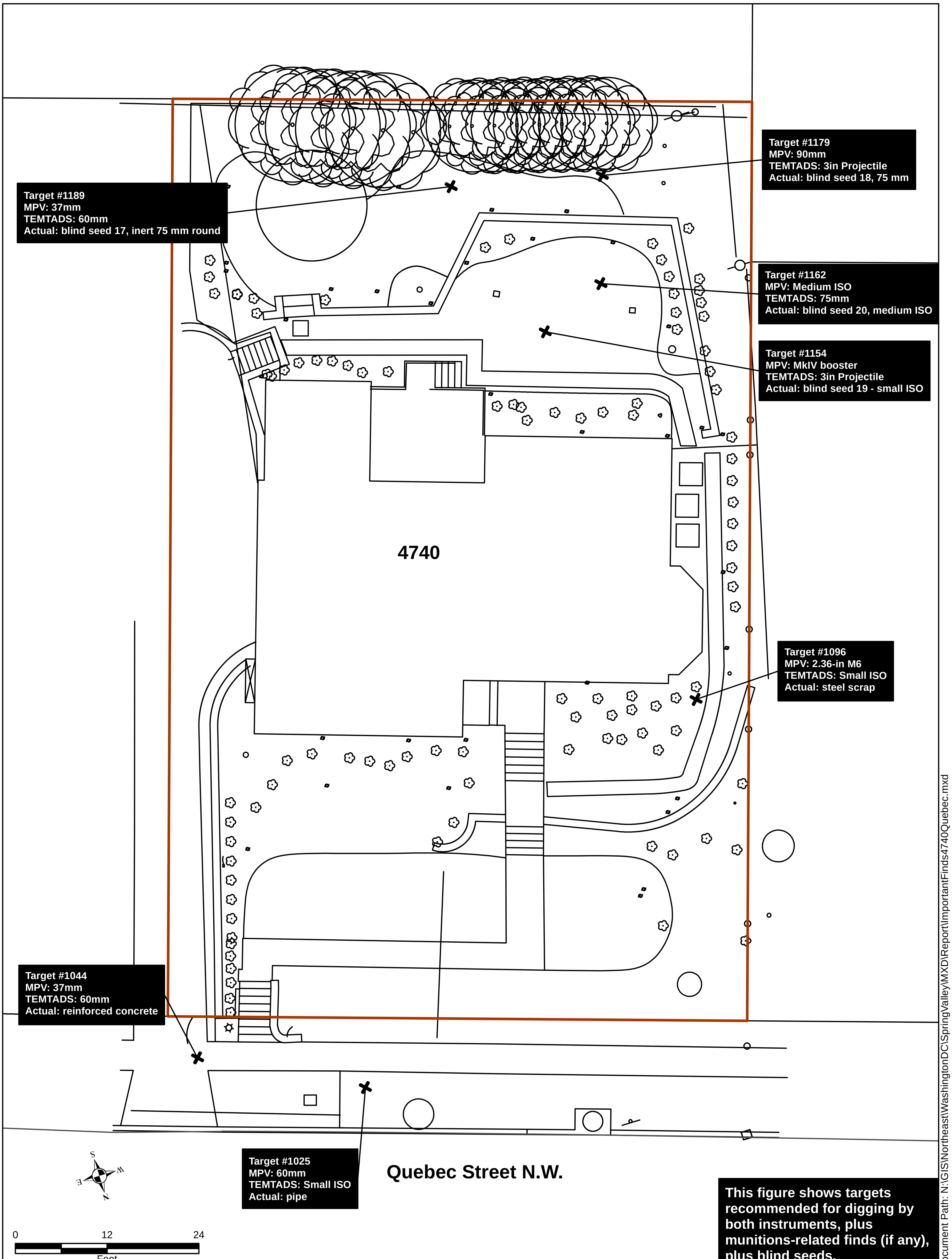
Document Path: N:\GIS\Northeast\WashingtonDC\SpringValley\MXD\Report\Summation4740Quebec.mxd



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Legend

- ✖ Selected Targets
- Surveyed Property Boundary
- Property Features

Figure 29
Summary of
Selected Targets
4740 Quebec Street N.W.

Spring Valley FUDS
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Appendix B: IVS and Blind Seed Installation Memoranda

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Appendix B-1:

IVS Memorandum

401 / 1755 West Broadway
Vancouver, BC, V6J 4S5
Canada

ESTCP Number	MR-201228
Project Title	UXO characterization in challenging survey environments using the MPV
Principal Investigator	Kevin Kingdon, Black Tusk Geophysics Inc
To	Elise Goggin
Date	31-Aug-2016
Re:	IVS Technical memo for the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study

MPV

Dear Ms Goggin,

The attached document "*Initial Dynamic and Static Instrument Verification Strip (IVS) Technical Memorandum*" represents the IVS memo for MPV data acquisition at the Spring Valley ESTCP demonstration site.

Should you have questions or require additional information, please feel free to contact me at 778-938-4822 or by email at len.pasion@btgeophysics.com.

Regards

Leonard Pasion

Initial Dynamic and Static Instrument Verification Strip (IVS) Technical Memorandum

The purpose of this Memorandum is to summarize the results of the initial instrument verification strip (IVS) data collection with the Man Portable Vector advanced electromagnetic induction sensor (MPV) for the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study in Spring Valley, Washington, D.C. The initial IVS testing took place on August 18, 2016.

1. Introduction

The SVFUDS Pilot Study includes dynamic MPV data to be collected on three properties. The detection surveys are being performed to create a map of geophysical anomalies due to buried metallic targets. At each anomaly location, a cued survey will be performed to determine whether the sources of those anomalies are targets of interest (TOI) that need to be excavated or non-hazardous clutter that can be safely left in the ground. Targets of interest include munitions and explosives of concern (MEC), inert munitions resembling MEC, and items seeded for the purpose of quality control (QC) or quality assurance (QA).

MPV testing was performed at the IVS prior to collecting dynamic data at the three pilot study properties. The primary objectives of the pre-detection survey IVS testing were:

- Verify basic functionality of the MPV;
- Confirm that the detection survey measurement performance criteria in the QAPP are appropriate and achievable.
- Demonstrate dynamic location repeatability over the IVS items;

2. MPV assembly

The MPV sensor (Figure 1 and Figure 2) was assembled in accordance with SOP03 MPV Assembly referenced on worksheet #22 of the QAPP. The MPV consists of sensor head that houses a circular coil transmitter and 5 receiver cubes that measure three orthogonal components of the field produced by a target. Positioning of the DGM data was achieved using either a Robotic Total Station (RTS) system (Figure 1) or a Real-Time Kinematic (RTK) Global Positioning System (GPS) (Figure 2). The RTS prism or RTK antenna is mounted on the top of a pole mounted to the end of the MPV handle. At the base of the pole, an Inertial Measurement Unit (IMU) is mounted that records pitch, roll, and yaw for each data point.

Figure 1 The MPV electromagnetic induction metal detector. Left: MPV surveying in dynamic mode, using RTS for positioning. Right: Photo of electronics, data acquisition system, and computer mounted on field backpack.

Figure 2 Cued interrogation surveying with the MPV. In cued mode, an additional two transmitter coils are added to the system for improved illumination of the buried target. The instrument is held stationary, thereby reducing sensor noise.

3. Instrument Verification Strip

Details on the IVS Construction can be found in the report "Initial Dynamic and Static Instrument Verification Strip (IVS) Technical Memorandum" prepared by the Naval Research Lab (NRL)to summarize the TEMTADS2x2 IVS measurements. The IVS is oriented North-South and four items are located along a line: a small ISO (Schedule 80), one medium ISO (Schedule 40), an inert 75 mm projectile, and an inert Stokes mortar. Location, orientation and depth of the four emplaced items are summarized in Table 1.

Table 1 Items seeded in the IVS

	IVS item	UTM Location (Easting, Northing) (m)	Orientation	Depth (m)
IVS1	Stokes Mortar	(317469.999, 4311986.730)	Horizontal, Along track	0.29
IVS2	75 mm projectile	(317470.213, 4311982.371)	Horizontal, Along track	0.36
IVS3	Medium ISO	(317470.161, 4311977.887)	Horizontal, Cross track	0.14
IVS4	Small ISO	(317470.006, 4311973.248)	Horizontal, Along track	0.28

4. Initial IVS survey results

4.1 Function test

The objective of the function test is to confirm that all transmitters and receivers are operating as expected. This is achieved by recording the instrument response to a known calibration item, and then comparing the data to a reference measurement. The reference measurement represents data acquired of the calibration item when the instrument was already established to have been operating properly.

The MPV function tests consists of acquiring a static measurement with a Schedule 80 small ISO in the middle of the horizontal transmitter coils. The small ISO is oriented vertically and stands on the x-component coil. To improve the repeatability of the ISO placement, a circle drawn on the coil indicates where the small ISO should be placed. A background measurement (i.e. no small ISO in place) is acquired such that the instrument and background response can be subtracted from the function test data.

The Measurement Quality Objective (MQO) for the function test is that the background subtracted response is within 20% of a reference measurement. Due to the geometry of the MPV transmitters, receivers, and small ISO there are transmitter/receiver combinations that will have a small response. These null response combinations are not informative for determining if the instrument is functioning properly. The transmitter receiver combinations that are used are chosen in the following manner. We first consider the response of all receivers when the Z-component transmitter is firing. For those receivers that are null-coupled with the small ISO, we analyze the response when the horizontal receivers are firing. The top panel of Figure 3 plots the sum of the response of the time channels from 0.135 ms to 0.435 ms. Three function tests were acquired on August 18, 2016. The "2016/8/18-8:33" and "2016/8/18-13:30" function tests were acquired with RTK-GPS for positioning, and the "2016/8/18-13:59" test was acquired with RTS positioning.

The bottom panel of Figure 3 plots the response variation for the three function tests. The reference measurement for the response comparison was acquired at the Black Tusk Geophysics test plot at the University of British Columbia. For each of the three function tests, the MQO of response variation less than 20% was successfully achieved.

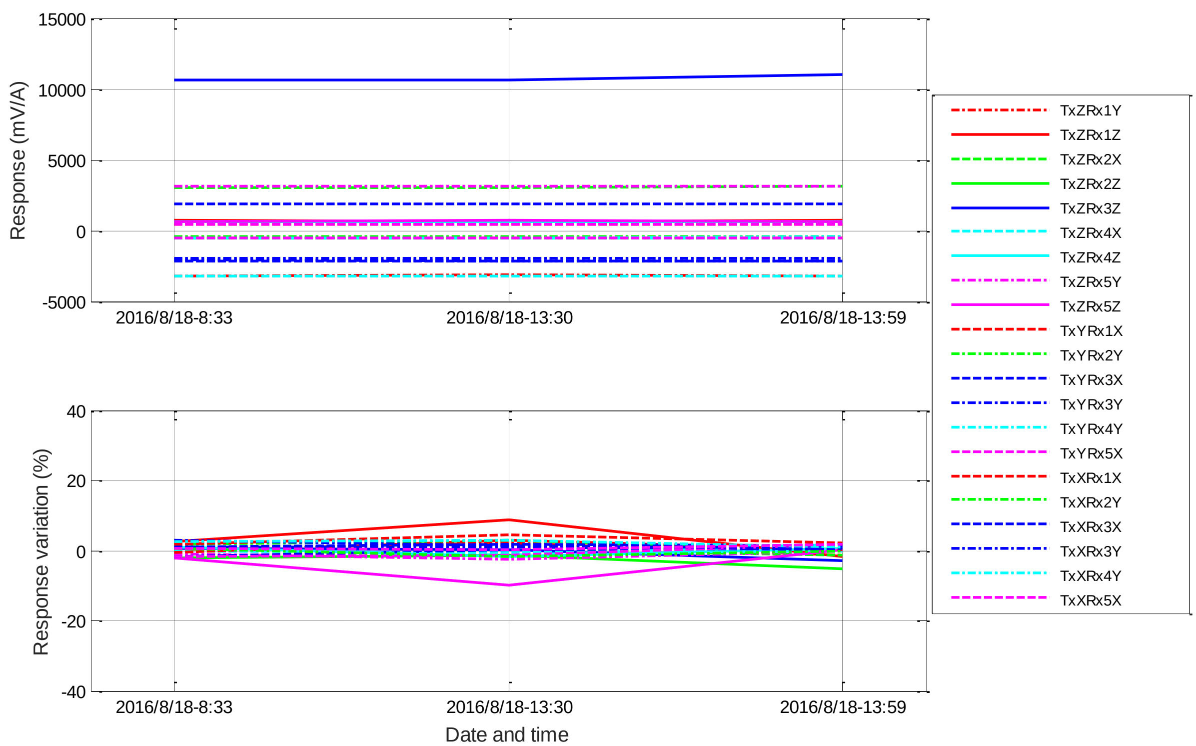


Figure 3. Top: The response for the three function tests are plotted. The plotted value is the sum of time channels 1-8 (0.135 to 0.435 ms).

4.2 Spin Test

The spin test is designed to verify proper operation of the GPS and IMU, as well as the correct integration of their respective data streams. The GPS antenna (or RTS prism) is offset from the MPV sensor head. Therefore, an accurate IMU measurement is critical for determining the location of the sensor head relative to the GPS receiver antenna. If the GPS and IMU function properly (e.g. no bias in the IMU data stream) and the sensor geometry is correctly defined in sensor definition files, the center cube of the MPV should exhibit a limited range of motion when the MPV is rotated about the center of the sensor head.

The spin test consists of doing a full 360 degree rotation of the MPV head, with the center of the MPV head in the same location. To minimize lateral movement of the sensor head, the sensor head is placed in jig during the rotation. Dynamic data are recorded during the rotation. If the MPV position on the field display appears to remain within a tight circle, then the positioning sensors are deemed to be operating correctly. Like the IVS tests, the spin test is to be done at the minimum at the beginning and end of the day.

The spin test data are analyzed prior to processing field data in order to identify potential malfunction or bias in the GPS or IMU readings. An algorithm is applied to each spin test to determine the bias correction in the heading measurements that would minimize the recorded range of motion of the center cube. Applying the proper correction should result in an optimal positional accuracy. If the bias between successive spin tests are consistent, all data collected between the spin tests can be processed with the same correction.

There are a pair of metrics that are calculated from the spin test data

- "*Optim. heading bias*" is the estimated bias in the heading that, when removed, results in the minimum amount of motion (in x and y directions) of the center of the sensor head.
- "*Std dxy optim*" quantifies the motion of the center of the sensor head. "*Std dxy optim*" is defined as the maximum of the standard deviation of locations in the x direction (σ_x) and the standard deviation of locations in the y direction (σ_y), i.e. max(σ_x, σ_y)

For the system to meet MQOs, (1) the estimated IMU heading bias should vary by less than 5 degrees between successive spin tests that are carried with the same geolocation system (GPS or RTS), i.e. "*Optim. heading bias*"<5 degrees, and (2) the standard deviation of positions for the center cube should vary by less than 0.10 m (i.e. "*Std dxy optim*"<0.1 m).

Figure 4 plots the path of the GPS antenna or RTS prism (green line), and the paths of the 5 receiver cubes (blue dots and line), during the spin tests on August 18. The red dots indicate the path of the receivers when applying an optimal heading correction. The legend indicates the amount of heading bias removed, in order to minimize the range of motion in the x and y.

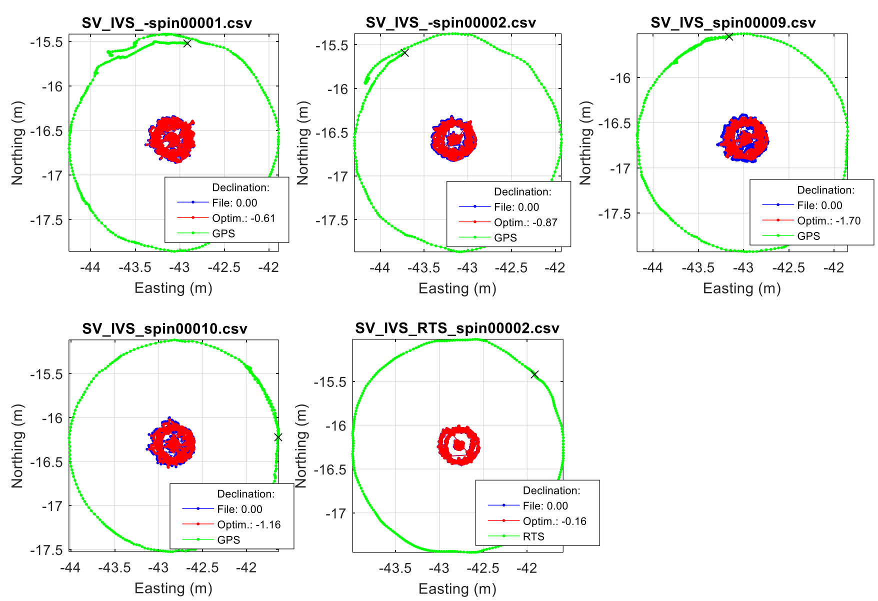


Figure 4. Paths of the GPS antenna or RTS prism, as well as 5 receiver cubes, during the spin tests of August 18. The range of receiver positions decrease when the heading bias is calculated and corrected.

Table 2 lists the heading bias correction and resulting max standard deviation once the heading has been corrected. All values are within the specified MQOs.

Table 2 Spin test results for August 18.

Day	File name	Time	Optim. heading bias (degrees)	Std dxy optim. (m)
8/18/2016	SV_IVS_-spin00001.csv	7:44	-0.61	0.03
8/18/2016	SV_IVS_-spin00002.csv	7:45	-0.87	0.03
8/18/2016	SV_IVS_spin00009.csv	8:19	-1.7	0.03
8/18/2016	SV_IVS_spin00010.csv	13:20	-1.16	0.03
8/18/2016	SV_IVS_RTS_spin00002.csv	14:22	-0.16	0.03

4.3 Dynamic data

Two sets of MPV data – corresponding to the two different positioning systems – were acquired on the IVS. The first set of data was acquired using RTK GPS for recording positioning, and the second dataset used RTS for positioning. To assist navigation, 3 ropes were place on the ground – one rope directly over the line of emplaced targets and 1 rope on either side of the center line, separated by a distance of 1 m. Lines were collected by traversing in alternate direction and walking with the outer edge of the sensor head aligned with a rope. In this manner, 6 lines of data were acquired with a line spacing of 0.5m. Since the MPV did not traverse with the sensor head directly over the ropes, there are no lines with the MPV passing directly over the emplaced IVS targets. Figure 5 shows the resulting data maps for Time Channel 5 (0.45 ms).

The positional accuracy of the system is assessed by comparing the known location of IVS targets to the source location derived from dipole inversions. Each anomaly is inverted using 1 and 2 sources.

Table 3 compares the induced dipole locations associated with the emplaced target to the true locations for data positioned using RTK GPS data. Table 4 compares the induced dipole locations associated with the emplaced target to the true locations for data positioned using RTK GPS data.

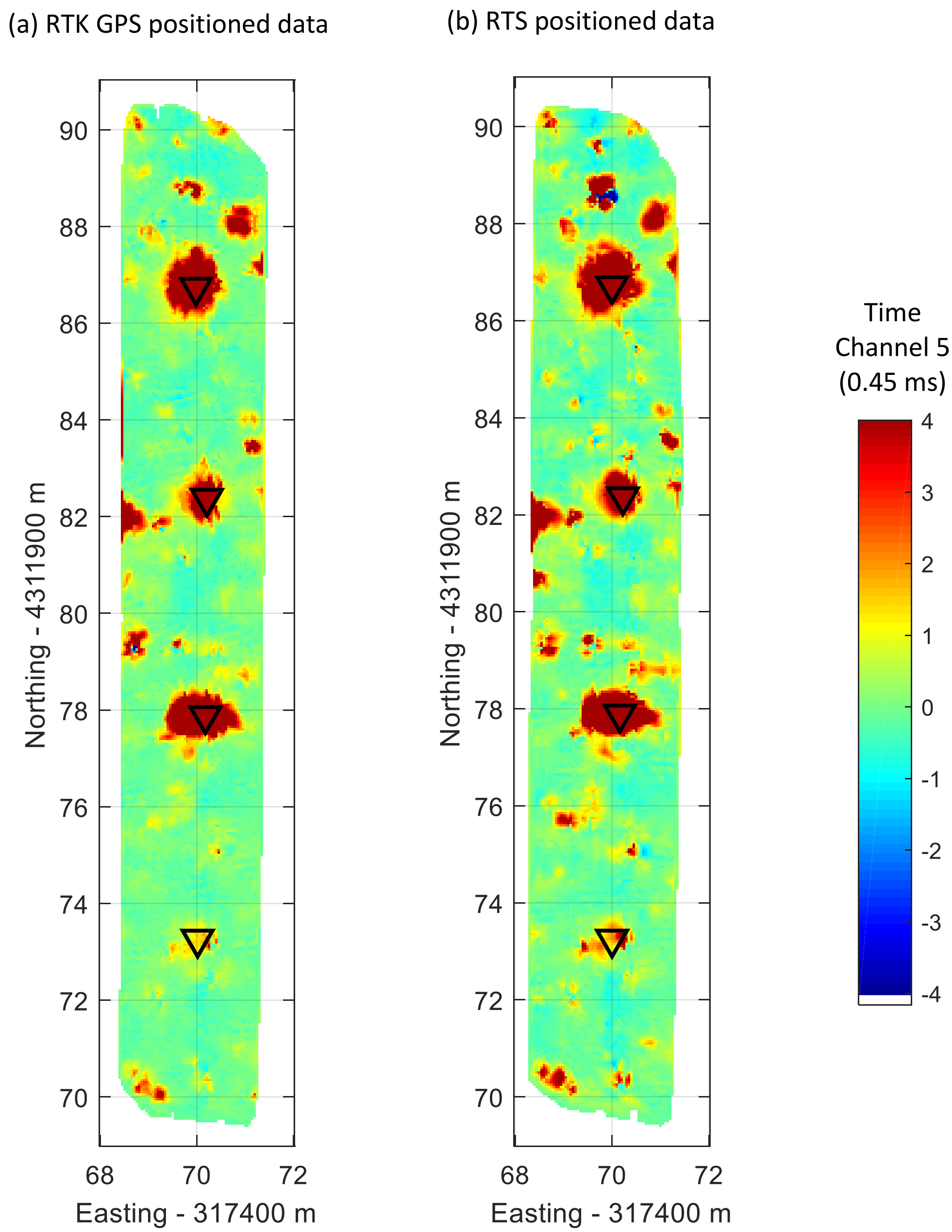


Figure 5: Detection map for GPS (left) and RTS (right) positioning systems. The black triangles indicate the locations of the 4 seeded IVS items, with IVS 1 (Stokes Mortar, depth-29cm) located farthest north and IVS 4 (Small ISO, depth=28cm) farthest south. The fifth time channel is plotted here.

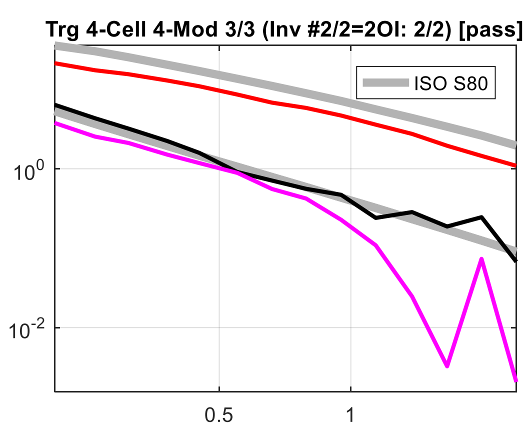
Table 3. Recovered source location when inverting RTK GPS dynamic MPV data.

	Estimated Location (Easting, Northing) (m)	Δr = location offset (m)	Estimated Depth (m)	Δd = depth offset (m)
IVS 1	(317469.971, 4311986.752)	0.04	0.29	0.00
IVS 2	(317470.181, 4311982.263)	0.11	0.43	0.07
IVS 3	(317470.138, 4311977.830)	0.06	0.09	0.05
IVS 4	(317469.895, 4311973.195)	0.12	0.26	0.02

Table 4. Recovered source location when inverting RTS dynamic MPV data.

	Estimated Location (Easting, Northing) (m)	Δr = location offset (m)	Estimated Depth (m)	Δd = depth offset (m)
IVS 1	(317469.984, 4311986.774)	0.05	0.34	0.05
IVS 2	(317470.217, 4311982.402)	0.03	0.29	0.07
IVS 3	(317470.084, 4311977.859)	0.08	0.13	0.01
IVS 4	(317469.888, 4311973.253)	0.12	0.27	0.01

For the small ISO (IVS 4), a single source inversion is not sufficient to extract accurate polarizabilities due to the presence of nearby metallic targets. Using a multi-source solver allows for a good depth estimate (<3cm error). The accuracy of recovered polarizabilities are affected by the noise level of the data (Figure 6).



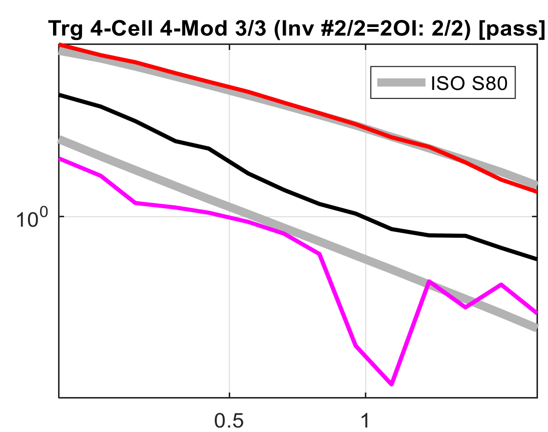


Figure 6. Estimated polarizabilities of the small ISO from inversion of dynamic MPV data. Due to nearby metal, a multi-source inversion is required to obtain a dipole source for the small ISO. In both the RTK (left) and RTS (right) data, the depth of the small ISO is well resolved (<3cm depth error) but the noise level of the data affects the accuracy with which the polarizabilities can be resolved.

One of the project goals is to detect a MarkIV booster at a depth of 30cm. The data amplitude threshold for a MarkIV booster was calculated using the Detection Modeler software from SERDP MR-2226. When surveying with the MPV on flat ground, the sensor head is typically brushing the ground surface and the line spacing is, nominally, 50 cm. We calculate the threshold assuming 65 cm line spacing and a ground clearance corresponding to the center of the z-transmitter being 10 cm above the surface (note: this corresponds to a sensor head ground clearance of approximately 2 inches). For time channel 5

(0.450ms), this results in a threshold of 1.44 mV/A. In order to reduce random noise levels, we use a composite channel that involves approximating the mean value integral of the signal from time channels 3 to 8. This approximate integration is a weighted sum of the measured response from channels 3 to 8. For the composite channel, the threshold is 1.19 mV/A (Figure 7).

(a) Polarizabilities for a MarkIV booster *(b) Depth response curve* *(c) Detection threshold*

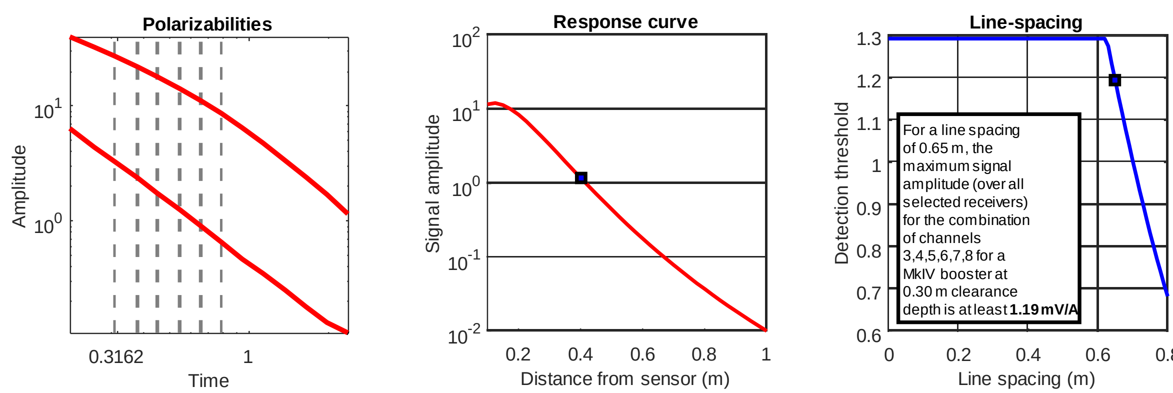


Figure 7. MarkIV booster modeling output from the SERDP MR-2226 Detection Modeler. These measurements assume the center of the z-transmitter coil is 0.10 cm above the surface. For a composite channel from time channel 3 (0.31 ms) to time channel 8 (0.79 ms), the threshold for a MarkIV booster at a depth of 0.3m is 1.19 mV/A.

Table 5 lists the noise level in the z-component of each of the 5 receivers at time channel 5 and the composite channel. The data acquired with RTK positioning in the morning of August 18 has lower noise than the data acquired at the end of the day with RTS positioning. We are unsure of the cause for the difference in noise levels. The center cube has the largest noise level of all the receivers. In the last row of Table 5, we use the noise level from the center cube to calculate the SNR for the single and composite time channels, and for the RTK and RTS positioned datasets. The composite channel has a slightly higher SNR (i.e. 4.3σ and 2.8σ for data acquired with RTK and RTS positioning, respectively).

Table 5. Noise levels derived from IVS data. We currently do not understand why the noise levels of the RTS positioned data is greater than the RTK positioned data.

	Time Channel 5 (0.45 ms)		Composite Channel (0.31 to 0.79 ms)	
Receiver	**RTK data: Noise standard deviation (mV/A)**	**RTS data: Noise standard deviation (mV/A)**	**RTK data: Noise standard deviation (mV/A)**	**RTS data: Noise standard deviation (mV/A)**
1	0.307	0.447	0.217	0.338
2	0.357	0.481	0.263	0.367
3	0.382	0.563	0.279	0.423
4	0.315	0.441	0.227	0.329
5	0.350	0.452	0.243	0.333
SNR at threshold	**3.8σ**	**2.6σ**	**4.3σ**	**2.8σ**

4.4 Cued data

Cued data were collected over each IVS item. There were three sets of cued data measurements: (1) RTK-GPS positioned data taken in the morning of August 18, (2) RTK-GPS positioned data taken in the afternoon of August 18, and (3) RTS positioned data taken also taken in the afternoon. Each sounding was inverted using a 1 and 2 source inversion algorithm.

The recovered polarizabilities for the inversions are shown in Figure 8. Recovered polarizabilities are plotted on the library polarizabilities for the buried items. For all but one instance, the model fit metric exceeded the MQO of 0.9. The one exception is for the small ISO measured with RTS positioning. Due to the lower SNR of this target and proximity to adjacent metal targets, we suggest that this target might not be suitable for testing instrument operation. We note that an item with that level of model fit would be chosen during classification process.

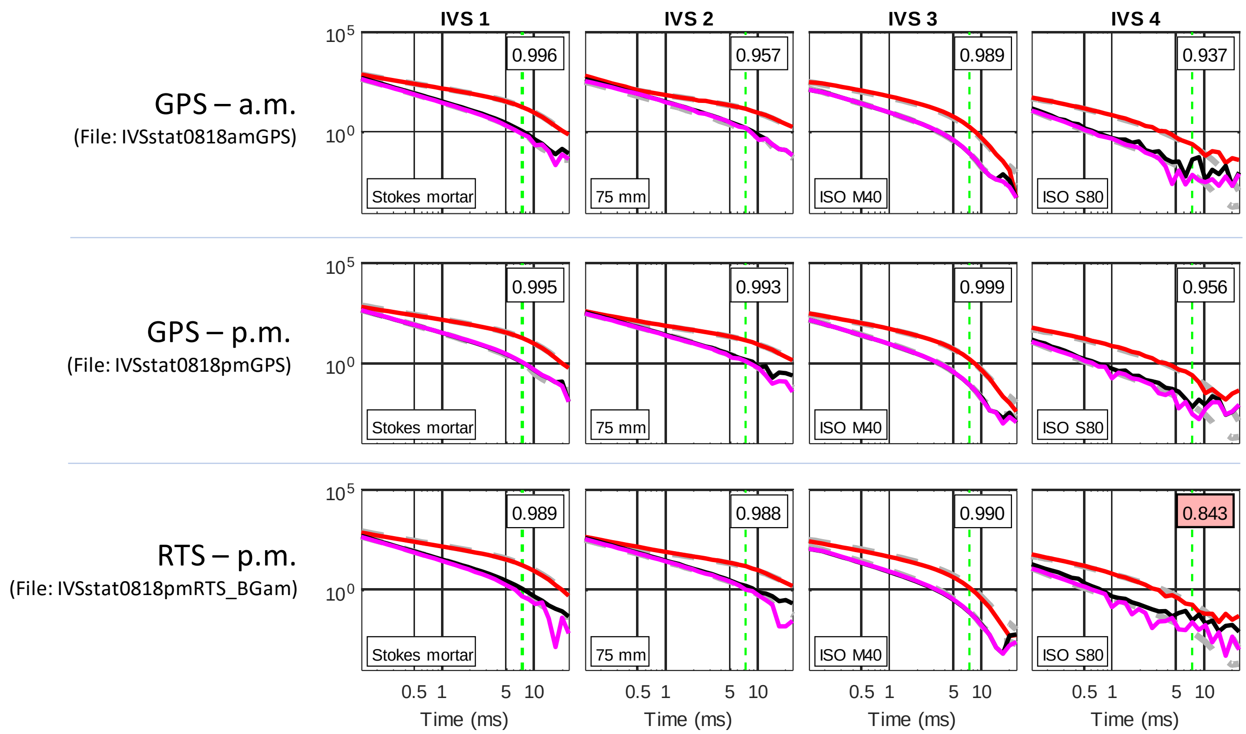


Figure 8. Recovered polarizabilities when inverting the three IVS cued data sets. In only one case (bottom right), is the MQO for the model fit not met.

Figure 9 and Tables 5 to 7 show the location prediction accuracy of the inversions. For all targets, the location is within 12 cm of the true target location, thereby meeting the MQO of prediction accuracy being within 25cm of the true target location. Tables 5 to 7 also include the recovered depth and resulting depth error. Estimated depths are within 8 cm of the true depth.

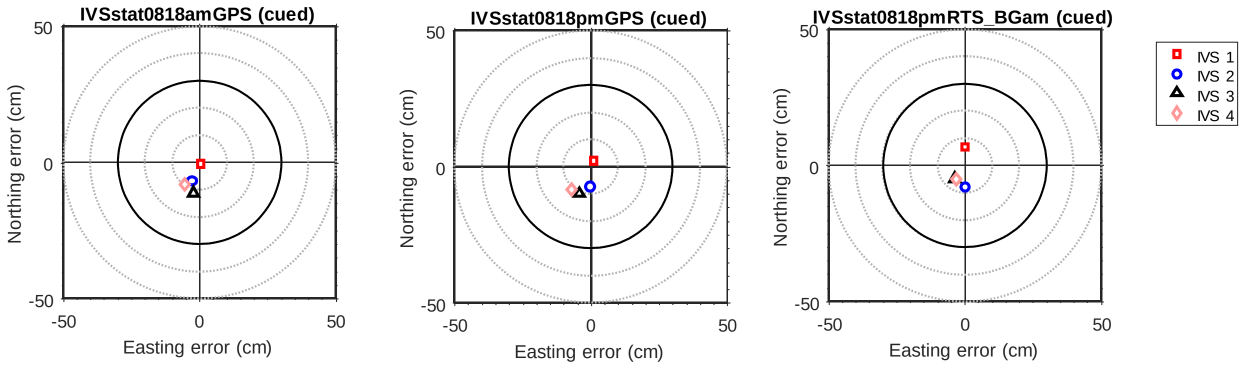


Figure 9. Predicted location accuracy for the three sets of cued data acquired on the IVS.

Table 6. Inversion performance for IVS data collected in the morning of August 18, and using RTK GPS positioning.

IVSstat0818amGPS		Predicted location (m)			Predicted Depth (cm)		
IVS ID	Target	Easting	Northing	Location error	Estimated	error	Polarizability Misfit %
IVS 1	Stokes mortar	317470.00	4311986.72	0.01	33.8	4.9	0.996
IVS 2	75 mm	317470.18	4311982.31	0.07	43.8	7.8	0.957
IVS 3	Medium ISO (schedule 40)	317470.14	4311977.78	0.11	16.7	2.8	0.989
IVS 4	Small ISO (schedule 80)	317469.95	4311973.17	0.10	30.9	2.9	0.937

Table 7. Inversion performance for IVS data collected in the afternoon of August 18, and using RTK GPS positioning.

IVSstat0818pmGPS		Predicted location (m)			Predicted Depth (cm)		
IVS ID	Target	Easting	Northing	Location error	Estimated	error	Polarizability Misfit %
IVS 1	Stokes mortar	317470.01	4311986.75	0.03	33.9	4.9	0.995
IVS 2	75 mm	317470.21	4311982.30	0.07	41.6	5.7	0.993
IVS 3	Medium ISO (schedule 40)	317470.12	4311977.79	0.11	17.1	3.1	0.999
IVS 4	Small ISO (schedule 80)	317469.93	4311973.17	0.11	31.1	3.1	0.956

Table 8. Inversion performance for IVS data collected in the afternoon of August 18, and using RTS positioning.

IVSstat0818pmRTS_BGam		Predicted location (m)			Predicted Depth (cm)		
IVS ID	Target	Easting	Northing	Location error	Estimated	error	Polarizability Misfit %
IVS 1	Stokes mortar	317470.00	4311986.80	0.07	33.9	4.9	0.989
IVS 2	75 mm	317470.21	4311982.29	0.08	42.8	6.8	0.988
IVS 3	Medium ISO (schedule 40)	317470.12	4311977.84	0.06	15.9	1.9	0.99
IVS 4	Small ISO (schedule 80)	317469.98	4311973.20	0.06	30.5	2.5	0.843

Conclusion

Initial IVS testing confirm that the MPV is operating properly.

- A function test demonstrated that all transmitters and receivers are operating properly, and the response error is less than the MQO of 20%. The function test for the initial IVA testing was in a static, cued mode. Dynamic function tests have been acquired, and the results will be compiled over the course of the project.
- The spin test is designed to verify proper operation of the GPS and IMU, as well as the correct integration of their respective data streams. Initial spin tests were showed that the system met the MQOs.
- Position accuracy was confirmed by comparing the recovered source locations from inverting dynamic data to the ground truth locations for the seeded targets.
- A detection analysis for a MarkIV booster at a depth of 30cm was completed. We found that for the center of the z-coil transmitter at a height of 10 cm above the surface (i.e. the bottom of the sensor head 2 inches above the ground) the detection threshold for the composite channel is 1.19 mV/A. This threshold is 4.3 times the IVS site noise when using RTK for positioning, and 2.8 times the IVS site noise when using RTS for positioning. We note that subsequent data acquired with the RTS positioning have lower levels of background noise than found at the IVS.
- At each site, the site specific noise will be estimated. The detection threshold will always be chosen to at least as large as 3 times the site noise. In cases where the detection threshold is set higher than 1.19 mV/A, we will recalculate the clearance depth for the MarkIV booster.
- Inversion of cued data result in polarizability fits exceeding the MQO of 0.9, with the only exception being the cued measurement of the small ISO when the RTS was used for positioning. For that small ISO instance, the polarizability fit was 0.843 which is sufficiently high to be chosen as a target of interest during classification.

Initial Dynamic and Static Instrument Verification Strip (IVS) Technical Memorandum

1. Introduction

This report documents the results for the initial Static and Dynamic Instrument Verification Strip (IVS) survey conducted as part of the Geophysical System Verification (GSV) process for the digital geophysical mapping (DGM) being performed in support of the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study in Spring Valley, Washington, D.C. The GSV process includes construction of an IVS near the survey site to be used for verification of proper DGM system operation. An initial survey of the IVS is conducted whereby sensor response amplitudes and position accuracy are evaluated against independently derived standards to ensure system functionality prior to the commencement of data acquisition in the survey area. Twice daily surveys of the IVS and a blind seeding program are used to monitor system performance throughout data collection activities. This process is discussed in greater detail in *Worksheet #22—Equipment Testing, Inspection, and Quality Control*, and *Appendix A Standard Operating Procedures (SOP)*, contained within the SVFUDS Pilot Study Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) (ERT, 2016).

The IVS was constructed at the site and an initial survey of the IVS was performed with the Naval Research Lab (NRL) TEMTADS 2x2 (TEMTADS) advanced EMI sensor.

2. TEMTADS Assembly

The TEMTADS sensor (Figure 1 and Figure 2) was assembled in accordance with SOP02 TEMTADS Assembly referenced on worksheet #22 of the QAPP. The TEMTADS sensor height above ground measured 21 centimeters (cm). Positioning of the static and dynamic DGM data was maintained using either a Real-Time Kinematic (RTK) Global Positioning System (GPS) or a Robotic Total Station system. Sensor orientation was measured with an Inertial Measurement Unit (IMU), which recorded pitch, roll, and yaw for each data point.

Figure 1. TEMTADS sensor after assembly with RTK GPS. The figure on the right shows the orientation of the IMU sensor.

Figure 2. TEMTADS sensor after assembly with RTS prism.

3. Instrument Verification Strip (IVS) Construction

ERT established the IVS on the Federal Property where the former SVFUDS GPO was installed on July 29 and August 1, 2016.

Prior to installation of the IVS, the ESTCP TEMTADS data collection team consisting of NRL field personnel collected an initial background (i.e. pre-seeded) survey at the proposed IVS location on July 25, 2016. The background survey data were processed and evaluated by the ESTCP TEMTADS data processor (AcornSI personnel). The results were subsequently sent to the ERT QC Geophysicist and Project Manager as well as the USACE Project Manager for review and approval.

The results of the background IVS survey are presented in Figure 3. The monostatic Z coil response amplitude on the 0.137 millisecond (ms) time gate are represented by color contours with anomalies greater than 1.6mV/A superimposed. The target population for this study is a booster/fuze from a 75mm MkIV Booster at 1foot below ground surface (bgs). At the time of the background survey this item was not available so a small ISO80 at 1 ft bgs was used to define the minimum response. The 1.6mV/A threshold was selected because it corresponded to the response of a small ISO at a depth of 35cm which is slightly deeper and thus more conservative than the project objective of 1ft bgs. The two red rectangles represent the location of the noise line (left) and IVS line (right). These areas were chosen because they contained the fewest background anomalies and would require the least effort to establish the IVS. All anomalies within and in close proximity to the rectangles were intrusively investigated and any located metal were removed. Figure 4 shows the objects that were excavated.

In accordance with the QAPP, one small Schedule 80 ISO, one medium ISO, an inert 75mm projectile and an inert Stokes mortar were buried along a transect in the IVS. The IVS transect start and end locations, along with the four seed items, were marked with vinyl-stem flags (Figure 5). Table 1 presents the locations and description of the seed items buried in the IVS. The coordinates presented in Table 1 were professionally surveyed during the installation of the IVS.

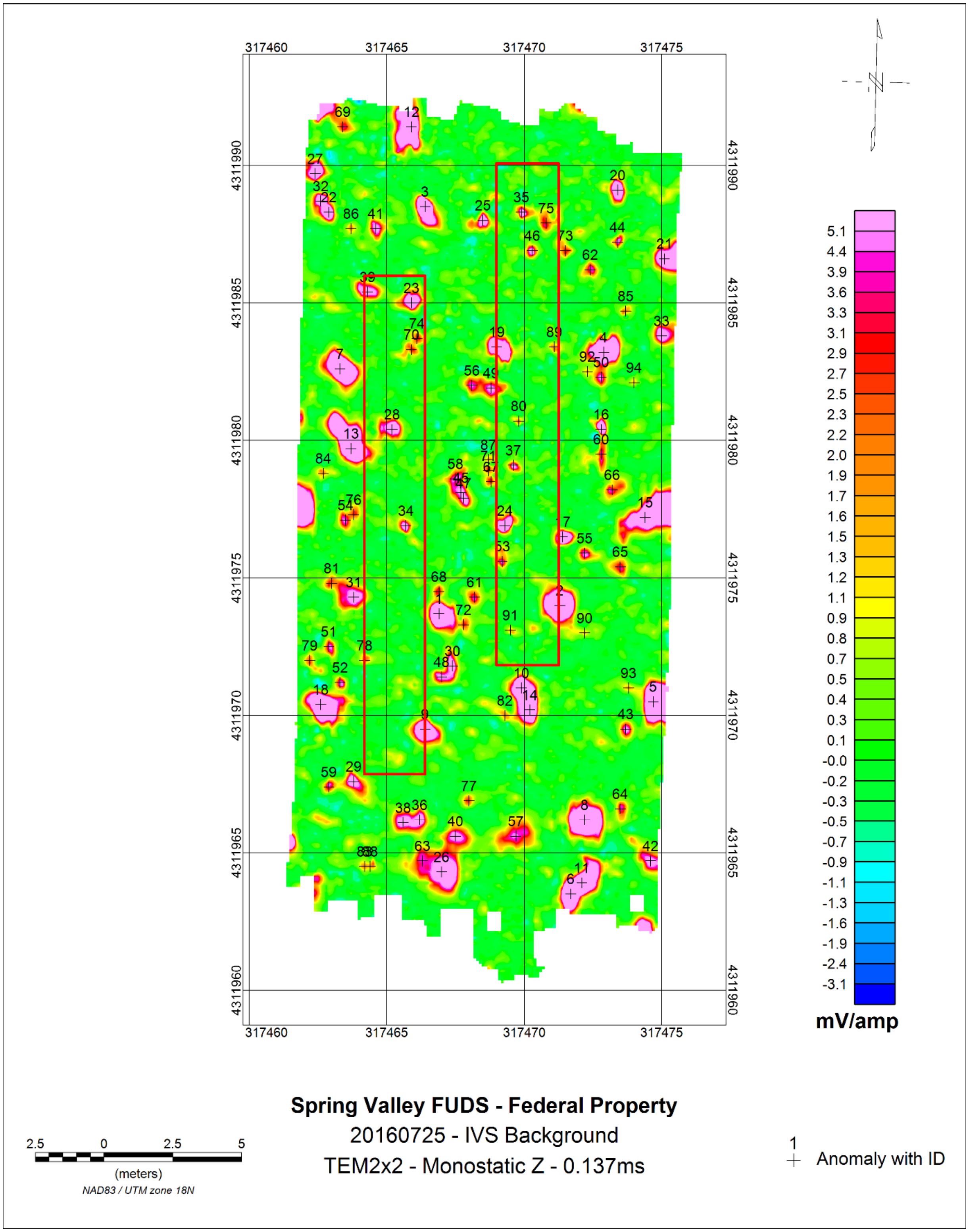


Figure 3. Background survey over the proposed IVS location with the TEMTADS2x2 sensor.

Figure 4. Metal objects removed from proposed IVS location after background survey

Table 1. IVS Seed Item Locations

IVS ID	Seed Description	UTM Easting (m)	UTM Northing (m)	Depth (m)
IVS-1	Stokes Mortar – Horizontal – Small diameter end points south	317469.999	4311986.730	0.29
IVS-2	75mm – Horizontal – nose to south	317470.213	4311982.371	0.36
IVS-3	Medium ISO – Horizontal – Cross track	317470.161	4311977.887	0.14
IVS-4	Small ISO – Horizontal – Along track	317470.006	4311973.248	0.28

Note 1: Coordinates are UTM Zone 18N, NAD-83
Note 2: Depths reflect depth below ground surface to approximate seed item center of mass

Figure 5. The TEMTADS 2x2 is at the north end of the IVS line. The pink and yellow pin flags in the foreground define the IVS static background location.

4. Initial IVS Survey Results

The dynamic IVS survey for the SVFUDS Pilot Study was collected on August 2, 2016 by NRL personnel, and processed by an AcornSI data processor and reviewed by the QC Geophysicist. The IVS items and noise line were surveyed two times using the same procedures except two different positioning systems were used. Some of the properties included in the pilot study contained vegetation which may prevent a clear view of the sky which is needed for RTK GPS thereby requiring the use of the RTS. As a precautionary measure it was decided to test both positioning systems at the IVS prior to the actual TEMTADS 2x2 surveys over the pilot study properties. The first survey used RTK GPS to position the sensor array and the subsequent survey was positioned using RTS. Both positioning systems used the monument P3MON (317444.09942E, 4311973.58056N – NAD83 UTM Zone 18N) as the main control point to calibrate their systems.

a. Dynamic

Data collection began with a sensor function test. This test involved the collection of data over a background location and a second measurement at the same location but with a small ISO mounted in the hole on the top of the sensor housing. The initial measurement was used to background correct the second measurement resulting in the sensor response to the small ISO. The data were processed using the purpose built tool in Geosoft's UX-Analyze. The tool compares the responses from each of the receiver cubes to reference values and flags measurements that exceed the +/-20% measurement quality objective (MQO). Both sensor setups passed the sensor function test as shown in Figure 6.

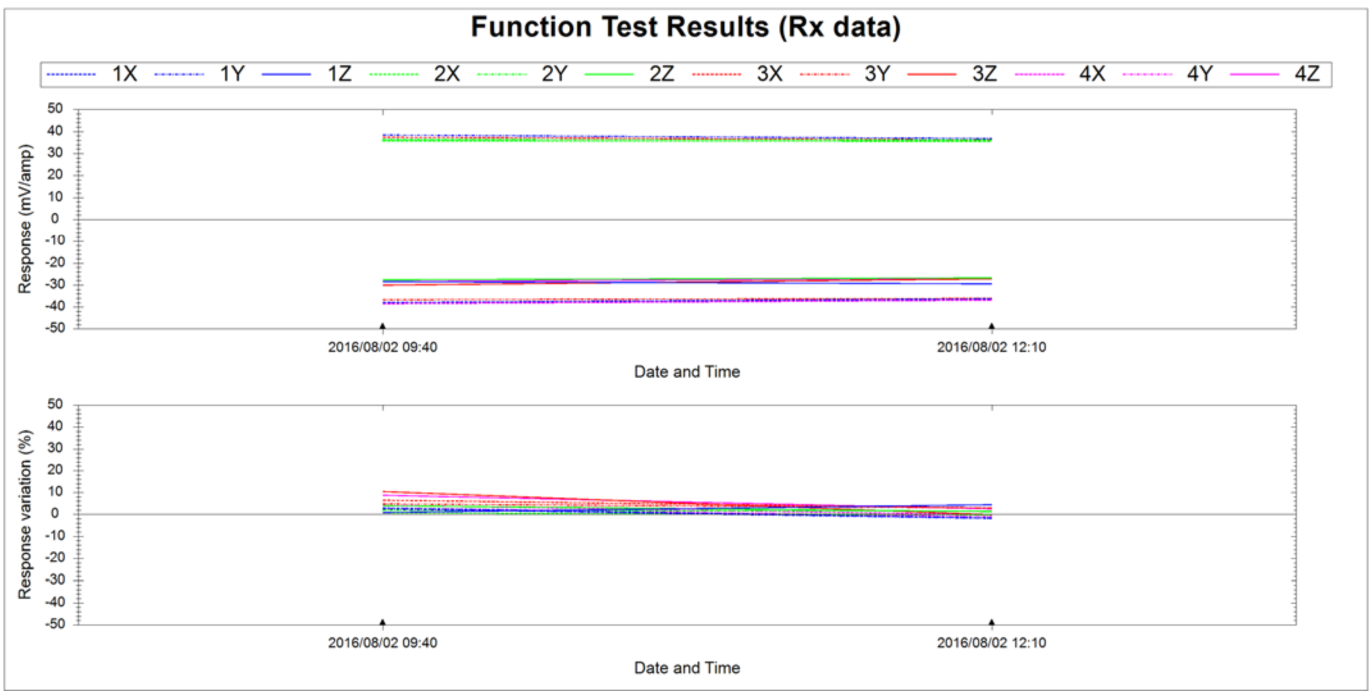


Figure 6. Dynamic sensor function test results using RTK GPS (9:40am) and RTS (12:10pm) positioning systems.

Dynamic data were collected over the IVS items and noise line. Five lines were traversed over the IVS items in alternate directions at a nominal line spacing of 0.45m. A single pass was recorded over the noise line. The data were imported into UX-Analyze and the data were checked for validity with regards to transmitter current, GPS fit quality, IMU data quality and EMI response range. Next, the data were located with positions corrected using the measured pitch, roll and heading and finally projected into the project coordinates system (NAD83, UTM Zone

18N, meters). Another purpose-built tool in UX-Analyze was used to assign a location to each coil in the sensor array. Finally, the data were leveled using a demedian filter to remove the background response.

The leveled monostatic Z coil data for the 0.137ms were gridded and used for amplitude response based target selection. The Blakely algorithm in Geosoft's automatic grid peak detection tool was used to select the IVS targets.

Quality control (QC) and data processing of the TEMTADS system was performed in accordance with the SOPs outlined in the QAPP. Details on the SOPs and associated MQOs can be found in the SVFUDS Pilot Study UFP QAPP (ERT, 2016).

All recorded data from both surveys passed the data validity checks. Figure 7 presents the dynamic TEMTADS2x2 monostatic Z coil data for the 0.137ms time gate. The survey positioned using RTK GPS is on the left and the right is the RTS positioned survey. The ground truth locations are plotted as circles and the peak response locations from the survey data are plotted as +'s. The TEMTADS peak responses and spatial offsets from the ground truth locations for the seed items in the IVS are presented in Table 2. As the table shows, all seed items were detected within the 0.25m MQO using data from both surveys. It should be noted that the selected target locations using the RTK GPS survey were the same as the RTS survey for all items except IVS-1 which was only slightly different.

Site specific noise levels were measured for the TEMTADS at the IVS site to confirm that the signal to noise ratio (SNR) for the detection goal of a small ISO80 at 1ft bgs (QAPP worksheet #11) was achievable. The system noise levels, calculated as the standard deviation of the amplitude response at the 0.137 ms time gate along the noise line, was 0.337 mV/A. Figure 8 presents the project detection goal, IVS noise level and SNR of 5 plotted with the theoretical response amplitude of the small ISO80. Even though the noise levels are higher than typical, probably due to environmental noise caused by the urban location, the project goal of detecting a small ISO80 at 1ft bgs is achievable.

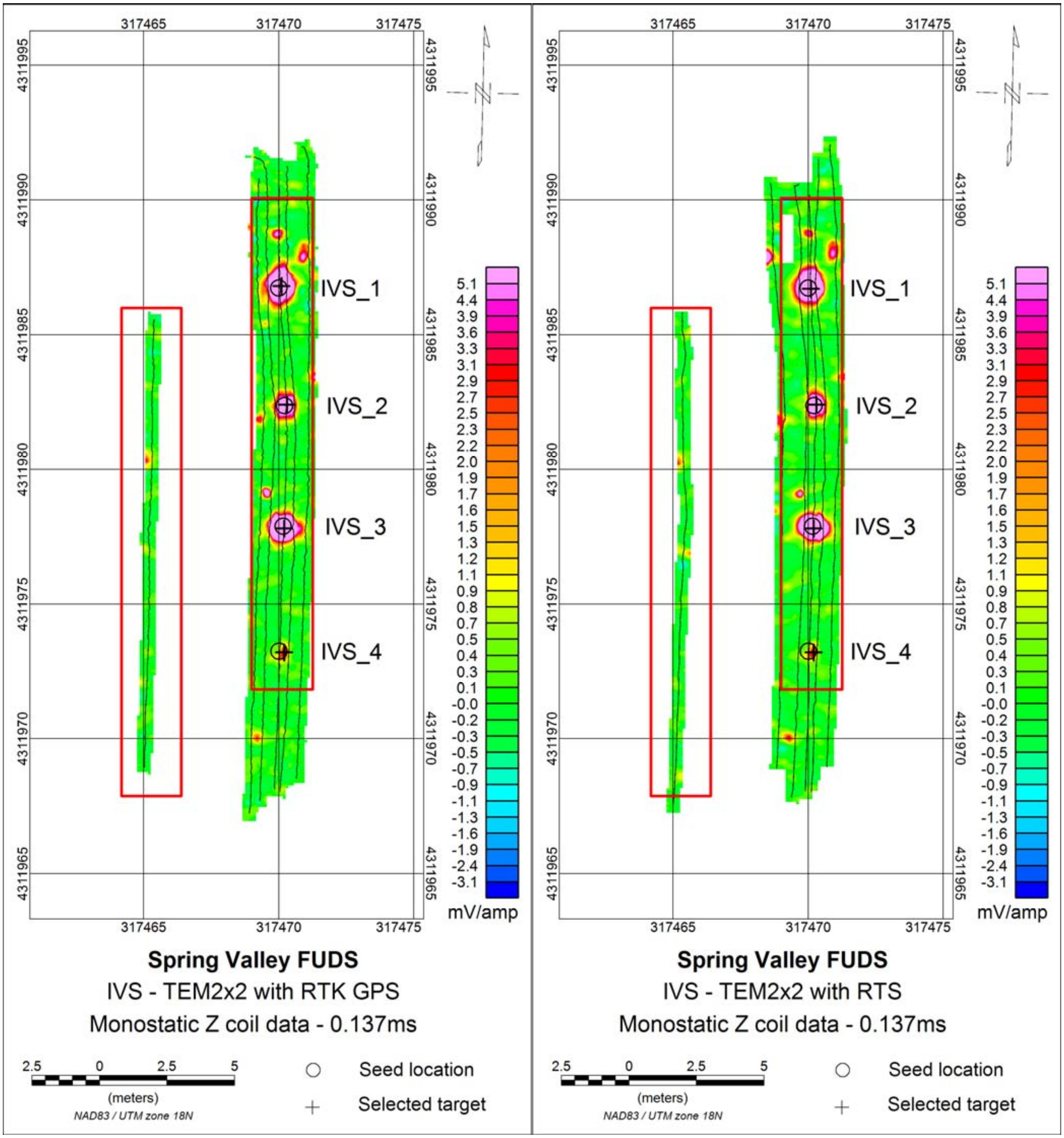


Figure 7. Dynamic TEMTADS2x2 monostatic Z coil data presented as color contours. The survey positioned using the RTK GPS is on the left and RTS on the right. The circles indicate the actual seed locations while the +'s are the target locations selected from the respective data.

Table 2. Dynamic IVS detection results

IVS ID	Seed Description	RTK GPS Survey		RTS Survey	
		Location offset (m)	Amplitude Response 0.137ms time gate (mV/A)	Location offset (m)	Amplitude Response 0.137ms time gate (mV/A)
IVS-1	Stokes Mortar	0.122	36.8	0.105	34.7
IVS-2	75mm	0.092	11.0	0.092	12.4
IVS-3	Medium ISO	0.096	57.8	0.096	78.1
IVS-4	Small ISO	0.199	4.1	0.199	4.2

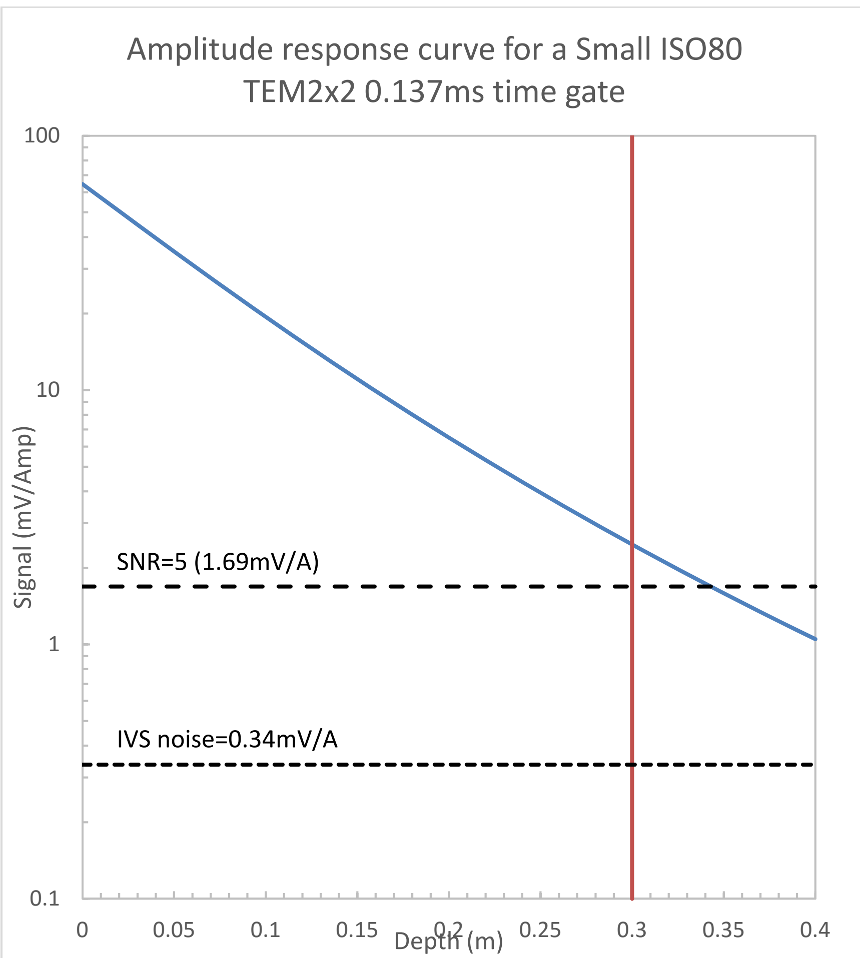


Figure 8. Response amplitude curve for a small ISO80 with IVS noise levels.

b. Cued

Similar to the dynamic survey data collection began with a sensor function test. The data were collected and processed using the same procedures as the dynamic survey with the only difference being the sensor configuration parameters were set for cued collection. Sensor setups using the RTK GPS and RTS positioning systems passed the sensor function test as shown in Figure 9.

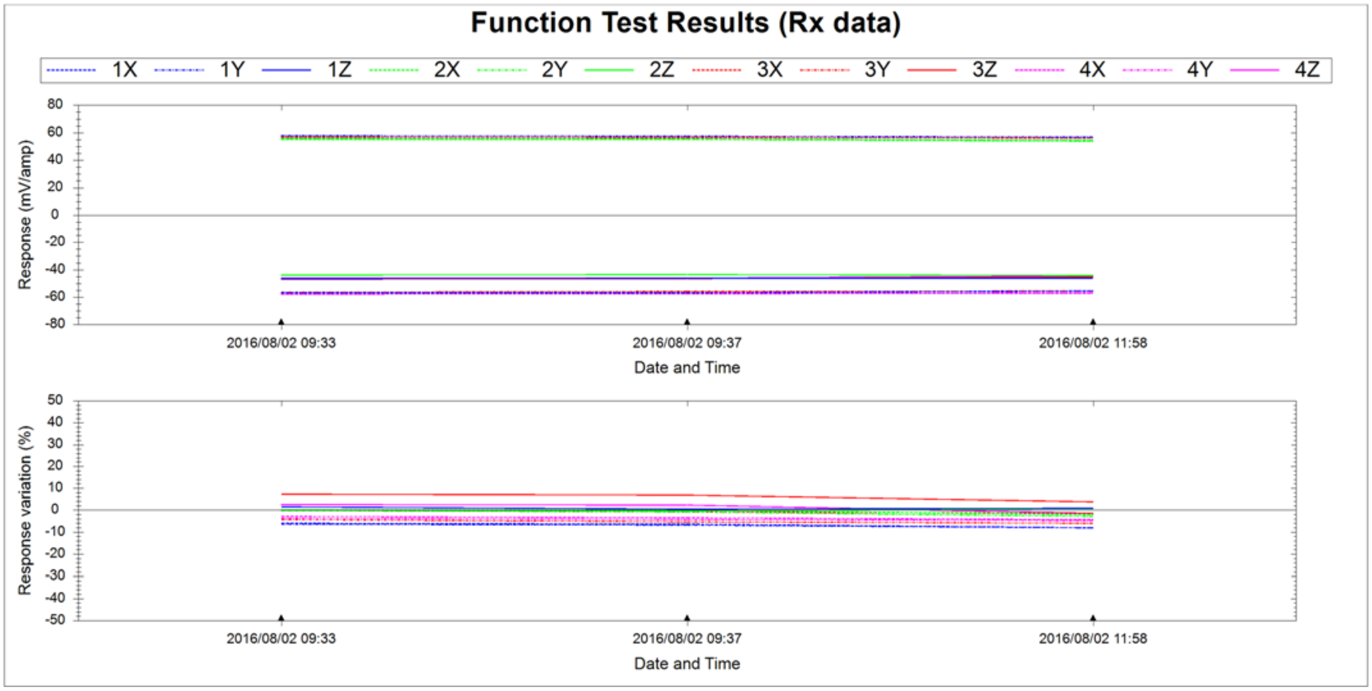


Figure 9. Static sensor function test results using RTK GPS (9:33am and 9:37am) and RTS (11:58am) positioning systems.

Next, cued data were collected over each IVS item and a predefined background location. The data were imported into UX-Analyze and the data were checked for validity with regards to transmitter current, GPS fit quality, IMU data quality and EMI response range. The position data were corrected for attitude using the measured pitch, roll and heading and projected into the project coordinates system (NAD83, UTM Zone 18N, meters). The data were then leveled using the background measurement. The background corrected data were submitted to the inversion process which used a single source solver to derive target features. These features include extrinsic parameters (location and orientation) as well as intrinsic parameters (principal axis polarizabilities) that are used for classification. The polarizabilities were compared to a library consisting of representative munitions and a fit metric (values from 0 to 1) was generated with higher values indicating a better match. Additional details on the processing can be found in the SVFUDS Pilot Study UFP QAPP (ERT, 2016).

All recorded data from both surveys passed the data validity checks. Table 3 and Table 4 present the inversion results and comparison to the ground truth locations for the seed items in the IVS for the RTK GPS and RTS surveys, respectively. As the tables show, all seed items were detected within the 0.25m MQO using data from both surveys and the inverted target locations using the RTK GPS survey and RTS survey were within a few cm of each other. It should be noted that both the cued and dynamic surveys using both positioning systems produced target locations that were biased toward the east by 5-10cm. This is within tolerance of the MQOs but it points to a small inconsistency between the surveyed IVS locations and those calculated using the geophysical data.

Table 3. Cued IVS results using RTK GPS and Single Source Solver

IVS ID	Seed Description	UTM Easting (m)	UTM Northing (m)	Depth (m)	Location offset (m)	Depth offset (m)	Fit coherence	Library match metric
IVS-1	Stokes Mortar	317470.086	4311986.759	0.312	0.091	-0.017	0.9985	0.9443
IVS-2	75mm	317470.282	4311982.377	0.393	0.070	-0.032	0.9988	0.9592
IVS-3	Medium ISO	317470.222	4311977.826	0.176	0.087	-0.041	0.9995	0.9799
IVS-4	Small ISO	317470.104	4311973.193	0.274	0.112	0.006	0.9503	0.8324

Table 4. Cued IVS results using RTS and Single Source Solver

IVS ID	Seed Description	UTM Easting (m)	UTM Northing (m)	Depth (m)	Location offset (m)	Depth offset (m)	Fit coherence	Library match metric
IVS-1	Stokes Mortar	317470.105	4311986.790	0.312	0.121	-0.018	0.9984	0.9440
IVS-2	75mm	317470.306	4311982.390	0.390	0.095	-0.029	0.9984	0.9537
IVS-3	Medium ISO	317470.221	4311977.822	0.176	0.089	-0.041	0.9995	0.9782
IVS-4	Small ISO	317470.105	4311973.183	0.252	0.118	0.028	0.9482	0.8450

The library match metric for all IVS items exceeded the MQO of 0.9 except for item IVS-4 which was the small ISO. The library match for that item was 0.8324 and .8450 for the RTK GPS and RTS systems, respectively. The small ISO was buried at a depth of 28cm which is approaching the project limit of 30cm. If a multi-source solver is used to extract the polarizations the library match metric increases to 0.9162. Figure 10 presents the results of the library match using both the single and multi-source solvers. The polarizations for the IVS item are shown in full color and those of the library are shown in reduced intensity. The polarizations are fairly noisy due to the low SNR but the polarizations from the multi-source solver clearly match a small ISO. Looking at the background survey (Figure 3) there is a small anomaly (91) and another 0.8m to the east which are in the immediate vicinity of the seed item. Anomaly 91 was investigated during the installation of the IVS but the other anomaly was below our threshold and not selected for investigation. Under most circumstances the small anomaly would not be an issue but in this instance it had an effect because the seed item was buried deep and very close (<0.5m) to the anomaly. In addition to the source shown in Figure 10, the multi-source solver also returned a very small source in the same vicinity as this small background anomaly.

The purpose of the IVS is to ensure and document the proper functioning of the system over the course of a project. The IVS is surveyed at the start and end of each day and the results are compared to a baseline to confirm the system has not changed. As the depth of an item increases, the SNR decreases and the polarizations typically become noisier which make the comparison to the baseline more variable. This variability does not necessarily indicate a problem with the sensor but is a function of the low SNR due to the depth of the item. For this reason, the IVS items are typically buried in an area devoid of anomalies at a depth which produces a moderate to high SNR. This reduces the complexity of the test because a single solver can be used to invert the data to produce reliable target parameters. Because IVS-4 does not conform to these criteria it is recommended that IVS-4 is not used to test the proper function of the system. Removing IVS-4 from the IVS test should not cause any problems because the other 3 items are sufficient to ensure the system is operational.

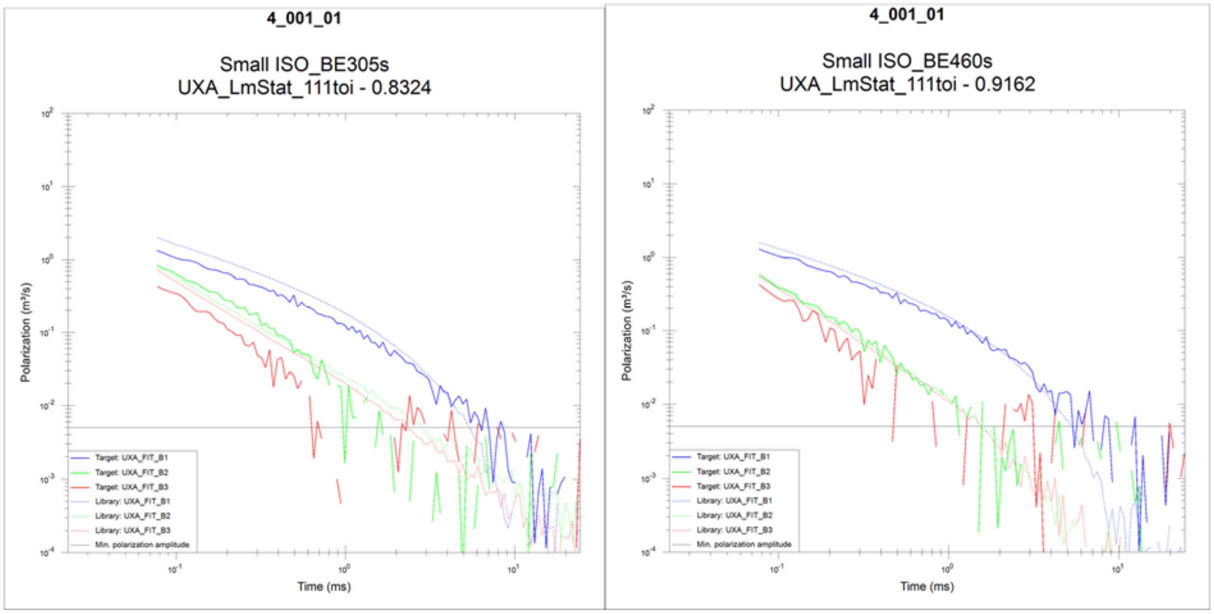


Figure 10. Library match for IVS-4 using polarizations from the single (left) and multi-source (right) solvers.

5. IVS Conclusions

ERT, Inc. installed an IVS and the ESTCP TEMTADS data collection team performed an initial IVS survey in dynamic and cued modes to validate the TEMTADS equipment prior to the start of the dynamic detection survey for the SVFUDS pilot study. Because the pilot study contains properties with thick overhead vegetation the IVS surveys were completed using an RTK GPS and a RTS positioning system. The dynamic data produced using the different positioning systems produced essentially the same results with both systems meeting the MQOs set forth in the QAPP. The data from the static survey also met all the MQOs but item IVS-4 needed an additional processing step to meet the library match MQO. IVS-4 was a small ISO at depth of 28cm and was buried near a small background anomaly. The low measured response of the small ISO in conjunction with the additional small anomaly necessitated the use of a multi-source solver to derive polarizations that met the MQO. It is recommended that IVS-4 not be used to ensure the proper functioning of the system and instead rely on the other 3 items buried in the IVS that have a higher SNR and are not affected by nearby anomalies. It was also observed that both the cued and dynamic surveys using both positioning systems produced target locations that were biased toward the east by 5-10cm. This is within tolerance of the MQOs but should be monitored over the course of the project.

In addition, the site specific noise levels as measured at the IVS indicate that the project detection goals are achievable.

6. References

ERT, 2016. *Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPP), (Advanced Geophysical Classification for Munitions Response), Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study, Washington, D.C.*

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EM61

MEMORANDUM

TO: Alex Zahl, USACE-CENAB, Thomas Colozza, USACE-CENAB, Cheryl Webster, USACE-CENAB

FROM: James Stuby, Ji Ma, and Thomas Bachovchin, ERT

DATE: September 27, 2016

SUBJECT: EM61-MK2A Instrument Verification Strip at Spring Valley FUDS, Washington, DC

ERT, under contract with the U.S. Army Corps of Engineers (USACE), Baltimore District, is performing a Pilot Study at the Spring Valley FUDS, Washington, DC. This memorandum addresses the testing of the EM61-MK2A on the existing Instrument Verification Strip (IVS) on the federal property.

The IVS was constructed in August 2016 by ERT at the federal property, as documented in "Initial Dynamic and Static Instrument Verification Strip (IVS) Technical Memorandum" dated 12 August 2016. The IVS consists of a noise line and a seed line consisting of 4 items including industry standard objects (ISOs) and inert munitions. The seed line is summarized in Table 1.

Table 1: IVS Seed summary

Seed	Seed type	Orientation	Maryland State Plane, US Survey Feet		diam. (cm)	depth to center (cm)
			Easting	Northing		
1	Stokes Mortar	horizontal, along track, smaller diam. to south	1282183.98	462959.89	7.5	29.5
2	75mm round	horizontal, along track, nose to south	1282184.99	462945.61	7.5	36.1
3	Medium ISO	horizontal, cross-track	1282185.15	462930.90	5.08	13.5
4	Small ISO	horizontal, along track	1282184.97	462915.67	2.54	28.0

On 19 September 2016, data were collected over the seeds with the EM61-MK2A in accordance with the Field Change Request (FCR) approved by USACE on 15 September 2016. The initial survey of the IVS was designed to confirm both the operation of the survey system and the ability of the EM61-MK2A to detect the items of interest at the depth of interest in the noise environment particular to the survey area. Initial data collection over the IVS was more extensive than production-level passes over the IVS area. The first pass was made with the EM61-MK2A sensor 2.0 ft offset from the seed line. The next pass was directly over the test items ("seed line"). The third pass was made with an offset of 2.0 ft on the opposite side from

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the first pass. The final pass was approximately 20 feet (at a pre-flagged location) offset from the line of test items to make a measurement of electromagnetic site noise ("noise line"). All lines were collected twice to assess repeatability. The results are shown in Figures 1 and 2.

All of the seeds were detected. Table 2 summarizes the EM61's Channel 2 millivolt (mV) responses from automatic picking along with offset from the surveyed seed location (shown in Table 1). The results from both runs (tests) are shown.

Table 2: IVS Interpretation from Profile Auto Pick

Seed	Test 1				Test 2			
	Easting	Northing	Channel 2 (mV)	Offset (ft)	Easting	Northing	Channel 2 (mV)	Offset (ft)
1	1282184.07	462960.73	151.80	0.84	1282184.19	462960.18	153.14	0.36
2	1282185.22	462945.92	65.11	0.38	1282185.31	462945.85	65.83	0.39
3	1282185.01	462930.35	118.10	0.57	1282185.16	462930.61	120.81	0.29
4	1282184.67	462915.44	7.02	0.38	1282184.80	462915.90	7.34	0.29

Seed 4, a small ISO, represents smallest TOI for the project, and its response indicates that a minimum threshold should be 7 mV (see below for further discussion of threshold).

Results of the noise line are shown in Table 3. Note that a small anomaly is present on the noise line (at a Northing of ~462920), and the peak was screened out of the standard deviation calculation.

Table 3: Noise Line Summary

Test	Number of Readings	Channel 2 Minimum (mV)	Channel 2 Maximum (mV)	Mean (mV)	Standard Deviation (mV)
1	340.00	-3.98	3.99	0.71	1.88
2	260.00	-2.76	3.44	0.6	1.36
Average	300.00	-3.37	3.72	0.66	1.62

Profiles of instrument responses for background line and seed line are shown in Figure 3.

The EM61 minimum response curves are shown in Figures 4 and 5 for the medium ISO (seed 3), and small ISO (seed 4), respectively. Both items plot above the minimum expected response.

During the production data collection on 20 to 22 September 2016, static noise tests were conducted at each of the three residential properties. This information is presented in Table 4. The noise varies considerably, and therefore it may be used to develop site-specific anomaly thresholds which supersede any anomaly threshold developed from the IVS data discussed above.

Table 4: Static Noise Test Summary and Thresholds

Site	Number of Readings	Channel 2 Minimum (mV)	Channel 2 Maximum (mV)	Mean (mV)	Standard Deviation (mV)	Mean + 3x SD Threshold (mV)
4720 Quebec	761.00	-6.83	8.73	1.0	2.22	7.66
4740 Quebec	742.00	-13.65	25.11	8.18	5.52	24.74
	745.00	-6.8	24.87	8.62	5.63	25.51
4733 Woodway	827.00	-29.52	36.09	7.29	11.17	40.80
	749.00	-12.68	24.21	3.91	6.19	22.48

The lower of the two thresholds at 4740 Quebec and at 4733 Woodway will be used for initial target picking. Other targets between 25 mV and 7 mV will be added manually if the local noise allows.

Static Quality control tests for the EM61-MK2A collected 19 September are included in Appendix A. All test results are normal.

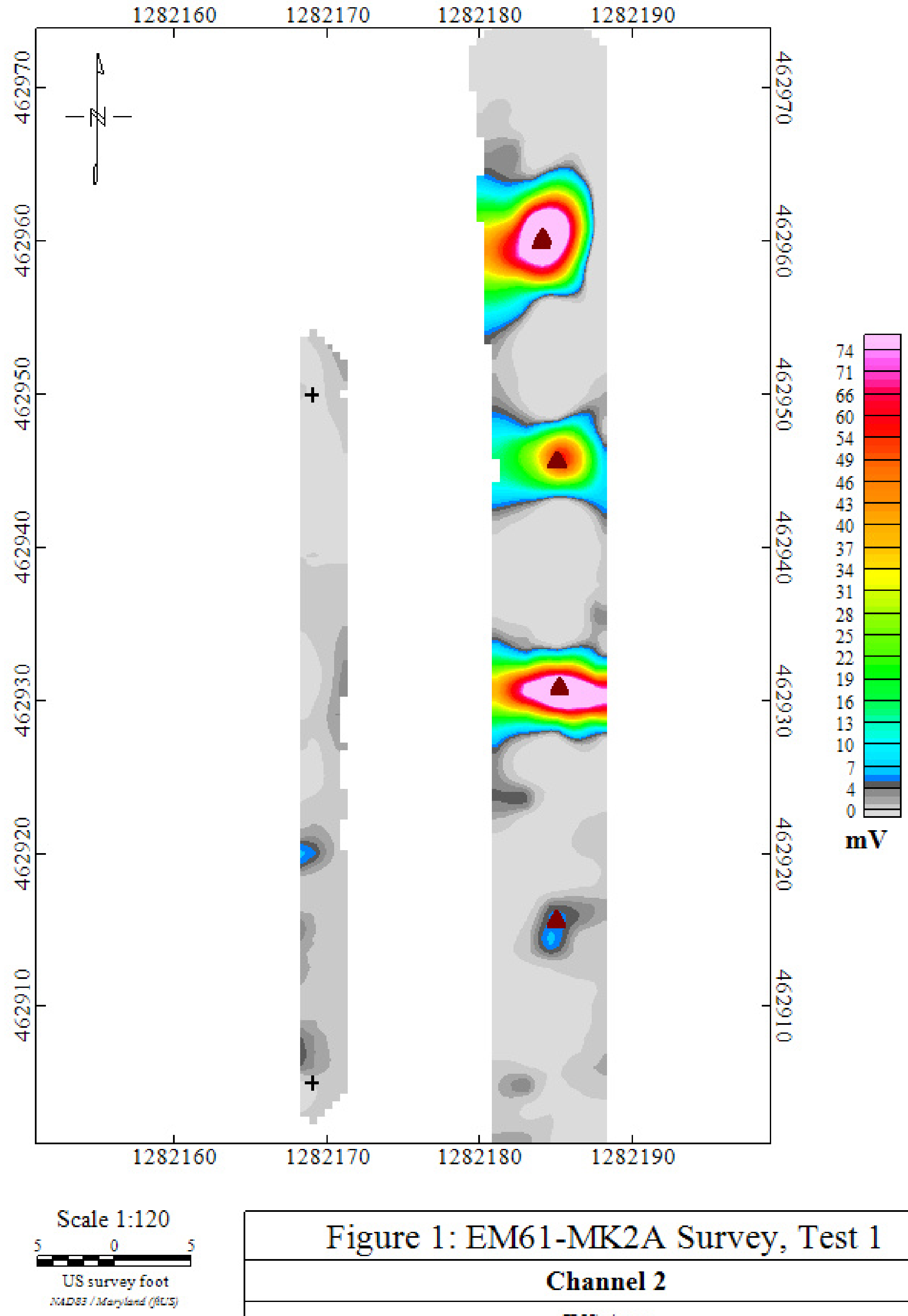
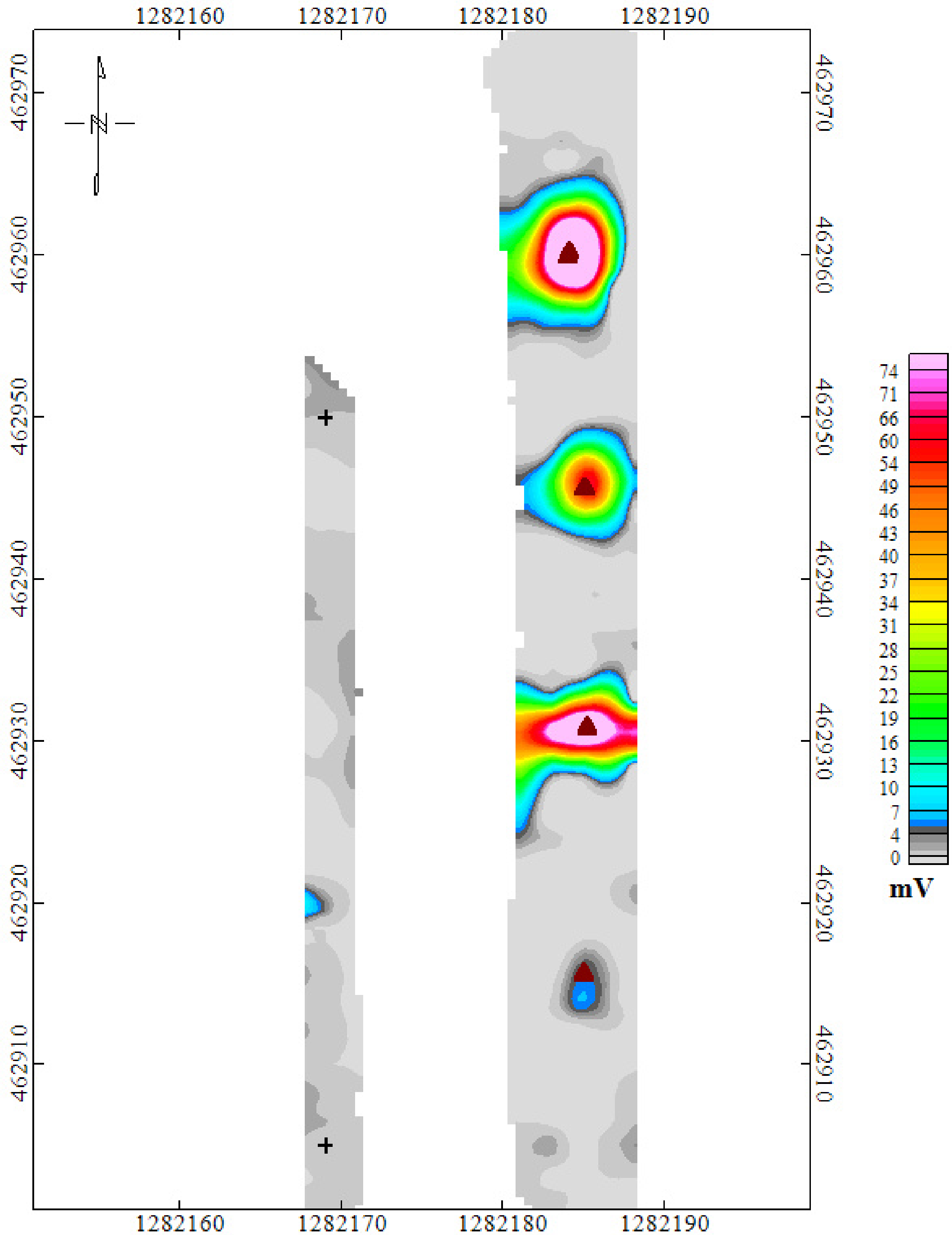


Figure 1: EM61-MK2A Survey, Test 1

Channel 2

IVS Area
Federal Property, Spring Valley, DC

ERT



Scale 1:120

5 0 5

US survey foot

NAD83 / Maryland (ftUS)

Figure 2: EM61-MK2A Survey, Test 2

Channel 2

IVS Area
Federal Property, Spring Valley, DC

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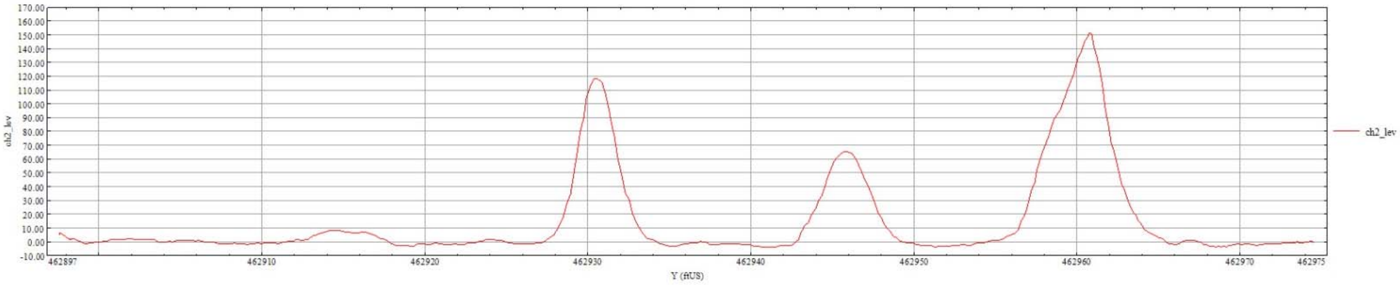
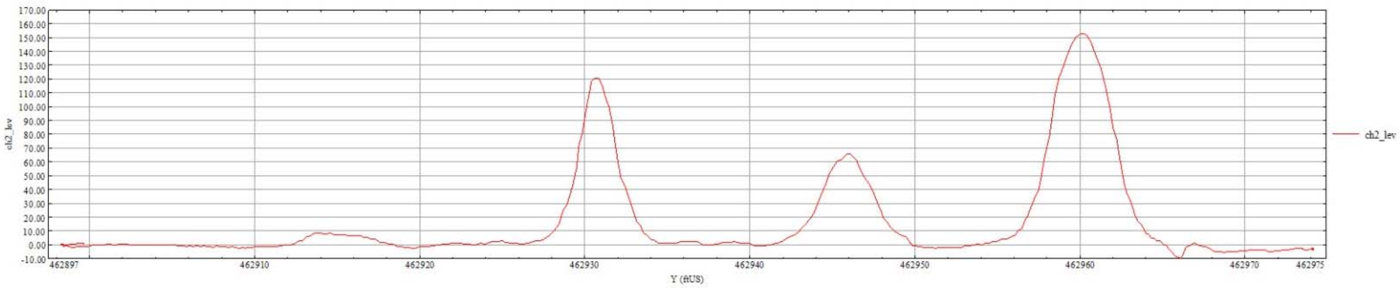
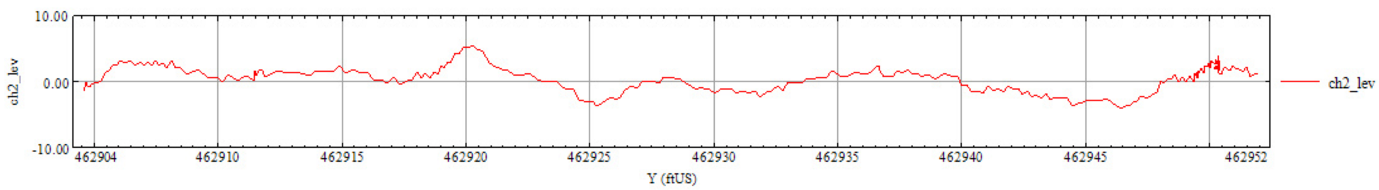
Figure 3



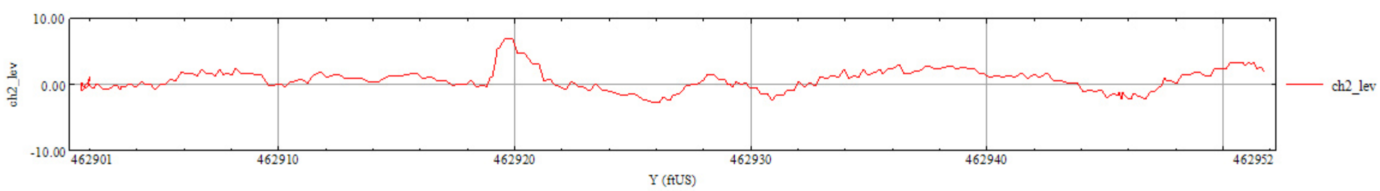
A: Test 1, EM61-MK2A, Channel 2, Seed Line



B: Test 2, EM61-MK2A, Channel 2, Seed Line



C: Test 1, EM61-MK2A, Channel 2, Background Line



D: Test 1, EM61-MK2A, Channel 2, Background Line

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EM61-MK2[4] Gate 2 - Medium Surrogate

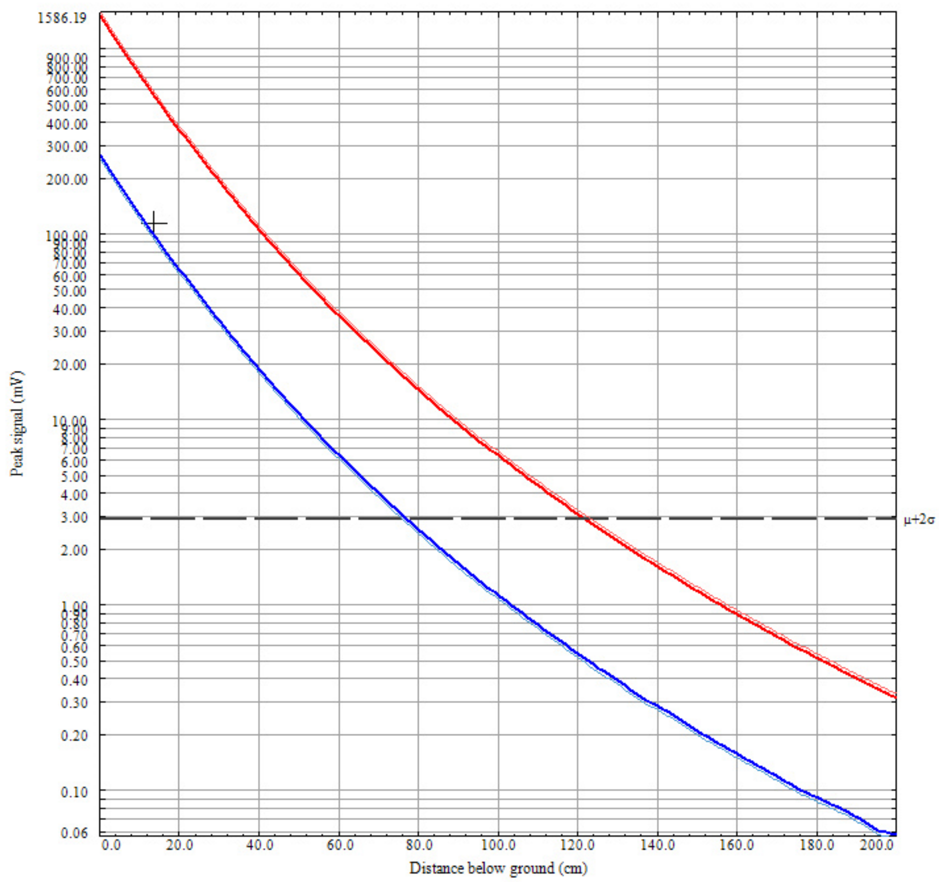

Figure 4

Depth/Response Curve

LEGEND

Noise Level
Most favorable orientation
Least favorable orientation

μ: -0.39
σ: 1.67

No of targets inside the original band: 1
No of targets inside the extended band: 0
No of targets outside the bands: 0

Client:

Project: SV

Contractor:

Created by:	Verified by:
Date:	File: IVS_Medium Surrogate_Gate2
Page number:	Approved:

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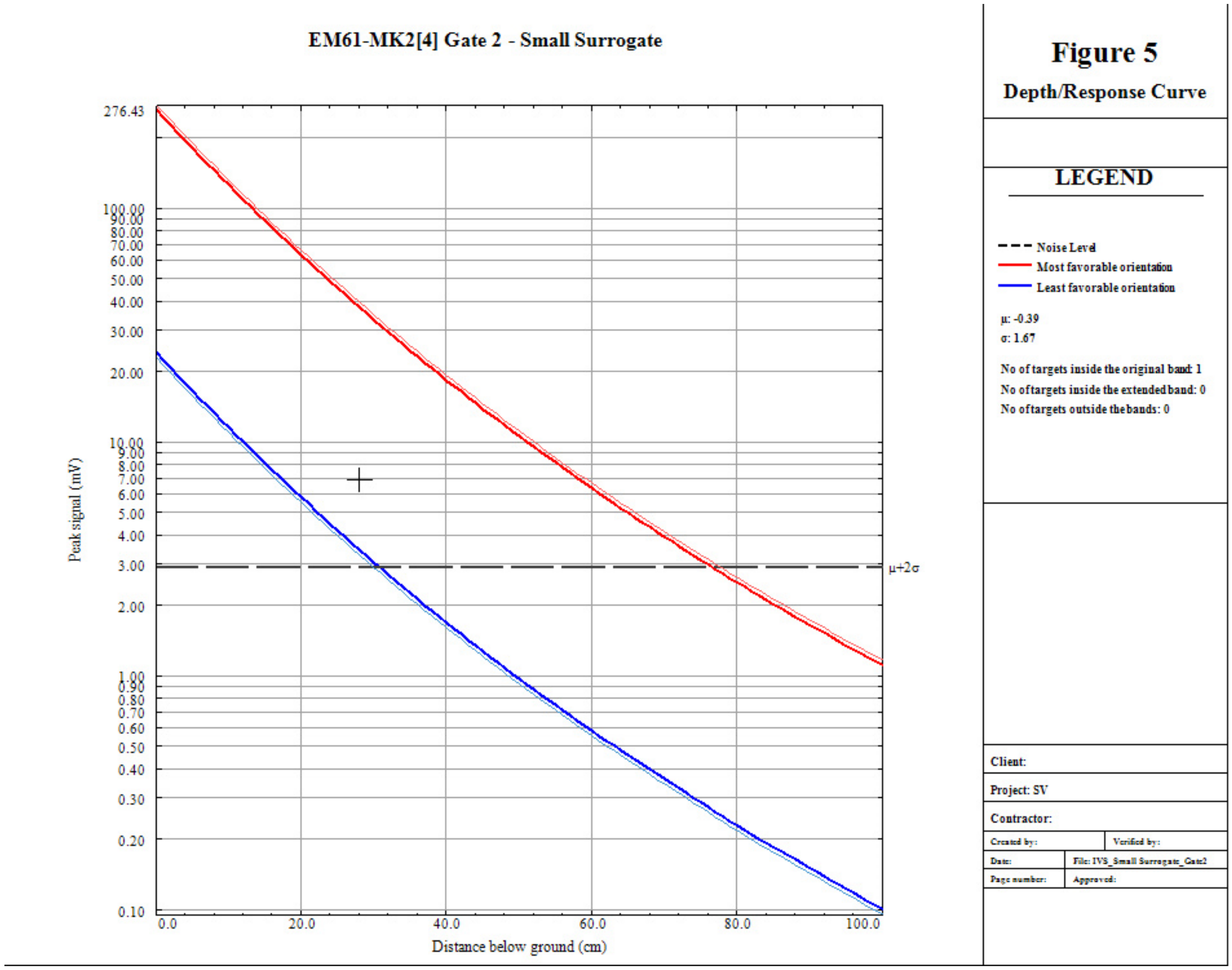


Figure 5
Depth/Response Curve

Appendix A

Instrument Static Quality Control Test Results

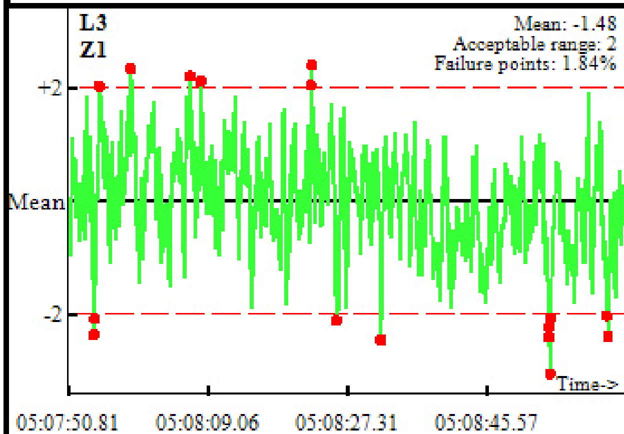
September 19, 2016

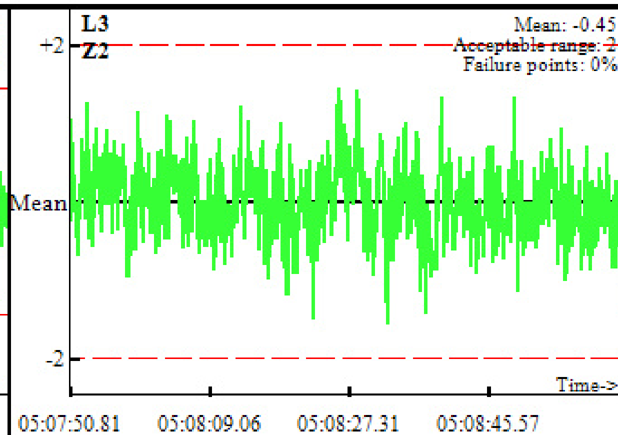
Static Calibration Test

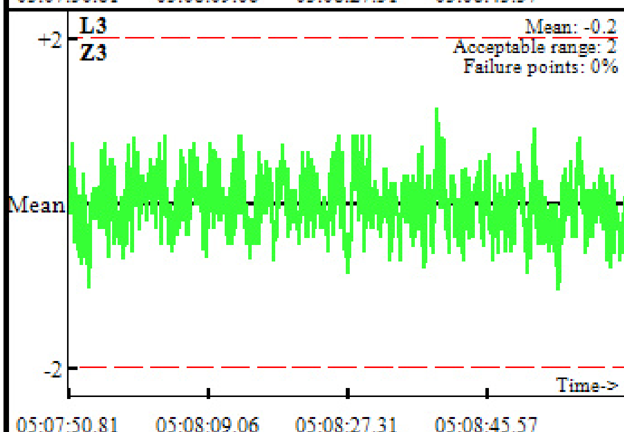
Project: SV
Equipment: EM-61 Mark II
Grid/Location: IVS Area

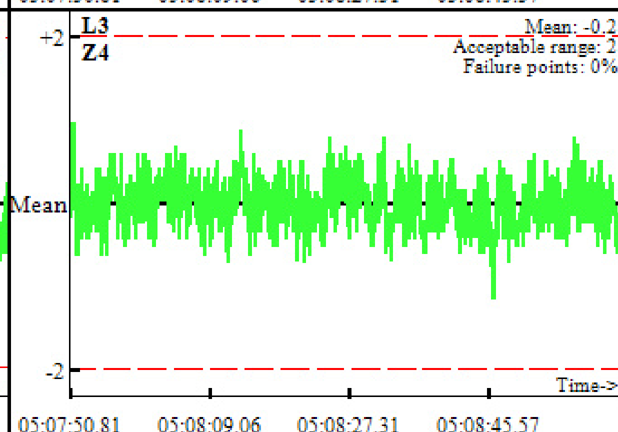
Allowable failure (%): 5%
Outside range
Acceptable limits

AM test
Operator: JM
Date: 09/19/2016









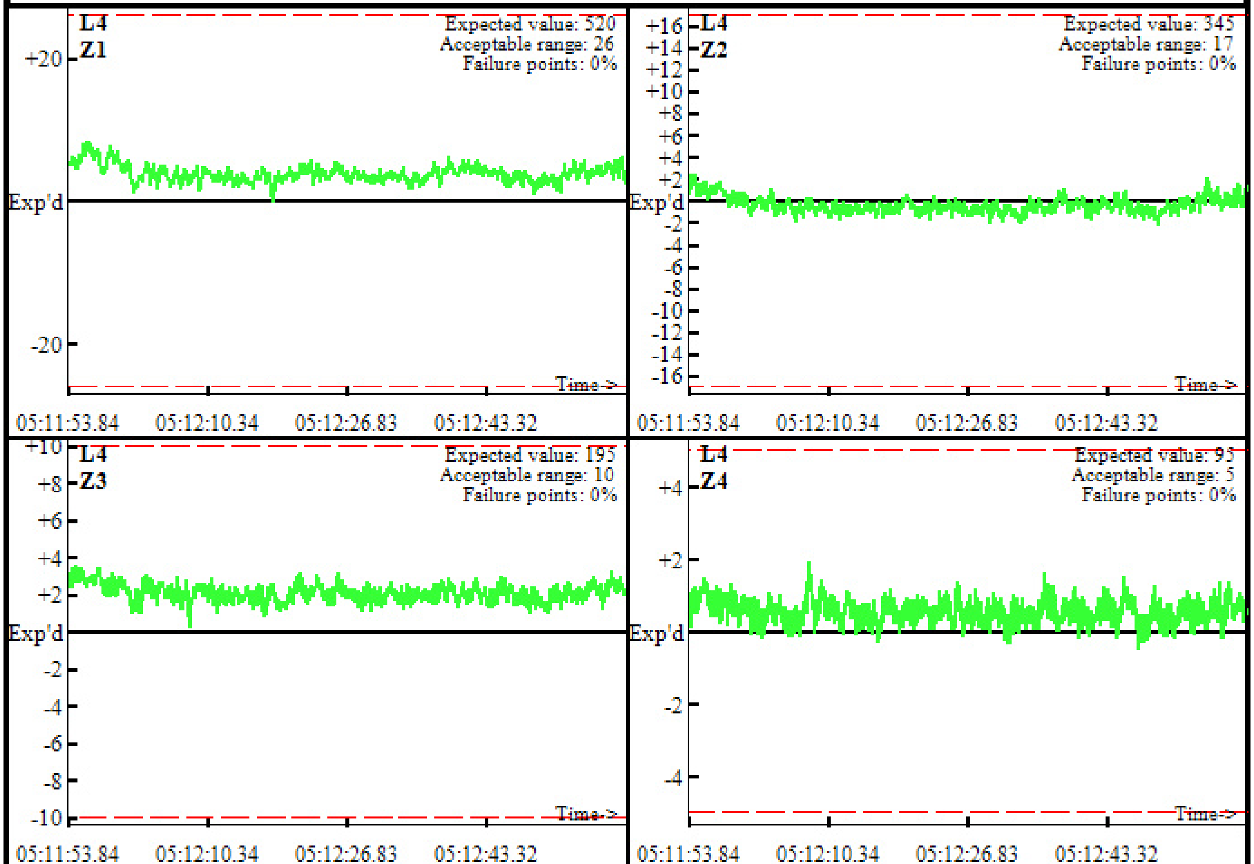
Database: c:\Users\Ji.ma\documents\Project\SV\IVS_0919\0919a.gdb
Line Name: L3

Static Calibration Test

Project: SV
Equipment: EM-61 Mark II
Grid/Location: IVS Area

Allowable failure (%): 5%
Outside range
Acceptable limits

AM test
Operator: JM
Date: 09/19/2016



Database: c:\Users\Ji.ma\documents\Project\SV\IVS_0919\0919a.gdb
Line Name: L4

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Appendix B-2:

Blind Seed Installation Memorandum

SVFUDS Pilot Study

MEMO: Blind Seed Installation

DATE: August 17, 2016

PREPARERS: Jim Stuby, ERT Site Geophysicist and Elise Goggin, ERT QC Geophysicist

As part of the Advanced Geophysical Classification for Munitions Response UFP-QAPP for the SVFUDS Pilot Study, ERT prepared a Geophysical System Verification (GSV) Plan (Appendix B of the UFP-QAPP). This memo details the actual blind seeding at the residential properties.

At the Spring Valley Pilot Study kick-off meeting on May 24, 2016, USACE Geophysicist Tom Colozza stated that ERT could remove items from the existing Geophysical Prove Out (GPO) grids to the east of the Federal Property trailers, and use inert munitions items as blind seeds on the properties, as part of the GSV Plan.

On July 22, 2016, ERT mobilized to the GPO grids. Many items were removed from grid P1, including 4 inert 75 mm projectiles (steel) and 4 inert stokes mortars. On July 29, five more inert munition items were removed from grid P3. These items had tags and were designated SV-P3-02, SV-P3-14 (both brass 75 mm projectiles), SV-P3-18 (M353 training practice tracer projectile), SV-P3-22 and SV-P3-23 (75 mm projectile parts).

On August 9, 2016, ERT began installation of blind seeds at the residential properties, beginning with 4733 Woodway Street. Anomaly avoidance procedures were followed using a Schonstedt GA-52Cx magnetometer, in order to identify safe locations to bury the items. Five items were installed, photographed in place, and the locations and elevations of the ends and centers of each item were surveyed by Charles P. Johnson & Associates, Inc. (CPJ). The excavations were then backfilled and the ground surface restored to its original condition.

On the same day, four blind seeds were installed at 4740 Quebec Street, using the same procedures. The land owner had requested that ERT not install blind seeds in the front yard, and so all blind seeds were installed in the back yard. Note that the GSV Plan outlined a goal of 5 items per property. The plan was to have 4 seeds at 4740 Quebec and 6 seeds at 5100 Tilden Street due to its larger size, but the Tilden street property was ultimately removed from the Pilot Study.

On August 10, 2016, five blind seeds were installed at 4720 Quebec Street, using the same procedures.

Table 1 below is a summary of installed items (a more detailed table of all survey data is included as Attachment A). Photos of installed seeds prior to burial are included as Attachment B.

Table 1: Blind Seed Summary

Property	Seed Number	Description	Northing*	Easting*	Depth to Top (ft)
4733 Woodway	7	75 mm	462787.93	1285625.24	0.70
	8	Stokes Mortar	462764.08	1285550.97	1.14
	9	small ISO (w.s.)	462851.46	1285601.60	0.87
	10	small ISO (s.s.)	462780.07	1285599.99	0.62
	11	medium ISO	462791.41	1285559.97	1.52
4720 Quebec	12	75 mm	462843.80	1285723.77	0.62
	13	Stokes Mortar	462863.79	1285698.92	1.30
	14	small ISO (w.s.)	462949.68	1285687.83	0.15
	15	M353 TPT projectile	462871.95	1285641.91	0.78
	16	large ISO	462920.62	1285758.22	2.55
4740 Quebec	17	75 mm	462898.40	1285520.91	1.89
	18	75 mm proj. part	462902.74	1285501.23	0.62
	19	small ISO (w.s.)	462920.20	1285514.27	0.62
	20	medium ISO	462916.60	1285505.65	0.77

* Maryland State Plane Coordinates - US Survey Feet.

ATTACHMENT A

4733 Woodway												
number	**item**	**orientation**	**point**	**northing**	**easting**	**elevation**	**point name**		**northing**	**easting**	**elevation**	**depth (ft)**
7	75 mm	vertical	903020	462788.0105	1285625.092	324.73704	MI IVS-7	top center	462787.93	1285625.24	325.0759	0.702443
			903021	462787.9613	1285625.201	325.07902	MI IVS-7					
			903022	462787.8713	1285625.205	325.07289	MI IVS-7					
			903023	462787.9053	1285625.287	325.07625	MI IVS-7					
			903024	462787.9788	1285625.257	325.07543	MI IVS-7					
			903025	462787.7597	1285625.205	324.69284	MI IVS-7					
			903026	462787.8745	1285625.38	324.75594	MI IVS-7					
			903027	462788.1166	1285625.295	324.71308	MI IVS-7					
			903016	462788.1959	1285624.561	325.74434	SU IVS-7	ground	462787.95	1285625.14	325.7783	
			903017	462787.3439	1285624.858	325.89269	SU IVS-7					
			903018	462788.5282	1285625.249	325.71762	SU IVS-7					
			903019	462787.7322	1285625.91	325.75871	SU IVS-7					
8	Stokes Mortar	horizontal	903042	462764.391	1285550.585	318.86748	MI IVS-8	top center	462764.08	1285550.97	318.9139	1.135284
			903043	462764.2918	1285550.765	318.87266	MI IVS-8					
			903044	462764.3099	1285550.776	318.93703	MI IVS-8					
			903045	462764.0976	1285551.177	318.93579	MI IVS-8					
			903046	462763.869	1285551.611	318.95672	MI IVS-8					
			903047	462763.6068	1285551.946	320.11394	SU IVS-8	ground	462764.11	1285551.05	320.0492	
			903048	462763.4273	1285550.858	320.00454	SU IVS-8					
			903049	462764.6358	1285550.024	319.91431	SU IVS-8					
			903050	462764.7514	1285551.366	320.16409	SU IVS-8					
9	small ISO (w.s.)	horizontal	903059	462851.3871	1285601.729	325.47422	MI IVS-9	top center	462851.46	1285601.60	325.4727	0.874665
			903060	462851.4432	1285601.624	325.47436	MI IVS-9					
			903061	462851.545	1285601.444	325.4694	MI IVS-9					
			903055	462851.0337	1285601.422	326.32427	SU IVS-9	ground	462851.45	1285601.66	326.3473	
			903056	462851.7201	1285601.051	326.35002	SU IVS-9					
			903057	462851.869	1285601.833	326.37563	SU IVS-9					
			903058	462851.1809	1285602.349	326.33938	SU IVS-9					
10	small ISO (s.s.)	vertical	903035	462780.0808	1285599.957	325.32902	MI IVS-10	top center	462780.071	1285599.99	325.2431	0.618099
			903036	462780.0251	1285599.994	325.33663	MI IVS-10					
			903037	462780.1033	1285600.018	325.33747	MI IVS-10					
			903038	462780.1214	1285599.999	325.33478	MI IVS-10					
			903039	462780.1473	1285599.918	325.12528	MI IVS-10					
			903040	462779.9991	1285599.967	325.11975	MI IVS-10					
			903041	462780.0187	1285600.075	325.11897	MI IVS-10					
			903031	462779.9137	1285600.454	325.85757	SU IVS-10	ground	462780.05	1285599.99	325.8612	
			903032	462780.4407	1285600.129	325.8784	SU IVS-10					
			903033	462780.2184	1285599.564	325.86022	SU IVS-10					
			903034	462779.6177	1285599.824	325.84872	SU IVS-10					
11	medium ISO	horizontal	903009	462791.4578	1285559.674	321.33604	MI IVS-11	top center	462791.41	1285559.97	321.3543	1.524916
			903010	462791.4167	1285559.973	321.36055	MI IVS-11					
			903011	462791.3488	1285560.273	321.3663	MI IVS-11					
			903012	462791.574	1285558.856	322.73099	SU IVS-11	ground	462791.37	1285559.88	322.8792	
			903013	462790.8475	1285559.795	322.88435	SU IVS-11					
			903014	462791.1575	1285560.865	322.97003	SU IVS-11					
			903015	462791.9088	1285559.997	322.93148	SU IVS-11					

ATTACHMENT A

4720 Quebec												
number	**item**	**orientation**	**point**	**northing**	**easting**	**elevation**	**point name**		**northing**	**easting**	**elevation**	**depth (ft)**
12	75 mm	horizontal	904038	462843.6259	1285724.073	333.92138	MI IVS-12	top center	462843.80	1285723.77	333.9186	0.617323
			904039	462843.7029	1285723.954	333.94603	MI IVS-12					
			904040	462843.8406	1285723.683	333.91931	MI IVS-12					
			904041	462844.0184	1285723.358	333.88786	MI IVS-12					
			904034	462844.2061	1285722.685	334.4837	SU IVS-12	ground	462843.83	1285723.69	334.536	
			904035	462844.3756	1285724.081	334.54078	SU IVS-12					
			904036	462843.4257	1285724.643	334.57614	SU IVS-12					
			904037	462843.2958	1285723.344	334.54325	SU IVS-12					
13	Stokes Mortar	horizontal	904025	462863.5023	1285699.571	333.14988	MI 1VS-13	top center	462863.79	1285698.92	333.1165	1.297866
			904026	462863.6779	1285699.151	333.14679	MI 1VS-13					
			904027	462863.8695	1285698.708	333.1459	MI 1VS-13					
			904028	462863.9105	1285698.682	333.07244	MI 1VS-13					
			904029	462863.9837	1285698.485	333.0675	MI 1VS-13					
			904030	462863.0066	1285698.529	334.38482	SU IVS-13	ground	462863.75	1285699.08	334.4144	
			904031	462864.4759	1285699.574	334.39411	SU IVS-13					
			904032	462863.2955	1285700.357	334.42629	SU IVS-13					
			904033	462864.2333	1285697.856	334.45225	SU IVS-13					
14	small ISO (w.s.)	horizontal	904005	462949.6224	1285687.992	327.17605	MI IVS-14	top center	462949.68	1285687.83	327.1711	0.148546
			904006	462949.6901	1285687.837	327.17562	MI IVS-14					
			904007	462949.7387	1285687.67	327.16153	MI IVS-14					
			904001	462950.2311	1285687.994	327.25317	SU IVS-14	ground	462949.82	1285687.68	327.3196	
			904002	462950.1553	1285686.877	327.27592	SU IVS-14					
			904003	462949.2646	1285687.404	327.37067	SU IVS-14					
			904004	462949.6277	1285688.427	327.37869	SU IVS-14					
15	M353 TPT projectile	horizontal	904021	462871.5472	1285641.708	330.48001	MI 1VS-15	top center	462871.95	1285641.91	330.3979	0.78036
			904022	462871.8744	1285641.879	330.42436	MI 1VS-15					
			904023	462872.0963	1285641.986	330.38266	MI 1VS-15					
			904024	462872.2931	1285642.069	330.30461	MI 1VS-15					
			904017	462872.1274	1285641.316	331.19177	SU 1VS-15	ground	462872.02	1285641.94	331.1783	
			904018	462872.9592	1285642.443	331.20492	SU 1VS-15					
			904019	462871.7805	1285642.47	331.23867	SU 1VS-15					
			904020	462871.2187	1285641.513	331.07772	SU 1VS-15					
16	large ISO	horizontal	904008	462920.4862	1285758.715	329.82803	MI IVS-16	top center	462920.62	1285758.22	329.8628	2.554528
			904009	462920.6244	1285758.201	329.87266	MI IVS-16					
			904010	462920.749	1285757.732	329.88783	MI IVS-16					
			904011	462920.0354	1285758.133	332.54469	SU IVS-16	ground	462920.70	1285758.22	332.4174	
			904012	462921.112	1285756.988	332.33837	SU IVS-16					
			904013	462920.3844	1285759.412	332.37748	SU IVS-16					
			904014	462921.2487	1285758.351	332.40893	SU IVS-16					

ATTACHMENT A

4740 Quebec												
number	item	orientation	point	northing	easting	elevation	point name		northing	easting	elevation	depth (ft)
17	75 mm	horizontal	903236	462898.4115	1285520.48	322.91779	MI IVS-17	top center	462898.40	1285520.91	322.9087	1.888241
			903237	462898.4009	1285520.887	322.93152	MI IVS-17					
			903238	462898.3952	1285521.361	322.87687	MI IVS-17					
			903239	462899.034	1285521.131	324.76934	SU IVS-17	ground	462898.36	1285520.88	324.797	
			903240	462898.0133	1285521.781	324.76826	SU IVS-17					
			903241	462897.631	1285520.616	324.8526	SU IVS-17					
			903242	462898.7802	1285520.004	324.79767	SU IVS-17					
18	75 mm proj. part	diagonal (45°	903233	462902.9447	1285501.011	323.99784	MI IVS-18	average	462902.74	1285501.23	323.8374	0.621432
			903234	462902.8925	1285501.099	324.07681	MI IVS-18					
			903235	462902.3735	1285501.572	323.43747	MI IVS-18					
			903229	462903.06	1285501.885	324.41612	SU IVS-18	ground	462902.47	1285501.40	324.4588	
			903230	462903.1959	1285500.747	324.47731	SU IVS-18					
			903231	462901.835	1285500.782	324.47685	SU IVS-18					
			903232	462901.7857	1285502.184	324.46494	SU IVS-18					
19	small ISO (w.s.)	horizontal	903226	462920.0499	1285514.201	321.83774	MI IVS-19	top center	462920.20	1285514.27	321.8384	0.620363
			903227	462920.1944	1285514.257	321.84305	MI IVS-19					
			903228	462920.3474	1285514.339	321.83443	MI IVS-19					
			903222	462919.589	1285514.042	322.4623	SU IVS-19	ground	462920.12	1285514.27	322.4588	
			903223	462919.9343	1285514.847	322.47534	SU IVS-19					
			903224	462920.6439	1285514.477	322.46791	SU IVS-19					
			903225	462920.2943	1285513.709	322.42953	SU IVS-19					
20	medium ISO	horizontal	903215	462916.6817	1285505.339	321.63575	MI IVS-20	top center	462916.60	1285505.65	321.6569	0.765599
			903216	462916.6122	1285505.665	321.65672	MI IVS-20					
			903217	462916.5203	1285505.954	321.67815	MI IVS-20					
			903218	462916.0881	1285505.473	322.39932	SU IVS-20	ground	462916.65	1285505.65	322.4225	
			903219	462916.7849	1285504.888	322.40371	SU IVS-20					
			903220	462917.2153	1285505.837	322.42588	SU IVS-20					
			903221	462916.5188	1285506.415	322.46098	SU IVS-20					

ATTACHMENT B

4733 Woodway

7 – vertical 75 mm

8 – horizontal stokes mortar

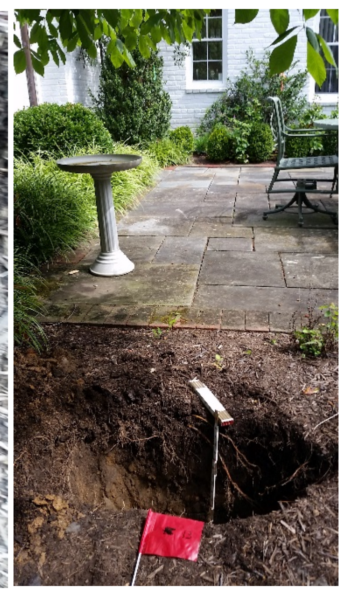
9 – horizontal small ISO

10 – vertical small ISO (stainless steel)

11 – horizontal medium ISO

4720 Quebec

12 – horizontal 75 mm



13 – horizontal stokes mortar

14 – horizontal small ISO

15 – horizontal M353 TPT (training practice tracer) projectile

16 – horizontal large ISO

4740 Quebec


17 – horizontal 75 mm


18 – diagonal 75 mm projectile part

19 – horizontal small ISO

20 – horizontal medium ISO

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Appendix C: Verification Documentation

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Appendix C-1:

TPC Checklists

Three-Phase Control Checklist for TEMTADS Assembly

BEGIN PREPARATORY TPCs

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	QAPP, SOP3	Have personnel performing the DFW been trained on the all aspects of the GCMR QAPP, APP/SSHP, SOP3 and is it documented?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP3	Is the MPV assembled in accordance with the instructions and in the sequence specified in this SOP?				
2	SOP3, WS #22	Has the procedure and tests for verification of the IMU orientation been completed i/a/w this SOP?				
3	SOP3	Was a photograph showing the system setup taken?				
4	SOP3	Was the TEMTADS sensor function test and spin test performed i/a/w this SOP?				

FINDINGS	
Item	**Comments**
	See additional checklist attached

- Conducted By: ______________________________

Additional Checklist

QC Step	QC Process and Guidance Reference	Yes/No	Initial of Field Geophysicist or Project Geophysicist
1. Qualifications	Are the qualifications of the Project and Field Geophysicists and the Data Processor in accordance with QAPP Worksheet 4, 7, & 8?	Yes	
2. Assembly	Is the MPV assembled in accordance with the published instructions and in the sequence specified in Section 4.1?	Yes	
3. Assembly: Cable	Are the cable labels matching their connectors?	Yes	
4. Assembly: Handle alignment	Is the handle installed and verified to be in the correct orientation (Section 4.3.1)?	Yes	
5. Assembly: GPS position	Has the GPS position relative to the sensor head been measured and reported in the INI file? (Sections 4.3.2 and 4.3.3)	Yes	
6. Assembly: Transmit coil verification	Is the orientation of the transmit coils verified to be in the correct orientation (Section 4.3.5)?	Yes	
7. Testing: AHRS orientation	Has the procedure and tests for verification of the orientation been completed (Section 4.4.2)?	Yes	
8. Rotation test	Has the rotation test been validated?	Yes	
9. Navigation test	Has the navigation test been validated?	Yes	
10. Function test	Dynamic: Is the transmitter current greater than 4.5 A and significant signal in all receiver cubes? Cued: Is the recovered location of the test item within 0.1 m of the array center?	Yes	
11. Photograph the installation	Has a photograph showing the entire assembly in cued mode been taken? Is the orientation of the X and Y coils visible?	Yes	
10. MPC Documentation	Have the MPCs for DFW 1 from Worksheet 9 been achieved?	Yes	

Three-Phase Control Checklist for TEMTADS Assembly

TEAM INFORMATION		
Team: NRL	Location: Spring Valley	Date: 08/02/16
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	QAPP, SOP2	Have personnel performing the DFW been trained on the all aspects of the GCMR QAPP, APP/SSHP, SOP2 and is it documented?	X			
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP2	Is the TEMTADS assembled in accordance with the published instructions and in the sequence specified in this SOP?				
2	SOP2, WS #22	Has the procedure and tests for verification of the IMU orientation been completed i/a/w this SOP?				
3	SOP2	Was a photograph showing the placement and orientation of the GPS (or RTS) and IMU taken?				
4	SOP2	Was the TEMTADS sensor function test performed i/a/w this SOP and were the results saved in the project database?				

FINDINGS	
Item	**Comments**

- Conducted By: ____________________

Three-Phase Control Checklist for Dynamic MPV Data Collection

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP5	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP5 and is it documented?	X			*Trained by Kevin*
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP5	Were sensor function tests performed in the am and pm using the real-time assessment?				
2	SOP5, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day?				
3	SOP5	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?				
4	SOP5	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?				
5	SOP5	Were the field notes converted to digital format and filenames resolved with regard to the field notes?				

FINDINGS	
Item	**Comments**

Conducted By: [signature] Reviewed By: ______________________________

Three-Phase Control Checklist for Dynamic TEMTADS Data Collection

TEAM INFORMATION		
Team: NRL	**Location: Spring Valley**	**Date: 08/02/16**
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ ***Preparatory;*** ☐ ***Initial;*** ☐ ***Follow-Up***		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP4	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP4 and is it documented?	X			
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?	X			
3	GCMR QAPP, SOP4	Do personnel have an Internal DOC Form in the records or have they been identified to demonstrate at this location?	X			*DOC will be performed at this location*
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
	WS#22, SOP4	Were sensor function tests performed a minimum of once every three hours and did all function tests pass using the real-time assessment?				
	SOP4, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day with exceptions noted in the field notes?				
1	SOP4	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?				
2	SOP4	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?				

TPC CHECKLIST POINTS						
3	**SOP4**	Were the field notes converted to digital format and filenames resolved with regard to the field notes?				

FINDINGS	
Item	**Comments**

Conducted By: ____________________ Reviewed By: ____________________

Three-Phase Control Checklist for Cued Data Collection

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP11	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP11 and is it documented?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP11, SOP2, WS#22	Was cued data collected over the IVS items in the am and pm?				
2	SOP11	Is the MPV properly centered on the anomaly location?				
3	WS#22, SOP11	Was the background data recorded and the signal amplitude verified to be below the selected threshold i/a/w this SOP?				
4	SOP11	Is background data recorded for each background location i/a/w this SOP?				
5	SOP11	Are the background readings for each area recorded i/a/w this SOP?				
6	WS#22, SOP11	Have the appropriate MQOs from Worksheet #22 been achieved?				
7	SOP11	Were am and pm field observations performed?				

FINDINGS	
Item	**Comments**

Conducted By: ____________________

Three-Phase Control Checklist for Cued Data Collection

TEAM INFORMATION		
Team: NRL	Location: Spring Valley	Date: 08/02/16
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP10	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP10 and is it documented?	X			
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP10, SOP2, WS#22	Was cued data collected over the IVS items in the am and pm?				
2	SOP10	Is the TEMTADS properly centered on the anomaly location?				
3	WS#22, SOP10	Was the background data recorded and the signal amplitude verified to be below the selected threshold i/a/w this SOP?				
4	SOP10	Is background data recorded for each background location i/a/w this SOP?				
5	SOP10	Are the background readings for each area recorded i/a/w this SOP?				
6	WS#22, SOP10	Have the appropriate MQOs from Worksheet #22 been achieved?				

TPC CHECKLIST POINTS						
7	SOP10	Were am and pm field observations performed?				

FINDINGS	
Item	**Comments**

Conducted By: ______________________________

Three-Phase Control Checklist for Background Data Collection

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP8	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP8 and is it documented?	X			
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP4, SOP5	Is the TEMTADS properly centered on the background location and are the corners of the sensor marked with non-metallic pin flags i/a/w this SOP?				
2	WS#22, SOP8	Was the background validation data recorded and the signal amplitude verified to be below the selected threshold i/a/w this SOP?				
3	SOP8	Is background data recorded for each background location i/a/w this SOP?				
4	WS#22, SOP8	Have the appropriate MQOs from Worksheet #22 been achieved?				

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Background Data Collection

TEAM INFORMATION		
Team: NRL	Location: Spring Valley	Date: 08/02/16
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP8	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP8 and is it documented?	X			
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP4, SOP5	Is the TEMTADS properly centered on the background location and are the corners of the sensor marked with non-metallic pin flags i/a/w this SOP?				
2	WS#22, SOP8	Was the background validation data recorded and the signal amplitude verified to be below the selected threshold i/a/w this SOP?				
3	SOP8	Is background data recorded for each background location i/a/w this SOP?				
4	WS#22, SOP8	Have the appropriate MQOs from Worksheet #22 been achieved?				
FINDINGS						
Item	**Comments**					

Conducted By: ______________________

Three-Phase Control Checklist for Cued Data Processing

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Nicolas Lhomme		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP11	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP11 and is it documented?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP11, WS#22	Were background locations verified to be free of localized sources and within the defined limits?				
2	SOP2, SOP7, SOP11, WS#22	Was the functionality of the MPV components verified for each sortie using function tests collected on the same day and did all associated function tests pass the MQO for this test?				
3	SOP2, SOP7, SOP11, WS#22	Was the functionality of the MPV system verified for each measurement using IVS tests collected on the same day, and did all associated IVS tests pass the MQOs?				
4	SOP11, WS#22	If GPS data are available for the target data collected, was valid data collected with the sensor positioned				

TPC CHECKLIST POINTS						
		over the initial detected anomaly location with any exceptions noted in the processing notes?				
5	**SOP11, WS#22**	For each cued measurement used for classification (including background and IVS measurements), were the MQOs with regard to transmit current, receiver decay data met?				
6	**SOP11, WS#22**	Do the derived models for each classified anomaly fit the observed data with a fit coherence that meets the MQO with exceptions added to the dig list as can't analyze (dig)?				
7	**SOP11, WS#22**	Do all targets classified as non-TOI have a fit position offset from the center of the array that meets the MQO?				

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Cued Data Processing

TEAM INFORMATION		
Team: Acorn SI	Location: Spring Valley	Date: 08/02/16
Team Leader: Tom Furuya		
Personnel Present: Tom Furuya		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP11	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP11 and is it documented?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP11, WS#22	Were background locations verified to be free of localized sources and within the defined limits?				
2	SOP2, SOP7, SOP11, WS#22	Was the functionality of the TEMTADS EMI components verified for each sortie using function tests collected on the same day and did all associated function tests pass the MQO for this test?				
3	SOP2, SOP7, SOP11, WS#22	Was the functionality of the TEMTADS system verified for each measurement using IVS tests collected on the same day, and did all associated IVS tests pass the MQOs?				
4	SOP11, WS#22	If GPS data are available for the target data collected, was valid data collected				

TPC CHECKLIST POINTS						
		with the sensor positioned over the initial detected anomaly location with any exceptions noted in the processing notes?				
5	**SOP11, WS#22**	For each cued measurement used for classification (including background and IVS measurements), were the MQOs with regard to transmit current, receiver decay data met?				
6	**SOP11, WS#22**	Do the derived models for each classified anomaly fit the observed data with a fit coherence that meets the MQO with exceptions added to the dig list as can't analyze (dig)?				
7	**SOP11, WS#22**	Do all targets classified as non-TOI have a fit position offset from the center of the array that meets the MQO?				

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Dynamic MPV Data Processing

TEAM INFORMATION		
Team: BTG/Westin	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Nicolas Lhomme		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP6	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP6 and is it documented?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP2, SOP6	Was the functionality of the MPV components verified for each sortie using function tests and did all function tests pass the MQO for this test?				
2	WS#22, SOP2, SOP6	Was the functionality of the MPV system verified for each sortie using IVS tests and did all IVS tests pass the associated MQOs?				
3	WS#22, SOP2, SOP6	Were invalid data for each sortie (with regard to Tx current, GPS or RTS fit quality, IMU data quality, and EMI response within range) identified and rejected?				
4	WS#22, SOP6	Were gaps in data coverage due to down-line and across line sampling identified and accounted for (obstructions)?				

TPC CHECKLIST POINTS						
6	**WS#22, SOP6**	Was the Dynamic Data Processing Checklist filled out and submitted to the QC Geophysicist along with the data?				
7	**WS#22, SOP6**	Did the QC Geophysicist verify that all blind seeds were detected?				
8	**WS#22, SOP6**	Was the final target list reviewed by the data processor and the QC geophysicist?				

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Dynamic TEMTADS Data Processing

TEAM INFORMATION		
Team: Acorn SI	Location: Spring Valley	Date: 08/02/16
Team Leader: Tom Furuya		
Personnel Present: Tom Furuya		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☒ *Preparatory;* ☐ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP6	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP6 and is it documented?	X			
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP2, SOP6	Was the functionality of the TEMTADS EMI components verified for each sortie using function tests and did all function tests pass the MQO for this test?				
2	WS#22, SOP2, SOP6	Was the functionality of the TEMTADS system verified for each sortie using IVS tests and did all IVS tests pass the associated MQOs?				
3	WS#22, SOP2, SOP6	Were invalid data for each sortie (with regard to Tx current, GPS or RTS fit quality, IMU data quality, and EMI response within range) identified and rejected?				
4	WS#22, SOP6	Were gaps in data coverage due to down-line and across line sampling identified and accounted				

TPC CHECKLIST POINTS						
		for (obstructions)?				
6	**WS#22, SOP6**	Was the Dynamic Data Processing Checklist filled out and submitted to the QC Geophysicist along with the data?				
7	**WS#22, SOP6**	Did the QC Geophysicist verify that all blind seeds were detected?				
8	**WS#22, SOP6**	Was the final target list reviewed by the data processor and the QC geophysicist?				

FINDINGS	
Item	**Comments**

Conducted By: ______________________________

Three-Phase Control Checklist for MPV Assembly

BEGIN INITIAL TPCs

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	QAPP, SOP3	Have personnel performing the DFW been trained on the all aspects of the GCMR QAPP, APP/SSHP, SOP3 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP3	Is the MPV assembled in accordance with the instructions and in the sequence specified in this SOP?	X			
2	SOP3, WS #22	Has the procedure and tests for verification of the IMU orientation been completed i/a/w this SOP?	X			
3	SOP3	Was a photograph showing the system setup taken?	X			
4	SOP3	Was the MPV sensor function test and spin test performed i/a/w this SOP?	X			

FINDINGS	
Item	**Comments**
	See additional checklist attached

- Conducted By: ______________________

Additional Checklist

QC Step	**QC Process and Guidance Reference**	**Yes/No**	**Initial of Field Geophysicist or Project Geophysicist**
1. Qualifications	Are the qualifications of the Project and Field Geophysicists and the Data Processor in accordance with QAPP Worksheet 4, 7, & 8?	Yes	
2. Assembly	Is the MPV assembled in accordance with the published instructions and in the sequence specified in Section 4.1?	Yes	
3. Assembly: Cable	Are the cable labels matching their connectors?	Yes	
4. Assembly: Handle alignment	Is the handle installed and verified to be in the correct orientation (Section 4.3.1)?	Yes	
5. Assembly: GPS position	Has the GPS position relative to the sensor head been measured and reported in the INI file? (Sections 4.3.2 and 4.3.3)	Yes	
6. Assembly: Transmit coil verification	Is the orientation of the transmit coils verified to be in the correct orientation (Section 4.3.5)?	Yes	
7. Testing: AHRS orientation	Has the procedure and tests for verification of the orientation been completed (Section 4.4.2)?	Yes	
8. Rotation test	Has the rotation test been validated?	Yes	
9. Navigation test	Has the navigation test been validated?	Yes	
10. Function test	Dynamic: Is the transmitter current greater than 4.5 A and significant signal in all receiver cubes? Cued: Is the recovered location of the test item within 0.1 m of the array center?	Yes	
11. Photograph the installation	Has a photograph showing the entire assembly in cued mode been taken? Is the orientation of the X and Y coils visible?	Yes	
10. MPC Documentation	Have the MPCs for DFW 1 from Worksheet 9 been achieved?	Yes	

Three-Phase Control Checklist for TEMTADS Assembly

TEAM INFORMATION		
Team: NRL	**Location: Spring Valley**	**Date: 08/02/16**
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ ***Preparatory;*** ☒ ***Initial;*** ☐ ***Follow-Up***		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	QAPP, SOP2	Have personnel performing the DFW been trained on the all aspects of the GCMR QAPP, APP/SSHP, SOP2 and is it documented?				
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP2	Is the TEMTADS assembled in accordance with the published instructions and in the sequence specified in this SOP?	X			
2	SOP2, WS #22	Has the procedure and tests for verification of the IMU orientation been completed i/a/w this SOP?	X			
3	SOP2	Was a photograph showing the placement and orientation of the GPS (or RTS) and IMU taken?	X			
4	SOP2	Was the TEMTADS sensor function test performed i/a/w this SOP and did the data pass the MQO?	X			
FINDINGS						

Item	Comments

- Conducted By: ______________________

Three-Phase Control Checklist for Dynamic MPV Data Collection

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP5	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP5 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP5	Were sensor function tests performed in the am and pm using the real-time assessment?	X			*Collected once, only IVS data collected this day*
2	SOP5, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day?	X			*Initial data collected over IVS*
3	SOP5	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?	X			
4	SOP5	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?	X			
5	SOP5	Were the field notes converted to digital format and filenames resolved with regard to the field notes?	X			

FINDINGS	
Item	**Comments**

Conducted By: [signature] Reviewed By: ______________________________

Three-Phase Control Checklist for Dynamic TEMTADS Data Collection

TEAM INFORMATION		
Team: NRL	Location: Spring Valley	Date: 08/02/16
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS

Item	Ref.	Preparatory Inspection Points	Yes	No	N/A	Comments
1	GCMR QAPP, SOP4	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP4 and is it documented?				
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP4	Were sensor function tests performed in the am and pm using the real-time assessment?	X			*Initial IVS, performed multiple sensor function tests*
2	SOP4, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day?	X			*Initial IVS*
3	SOP4	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?			X	
4	SOP4	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?	X			
5	SOP4	Were the field notes converted to digital format and filenames resolved with regard to the field notes?	X			*Photographed log book*

FINDINGS

Item	Comments

Conducted By: ______________________ Reviewed By: ______________________

Three-Phase Control Checklist for Cued Data Collection

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/18/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	Ref.	Preparatory Inspection Points	Yes	No	N/A	Comments
1	GCMR QAPP, SOP11	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP11 and is it documented?				
Item	Ref.	Initial/Follow-up Inspection Points	Yes	No	N/A	Comments
1	SOP11, SOP2, WS#22	Was cued data collected over the IVS items in the am and pm?		X		*Initial IVS data collected*
2	SOP11	Is the MPV properly centered on the anomaly location?	X			
3	WS#22, SOP11	Was the background data recorded and the signal amplitude verified to be below the selected threshold i/a/w this SOP?	X			
6	WS#22, SOP11	Have the appropriate MQOs from Worksheet #22 been achieved?	X			
7	SOP11	Were regular sensor function tests performed performed?	X			

FINDINGS	
Item	Comments

Conducted By: ______________________

Three-Phase Control Checklist for Cued Data Collection

TEAM INFORMATION		
Team: NRL	**Location: Spring Valley**	**Date: 08/02/16**
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ ***Preparatory;*** ☒ ***Initial;*** ☐ ***Follow-Up***		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP10	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP10 and is it documented?				
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP10, SOP2, WS#22	Was cued data collected over the IVS items in the am and pm?	X			*Initial IVS data collected*
2	SOP10	Is the TEMTADS properly centered on the anomaly location?	X			
3	WS#22, SOP10	Was the background data recorded and the signal amplitude verified to be below the selected threshold i/a/w this SOP?	X			*Threshold will be defined in the IVS report*
4	WS#22, SOP10	Have the appropriate MQOs from Worksheet #22 been achieved?	X			
5	SOP10	Were recollects performed if the fit location was greater than 40cm from the center of the array?			X	

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Background Data Collection

TEAM INFORMATION		
Team: BTG/Weston	**Location: Spring Valley**	**Date: 08/18/16**
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ ***Preparatory;*** ☒ ***Initial;*** ☐ ***Follow-Up***		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP8	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP8 and is it documented?				
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP4, SOP5	Is the TEMTADS properly centered on the background location and are the corners of the sensor marked with non-metallic pin flags i/a/w this SOP?	X			
2	WS#22, SOP8	Was the background validation data recorded and the signal amplitude verified to be below the selected threshold i/a/w this SOP?	X			*Threashold will be defined in IVS report*
3	SOP8	Is background data recorded for each background location i/a/w this SOP?	X			
4	WS#22, SOP8	Have the appropriate MQOs from Worksheet #22 been achieved?	X			

FINDINGS	
Item	**Comments**

Conducted By: ______________

Three-Phase Control Checklist for Background Data Collection

TEAM INFORMATION		
Team: NRL	Location: Spring Valley	Date: 08/02/16
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP8	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP8 and is it documented?				
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP4, SOP5	Is the TEMTADS properly centered on the background location and are the corners of the sensor marked with non-metallic pin flags i/a/w this SOP?	X			
2	WS#22, SOP8	Was the background validation data recorded and the signal amplitude verified to be below the selected threshold i/a/w this SOP?	X			*Threashold will be defined in IVS report*
3	SOP8	Is background data recorded for each background location i/a/w this SOP?	X			
4	WS#22, SOP8	Have the appropriate MQOs from Worksheet #22 been achieved?	X			

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Dynamic MPV Data Processing

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 09/01/16
Team Leader: Kevin Kingdon		
Personnel Present: Nicolas Lhomme		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	Ref.	Preparatory Inspection Points	Yes	No	N/A	Comments
1	GCMR QAPP, SOP6	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP6 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP2, SOP6	Was the functionality of the MPV components verified for each sortie using function tests and did all function tests pass the MQO for this test?	X			
2	WS#22, SOP2, SOP6	Was the functionality of the MPV system verified for each sortie using IVS tests and did all IVS tests pass the associated MQOs?	X			
3	WS#22, SOP2, SOP6	Were invalid data for each sortie (with regard to Tx current, GPS or RTS fit quality, IMU data quality, and EMI response within range) identified and rejected?			X	*No invalid data identified*
4	WS#22, SOP6	Were gaps in data coverage due to down-line and across line sampling identified and accounted for (obstructions)?			X	*No gaps identified*

TPC CHECKLIST POINTS						
6	**WS#22, SOP6**	Was the Dynamic Data Processing Checklist filled out and submitted to the QC Geophysicist along with the data?		X		
7	**WS#22, SOP6**	Did the QC Geophysicist verify that all blind seeds were detected?			X	*Initial IVS Data*
8	**WS#22, SOP6**	Was the final target list reviewed by the data processor and the QC geophysicist?			X	*Initial IVS Data*

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Dynamic TEMTADS Data Processing

TEAM INFORMATION		
Team: Acorn SI	Location: Spring Valley	Date: 08/02/16
Team Leader: Tom Furuya		
Personnel Present: Tom Furuya		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP6	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP6 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP2, SOP6	Was the functionality of the TEMTADS EMI components verified for each sortie using function tests and did all function tests pass the MQO for this test?	X			
2	WS#22, SOP2, SOP6	Was the functionality of the TEMTADS system verified for each sortie using IVS tests and did all IVS tests pass the associated MQOs?	X			
3	WS#22, SOP2, SOP6	Were invalid data for each sortie (with regard to Tx current, GPS or RTS fit quality, IMU data quality, and EMI response within range) identified and rejected?			X	*No invalid data identified*
4	WS#22, SOP6	Were gaps in data coverage due to down-line and across line sampling identified and accounted			X	*No gaps identified*

TPC CHECKLIST POINTS						
		for (obstructions)?				
6	**WS#22, SOP6**	Was the Dynamic Data Processing Checklist filled out and submitted to the QC Geophysicist along with the data?		X		*Still processing data at time of inspection*
7	**WS#22, SOP6**	Did the QC Geophysicist verify that all blind seeds were detected?			X	*Initial IVS Data*
8	**WS#22, SOP6**	Was the final target list reviewed by the data processor and the QC geophysicist?			X	*Initial IVS Data*

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Cued Data Processing

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 09/01/16
Team Leader: Kevin Kingdon		
Personnel Present: Nicolas Lhomme		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP11	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP11 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP11, WS#22	Were background locations verified to be free of localized sources and within the defined limits?	X			
2	SOP2, SOP7, SOP11, WS#22	Was the functionality of the MPV components verified for each sortie using function tests collected on the same day and did all associated function tests pass the MQO for this test?	X			
3	SOP2, SOP7, SOP11, WS#22	Was the functionality of the MPV system verified for each measurement using IVS tests collected on the same day, and did all associated IVS tests pass the MQOs?	X			*Initial IVS Data collected*
4	SOP11, WS#22	If GPS data are available for the target data collected, was valid data collected with the sensor positioned	X			

TPC CHECKLIST POINTS						
		over the initial detected anomaly location with any exceptions noted in the processing notes?				
5	**SOP11, WS#22**	For each cued measurement used for classification (including background and IVS measurements), were the MQOs with regard to transmit current, receiver decay data met?	X			
6	**SOP11, WS#22**	Do the derived models for each classified anomaly fit the observed data with a fit coherence that meets the MQO with exceptions added to the dig list as can't analyze (dig)?	X			
7	**SOP11, WS#22**	Do all targets classified as non-TOI have a fit position offset from the center of the array that meets the MQO?			X	

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Cued Data Processing

TEAM INFORMATION		
Team: Acorn SI	Location: Spring Valley	Date: 08/02/16
Team Leader: Tom Furuya		
Personnel Present: Tom Furuya		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☒ *Initial;* ☐ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP11	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP11 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP11, WS#22	Were background locations verified to be free of localized sources and within the defined limits?	X			
2	SOP2, SOP7, SOP11, WS#22	Was the functionality of the TEMTADS EMI components verified for each sortie using function tests collected on the same day and did all associated function tests pass the MQO for this test?	X			
3	SOP2, SOP7, SOP11, WS#22	Was the functionality of the TEMTADS system verified for each measurement using IVS tests collected on the same day, and did all associated IVS tests pass the MQOs?	X			*Initial IVS Data collected*
4	SOP11, WS#22	If GPS data are available for the target data collected, was valid data collected	X			

TPC CHECKLIST POINTS						
		with the sensor positioned over the initial detected anomaly location with any exceptions noted in the processing notes?				
5	**SOP11, WS#22**	For each cued measurement used for classification (including background and IVS measurements), were the MQOs with regard to transmit current, receiver decay data met?	X			
6	**SOP11, WS#22**	Do the derived models for each classified anomaly fit the observed data with a fit coherence that meets the MQO with exceptions added to the dig list as can't analyze (dig)?	X			
7	**SOP11, WS#22**	Do all targets classified as non-TOI have a fit position offset from the center of the array that meets the MQO?			X	

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Dynamic MPV Data Collection BEGIN FOLLOW-UP TPCs

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/19/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☐ *Initial;* ☒ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP5	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP5 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP5	Were sensor function tests performed in the am and pm using the real-time assessment?	X			
2	SOP5, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day?	X			
3	SOP5	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?	X			
4	SOP5	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?	X			
5	SOP5	Were the field notes converted to digital format and filenames resolved with regard to the field notes?	X			

FINDINGS	
Item	**Comments**

Conducted By: [signature] Reviewed By: ______________________________

Three-Phase Control Checklist for Dynamic TEMTADS Data Collection

TEAM INFORMATION		
Team: NRL	Location: Spring Valley	Date: 08/15/16
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☐ *Initial;* ☒ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP4	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP4 and is it documented?				
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP4	Were sensor function tests performed in the am and pm using the real-time assessment?	X			*Several sensor tests failed at the Woodway site due to ambient noise. Overheating became an issue in early afternoon. DUA will be performed to determine if production data is affected. No PM sensor function test was obtained due to TX not firing.*
2	SOP4, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day?		X		*DUA will be performed to determine if data is acceptable. Because PM IVS was not completed.*
3	SOP4	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?	X			*Did not finish collecting Woodward Property.*

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
4	**SOP4**	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?	X			
5	**SOP4**	Were the field notes converted to digital format and filenames resolved with regard to the field notes?		X		*Not at the time of the Inspection, but will confirm tomorrow am.*

FINDINGS	
Item	**Comments**
	DUA must be performed to determine effect of heat and ambient site noise.

Conducted By: ______________________ Reviewed By: ____________________________

Three-Phase Control Checklist for Dynamic MPV Data Collection

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 08/30/16
Team Leader: Kevin Kingdon		
Personnel Present: Kevin Kingdon, Brian, Kyle		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☐ *Initial;* ☒ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP5	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP5 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP5	Were sensor function tests performed in the am and pm using the real-time assessment?	X			
2	SOP5, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day?	X			
3	SOP5	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?	X			
4	SOP5	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?	X			
5	SOP5	Were the field notes converted to digital format and filenames resolved with regard to the field notes?	X			

FINDINGS	
Item	**Comments**

Conducted By: [signature] Reviewed By: ______________________________

Three-Phase Control Checklist for Dynamic TEMTADS Data Collection

TEAM INFORMATION		
Team: NRL	**Location: Spring Valley**	**Date: 08/17/16**
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ ***Preparatory;*** ☐ ***Initial;*** ☒ ***Follow-Up***		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP4	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP4 and is it documented?				
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP4	Were sensor function tests performed in the am and pm using the real-time assessment?	X			*PM test failed initially (TX wasn't firing) but then passed*
2	SOP4, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day?	X			
3	SOP4	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?	X			*Did not finish collecting 4720 Quebec Property.*
4	SOP4	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?	X			
5	SOP4	Were the field notes converted to digital format and filenames resolved with regard to the field notes?		X		*Not at the time of the Inspection, but will confirm tomorrow am.*

FINDINGS	
Item	**Comments**

Conducted By: ______________________ Reviewed By: ______________________

Three-Phase Control Checklist for Dynamic TEMTADS Data Collection

TEAM INFORMATION		
Team: NRL	Location: Spring Valley	Date: 08/30/16
Team Leader: Dan Steinhurst		
Personnel Present: Dan Steinhurst, Glenn Harbaugh		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☐ *Initial;* ☒ *Follow-Up*		

TPC CHECKLIST POINTS

Item	Ref.	Preparatory Inspection Points	Yes	No	N/A	Comments
1	GCMR QAPP, SOP4	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP4 and is it documented?				
2	SOP2	Have personnel performing the DFW reviewed the NRL TEMTADS Instruction Manual?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP4	Were sensor function tests performed in the am and pm using the real-time assessment?	X			
2	SOP4, SOP2	Were transect surveys conducted over the IVS items at the start and end of the day?	X			
3	SOP4	For the dynamic data collected, were valid data collected along the intended transects with any exceptions or gaps in coverage noted in the field notes?	X			*Filling gaps on Woodway*
4	SOP4	For the dynamic data collection (including IVS measurements), was the system monitored with regard to transmit current, receiver decay curves and any exceptions noted in the field notes?	X			
5	SOP4	Were the field notes converted to digital format and filenames resolved with regard to the field notes?	X			

FINDINGS

Item	Comments

Conducted By: [signature] ____________________ Reviewed By: ______________________________

Three-Phase Control Checklist for Dynamic MPV Data Processing

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 09/07/16
Team Leader: Kevin Kingdon		
Personnel Present: Nicolas Lhomme		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☐ *Initial;* ☒ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP6	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP6 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP2, SOP6	Was the functionality of the MPV components verified for each sortie using function tests and did all function tests pass the MQO for this test?	X			
2	WS#22, SOP2, SOP6	Was the functionality of the MPV system verified for each sortie using IVS tests and did all IVS tests pass the associated MQOs?	X			
3	WS#22, SOP2, SOP6	Were invalid data for each sortie (with regard to Tx current, GPS or RTS fit quality, IMU data quality, and EMI response within range) identified and rejected?			X	*No invalid data identified*
4	WS#22, SOP6	Were gaps in data coverage due to down-line and across line sampling identified and accounted for (obstructions)?			X	*No gaps identified*

TPC CHECKLIST POINTS						
6	**WS#22, SOP6**	Was the Dynamic Data Processing Checklist filled out and submitted to the QC Geophysicist along with the data?		X		*No Checklist for MPV*
7	**WS#22, SOP6**	Did the QC Geophysicist verify that all blind seeds were detected?		X		*NCR was written for blind seeds*
8	**WS#22, SOP6**	Was the final target list reviewed by the data processor and the QC geophysicist?	X			

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Dynamic TEMTADS Data Processing

TEAM INFORMATION		
Team: Acorn SI	**Location: Spring Valley**	**Date: 08/24/16**
Team Leader: Tom Furuya		
Personnel Present: Tom Furuya		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ ***Preparatory;*** ☐ ***Initial;*** ☒ ***Follow-Up***		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP6	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP6 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	WS#22, SOP2, SOP6	Was the functionality of the TEMTADS EMI components verified for each sortie using function tests and did all function tests pass the MQO for this test?	X			
2	WS#22, SOP2, SOP6	Was the functionality of the TEMTADS system verified for each sortie using IVS tests and did all IVS tests pass the associated MQOs?	X			
3	WS#22, SOP2, SOP6	Were invalid data for each sortie (with regard to Tx current, GPS or RTS fit quality, IMU data quality, and EMI response within range) identified and rejected?			X	*No invalid data identified*
4	WS#22, SOP6	Were gaps in data coverage due to down-line and across line sampling identified and accounted			X	*No gaps identified*

TPC CHECKLIST POINTS						
		for (obstructions)?				
6	**WS#22, SOP6**	Was the Dynamic Data Processing Checklist filled out and submitted to the QC Geophysicist along with the data?	X			
7	**WS#22, SOP6**	Did the QC Geophysicist verify that all blind seeds were detected?	X			*NCR written for missed seeds*
8	**WS#22, SOP6**	Was the final target list reviewed by the data processor and the QC geophysicist?	X			

FINDINGS

Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Cued Data Processing

TEAM INFORMATION		
Team: BTG/Weston	Location: Spring Valley	Date: 09/15/16
Team Leader: Kevin Kingdon		
Personnel Present: Nicolas Lhomme		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☐ *Initial;* ☒ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP11	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP11 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP11, WS#22	Were background locations verified to be free of localized sources and within the defined limits?	X			
2	SOP2, SOP7, SOP11, WS#22	Was the functionality of the MPV components verified for each sortie using function tests collected on the same day and did all associated function tests pass the MQO for this test?	X			
3	SOP2, SOP7, SOP11, WS#22	Was the functionality of the MPV system verified for each measurement using IVS tests collected on the same day, and did all associated IVS tests pass the MQOs?	X			
4	SOP11, WS#22	If GPS data are available for the target data collected, was valid data collected with the sensor positioned	X			

TPC CHECKLIST POINTS						
		over the initial detected anomaly location with any exceptions noted in the processing notes?				
5	**SOP11, WS#22**	For each cued measurement used for classification (including background and IVS measurements), were the MQOs with regard to transmit current, receiver decay data met?	X			
6	**SOP11, WS#22**	Do the derived models for each classified anomaly fit the observed data with a fit coherence that meets the MQO with exceptions added to the dig list as can't analyze (dig)?	X			
7	**SOP11, WS#22**	Do all targets classified as non-TOI have a fit position offset from the center of the array that meets the MQO?		X		*Low signal targets have greater offsets in some cases*

FINDINGS	
Item	**Comments**

Conducted By: ______________________

Three-Phase Control Checklist for Cued Data Processing

TEAM INFORMATION		
Team: Acorn SI	Location: Spring Valley	Date: 09/09/16
Team Leader: Tom Furuya		
Personnel Present: Tom Furuya		
Contract #: W912DR-15-D-0015		
Task Order #: 0001		
Phase of Inspection (Check one): ☐ *Preparatory;* ☐ *Initial;* ☒ *Follow-Up*		

TPC CHECKLIST POINTS						
Item	**Ref.**	**Preparatory Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	GCMR QAPP, SOP11	Have personnel performing the DFW been trained on the all aspects of the MEC QAPP, APP/SSHP, SOP11 and is it documented?				
Item	**Ref.**	**Initial/Follow-up Inspection Points**	**Yes**	**No**	**N/A**	**Comments**
1	SOP11, WS#22	Were background locations verified to be free of localized sources and within the defined limits?	X			
2	SOP2, SOP7, SOP11, WS#22	Was the functionality of the TEMTADS EMI components verified for each sortie using function tests collected on the same day and did all associated function tests pass the MQO for this test?	X			
3	SOP2, SOP7, SOP11, WS#22	Was the functionality of the TEMTADS system verified for each measurement using IVS tests collected on the same day, and did all associated IVS tests pass the MQOs?	X			
4	SOP11, WS#22	If GPS data are available for the target data collected, was valid data collected	X			

TPC CHECKLIST POINTS						
		with the sensor positioned over the initial detected anomaly location with any exceptions noted in the processing notes?				
5	**SOP11, WS#22**	For each cued measurement used for classification (including background and IVS measurements), were the MQOs with regard to transmit current, receiver decay data met?	X			
6	**SOP11, WS#22**	Do the derived models for each classified anomaly fit the observed data with a fit coherence that meets the MQO with exceptions added to the dig list as can't analyze (dig)?	X			
7	**SOP11, WS#22**	Do all targets classified as non-TOI have a fit position offset from the center of the array that meets the MQO?	X			

FINDINGS	
Item	**Comments**

Conducted By: ____________________

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Appendix C-2:

Daily Geophysical Quality Control Reports

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-001

Project No: W912DR-15-D-0015

Location: Spring Valley

Date: 15 Aug 2016

☐ Sunday ☒ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- AM sensor function test passed and the AM IVS appeared to be passing based on field inversions.
- Performed a Follow-up TPC Inspection for Dynamic TEMTADS data collection.
- The field team had difficult time finding a location to perform the sensor function test at the Woodway property. We believe that the ambient site noise due to the local radio tower and other utilities was causing the test to fail. A passing sensor function test was performed prior to beginning production data collection, however the error percentages were very close to the threshold.
- After completing data collection in the majority of the front yard, the team attempted to collect data along the eastern side of the house. The GPS was not able to consistently maintain a fixed position in this location. Based on this, it is likely that the majority of the site will need to be surveyed with the RTS.
- The field team collected 3 minutes of static data to get a representative sample of the site noise. After this test was performed Transmitter 1 (TX1) was not firing properly. The team assumed that the issue was due to overheating so the equipment was packed up and transported to the field office to allow it to cool down. After approximately 40 minutes, the team attempted to collect the PM sensor function test and IVS and TX1 was still not firing properly. The computer was switched out, and the problem persisted. The current theory is that the error is still heat related, but further analysis will be performed.
- The team demobilized for the day around 1500 after collecting data over approximately 1/3 of the Woodway Property.
- Data collection at the Woodway property will resume on 16 August.

III. Problems Encountered / Corrective Actions Taken

See summary above. Heat and Noise Issues

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 15 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study   Report No: DGQCR-002

Project No: W912DR-15-D-0015   Location: Spring Valley   Date: 16 Aug 2016

☐ Sunday ☐ Monday ☒ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- AM sensor function test passed
- IVS and production data was collected with RTS positioning
- Checkshots were performed to verify each RTS setup
- A clean location was found at the Woodway Property and a passing sensor function test was obtained
- Data collection was completed at the Woodway property at approximately 1500
- PM sensor function test passed and PM IVS was collected
- The team demobilized for the day around 1600
- The team will begin data collection at 4720 Quebec tomorrow

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 16 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-003

Project No: W912DR-15-D-0015

Location: Spring Valley

Date: 17 Aug 2016

☐ Sunday ☐ Monday ☐ Tuesday ☒ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- AM sensor function test passed
- IVS and production data was collected with RTS positioning
- Checkshots were performed to verify each RTS setup
- A clean location was found at 4720 Quebec and a passing sensor function test was obtained
- Data collection was not completed at the 4720 Quebec property. Approximately a 30’ x 30’ square (the back patio) still needs to be collected
- PM sensor function test passed and PM IVS was collected
- The team demobilized for the day at 1600
- The team will finish data collection at 4720 Quebec tomorrow and then proceed to 4740 Quebec.
- A Follow-up TPC Inspection was performed.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

Low hanging tree branches make data collection with the RTS difficult. While tie-back of smaller bushes has been done, in the future, efforts should focus on removing or tying back lower hanging tree branches where possible.

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 17 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study   Report No: DGQCR-004

Project No: W912DR-15-D-0015   Location: Spring Valley   Date: 18 Aug 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☒ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- TEMTADS
  - AM sensor function test passed
  - IVS and production data was collected with RTS positioning
  - Checkshots were performed to verify each RTS setup
  - A clean location was found at 4720 Quebec and a passing sensor function test was obtained
  - Data collection was completed at the 4720 Quebec property
  - Test stand data was collected in accordance with the industry standard SOP for adding data to a library. Data was collected over the MKIV Booster and Livens Simulant
  - PM sensor function test passed and PM IVS was collected
  - The team demobilized for the day at 1530
  - The team will begin data collection at 4740 Quebec tomorrow
- MPV
  - Preparatory and Initial TPC Inspections were performed for MPV Assembly, Dynamic Data collection, and Cued Data Collection
  - Initial IVS data was collected in cued and static modes using both GPS and RTS
  - Collected test stand data over the MKIV Booster and Livens Simulant
  - Attempted to collect data at 4720 Quebec, however the team could not receive cell correction for the GPS using an AT&T SIM card. They will try Verizon tomorrow.

III. Problems Encountered / Corrective Actions Taken

AT&T cell service is not good enough at the job site to receive GPS corrections

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 18 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study   Report No: DGQCR-005

Project No: W912DR-15-D-0015   Location: Spring Valley   Date: 19 Aug 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☒ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- TEMTADS
  - AM sensor function test passed
  - IVS and production data was collected with RTS positioning
  - Checkshots were performed to verify each RTS setup
  - A clean location was found at 4740 Quebec and a passing sensor function test was obtained
  - PM sensor function test passed and PM IVS was collected
  - The team demobilized for the day at 1530
  - The team will need to return to collect a small amount of gap data next week. We will coordinate their visit with the MPV team.
- MPV
  - Follow-Up TPC Inspection was performed for Dynamic Data collection
  - AM sensor function test passed
  - IVS and production data was collected with RTK-DGPS positioning
  - Data was collected in the front yard of 4720 Quebec during times when the TT was not operating
  - PM sensor function test passed and PM IVS was collected
  - The team demobilized for the day at 1700
  - The team will return to 4720 Quebec to finish data collection on 22 August.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

The QAPP requires that TEMTADS and MPV be at least 100 meters apart when both in operation. Due to the close vicinity of the three pilot study properties the two systems cannot operate at the same time based on this requirement. Previous tests have been performed on other sites indicating that this distance could be reduced, so if it becomes necessary to have both teams collecting data simultaneously we will need to perform a test to determine if the separation distance could be reduced.

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 19 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study Report No: DGQCR-006

Project No: W912DR-15-D-0015 Location: Spring Valley Date: 22 Aug 2016

☐ Sunday ☒ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- MPV
  - AM sensor function test passed
  - IVS and production data was collected with RTK-DGPS and RTS positioning. The field team had difficulty getting the RTS data to stream into the MPV correctly which delayed them getting to the site.
  - Data was collected in the backyard and driveway of 4720 Quebec. The side yards and patio still remain to be collected.
  - PM sensor function test passed and PM IVS was collected with RTS positioning only
  - The team demobilized for the day at 1745
  - The team will return to 4720 Quebec to finish data collection on 23 August.

A technical discussion was held over the phone with Tom Colozza, Tom Furuya, Cheryl Webster and Elise Goggin. The discussion was centered around the TEMTADS data quality for 4720 Quebec as well as the path forward for trying to maximize data collection prior to construction activities beginning on the property as soon as 29 August. The following topics were addressed:

- While data coverage was maximized in the field, there are small data gaps in the TEMTADS coverage at this property. Some data gaps could be eliminated by interpolating data to cover RTS shadows. Tom Furuya will address these in his data processing routines. Other small data gaps were due to discrepancies in line spacing and would require additional data collection to fill. Overall, there is only one significant area in the backyard where Elise felt coverage could have been obtained, but was not.
  - Path Forward: Continue processing data as is and select targets for cued data collection. Reassess the data gaps after MPV data collection is complete to determine if TEMTADS should be re-deployed in dynamic mode to collect additional data. This additional data, if warranted, would not be collected until after initial cued data has been collected. Coverage maps will be annotated to better define rationale for data gaps.
- The IMU was not functioning for a small amount of data (4 lines) in the front yard. Elise confirmed that the terrain in the affected area is flat, which means that the lack of IMU data to correct the sensor position would not introduce significant error.
  - Path Forward: The data issue will be documented, however, no corrective action is warranted.
- The site noise is inconsistent, and in some cases significantly higher than that observed at the IVS location. In portions of the site, the target selection threshold defined in the IVS Letter Report is less than the background noise, making target selection at this threshold difficult if not impossible. Attempting to select targets at this threshold will add a significant number of cued targets due to noise rather than potential TOI.
  - Path Forward: Targets will initially be selected at the defined target selection threshold (1.5mV/A), however, Tom F. will manually remove targets interpreted to be due to noise, rather than a dipole source. Additional data processing will be carried out to attempt to reduce the background noise, however this cannot be achieved prior to the 29 August deadline. Instead, the results of this analysis will be incorporated into the Data Usability Assessment.

III. Problems Encountered / Corrective Actions Taken

The RTS was not initially set up correctly. After a few hours of trouble shooting the data was streaming correctly and the team was able to collect the IVS data using RTS positioning.

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-006

Project No: W912DR-15-D-0015

Location: Spring Valley

Date: 22 Aug 2016

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 22 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study   Report No: DGQCR-006

Project No: W912DR-15-D-0015   Location: Spring Valley   Date: 23 Aug 2016

☐ Sunday ☐ Monday ☒ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- MPV
    - A bolt on the MPV handle and the tablet broke first thing in the morning causing a delay.
    - AM sensor function test passed
    - IVS and production data was collected with RTS positioning.
    - Data was collected on the back patio and side yard of 4720 Quebec. The side yard and a few gaps in the front yard still need to be recollected.
    - Computer battery died and would not reconnect to the wifi. Kevin had to bring it to the office to restart the system.
    - PM sensor function test passed and PM IVS was collected with RTS positioning
    - The team demobilized for the day at 1730
    - The team will return to 4720 Quebec to finish data collection on 24 August and then will proceed to 4740 Quebec.

III. Problems Encountered / Corrective Actions Taken

Broken equipment was repaired or replaced.

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

It is important not to let the computer battery die on the MPV. This required a trip to the office to restart the system and caused a fairly significant delay.

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 23 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study | Report No: DGQCR-008

Project No: W912DR-15-D-0015 | Location: Spring Valley | Date: 24 Aug 2016

☐ Sunday ☐ Monday ☐ Tuesday ☒ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- MPV
  - AM sensor function test passed
  - IVS and production data was collected with RTS positioning.
  - Data was collected in gaps of 4720 Quebec before moving to 4740 Quebec. The backyard, side yards and part of the front yard were completed on 4740 Quebec.
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1800
  - The team will return to 4740 Quebec to finish data collection on 25 August and then will proceed to 4733 Woodway.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 24 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-009

Project No: W912DR-15-D-0015 Location: Spring Valley Date: 25 Aug 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☒ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- MPV
  - AM sensor function test passed
  - IVS and production data was collected with RTS and GPS positioning.
  - Colonel Chamberlayne (CENAB) was onsite and observed the IVS data collection and initial data collection at 4740 Quebec.
  - Data collection was completed at 4740 Quebec. Approximately half of the front yard was completed on 4733 Woodway.
  - The field team could not get the GPS to maintain fixed positions at the Woodway property, so no data was collected with GPS positioning.
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1800
  - The team will return to 4733 Woodway tomorrow to complete dynamic data collection.

Kevin Kingdon (BTG) and I had a call with the BTG data processors to discuss the target selection status for 4720 Quebec. There are significantly more targets in the MPV data than in the TEMTADS data, but several of them appear to be related to noise. The BTG group is going to prepare two target lists to discuss with Tom Colozza tomorrow. One will be more conservative (more targets) and the other will be more aggressive (fewer targets). They will also provide a description of the process used to arrive at each list. The plan is to decide on the path forward and be ready to collect cued data at 4720 Quebec on Monday.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 25 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study   Report No: DGQCR-010

Project No: W912DR-15-D-0015   Location: Spring Valley   Date: 26 Aug 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☒ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- MPV
  - AM sensor function test passed
  - IVS and production data was collected with RTS and GPS positioning.
  - Dynamic Data collection was completed at 4733 Woodway
  - The field team could not get the GPS to maintain fixed positions at the Woodway property, so no data was collected with GPS positioning.
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1730
  - The team will plan to collect cued data at 4720 Quebec on Monday.

Kevin Kingdon and I had another call with the BTG data processors to discuss the target selection status for 4720 Quebec. I recommended that they review their target selection to ensure that they are not selecting noise spikes. They are going to get me a revised target list this weekend so I can combine with the TEMTADS and EM61/G-858 targets. This list will be available to be reviewed by QA on Monday (as long as I get targets by Saturday evening), however cued data collection will proceed prior to approval due to schedule restraints. This plan was discussed with Tom C. and Cheryl W.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 26 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study | Report No: DGQCR-011

Project No: W912DR-15-D-0015 | Location: Spring Valley | Date: 29 Aug 2016

☐ Sunday ☒ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- MPV
  - AM sensor function test passed
  - IVS and production data was collected with RTS and GPS positioning. Both cued and dynamic IVS were collected.
  - Dynamic Data was collected in the remaining gap on the back patio of 4720 Quebec.
  - Over 100 cued targets were collected at 4720 Quebec using both GPS and RTS positioning
  - PM sensor function test passed and PM IVS was collected with GPS and RTS positioning
  - The team demobilized for the day at 1830
  - The team will plan to complete cued data collection at 4720 Quebec on Tuesday.
- ERT reacquired anomalies and removed 4 targets that were clearly associated with surface metal.
- TEMTADS will mobilize to the site at noon tomorrow and will collect gap data at 4733 Woodway, before beginning cued data collection at 4720 Quebec. This data is needed for their data processor to complete target selection at the Woodway property.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 29 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name:	SVFUDS Pilot Study	Report No:	DGQCR-012
Project No: W912DR-15-D-0015	Location: Spring Valley	Date:	30 Aug 2016

☐ Sunday ☐ Monday ☒ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- MPV
  - AM sensor function test passed
  - IVS data was collected with RTS and GPS positioning.
  - The remaining cued targets were collected at 4720 Quebec using both GPS and RTS positioning
  - PM sensor function test passed and PM IVS was collected with GPS and RTS positioning
  - The team demobilized for the day at 1230
  - The team will not return to the site until after Labor Day
  - Follow-up TPC Inspection performed
- TEMTADS
  - The team arrived at the site around 1200.
  - AM sensor function test passed
  - IVS data was collected with RTS. Both cued and dynamic IVS were collected.
  - Dynamic data was collected in the gaps at Woodway
  - Initial background verification was performed and approximately 15 targets were collected at 4720 Quebec using RTS positioning
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1800
  - The team will return to 4720 tomorrow to complete cued data collection
  - Follow-up TPC Inspection performed
- ERT reacquired the remaining anomalies at 4720

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 30 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study   Report No: DGQCR-013

Project No: W912DR-15-D-0015   Location: Spring Valley   Date: 31 Aug 2016

☐ Sunday ☐ Monday ☐ Tuesday ☒ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- TEMTADS
  - AM sensor function test passed
  - Cued IVS data was collected with RTS.
  - Almost all of the cued targets in the front yard and a portion of the targets in the backyard were collected at 4720 Quebec using RTS positioning
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1800
  - The team will return to 4720 tomorrow to complete cued data collection

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

At approximately 1530 the EM noise levels drastically increased in the backyard of 4720 Quebec. The source of the noise is unknown and no additional data was collected. The team returned to the IVS to verify that the instrument was still functioning correctly and confirmed that it was.

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 31 August 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-014

Project No: W912DR-15-D-0015

Location: Spring Valley

Date: 01 Sep 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☒ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- TEMTADS
    - AM sensor function test passed
    - Cued IVS data was collected with RTS.
    - It started to rain while at the IVS so the team was delayed about an hour before being able to start data collection at the site.
    - Cued data collection was completed at 4720 Quebec using RTS positioning
    - PM sensor function test passed and PM IVS was collected with RTS positioning
    - The team demobilized for the day at 1500
    - The team will not be onsite tomorrow. MPV will resume cued data collection at 4740 Quebec on 6 Sept.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 01 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-015

Project No: W912DR-15-D-0015

Location: Spring Valley

Date: 06 Sep 2016

☐ Sunday ☐ Monday ☒ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- ERT reacquired targets at 4740 Quebec
- MPV
  - AM sensor function test passed
  - Cued IVS data was collected with RTS.
  - Cued data collection was completed at 4740 Quebec using RTS positioning
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1800

MPV will process cued data this evening to determine if any recollects are necessary. Additionally, MPV will provide cued targets for Woodway to me tomorrow morning. I will merge targets when available, and prepare the cued target list for Woodway.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 06 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study   Report No: DGQCR-016

Project No: W912DR-15-D-0015   Location: Spring Valley   Date: 07 Sep 2016

☐ Sunday ☐ Monday ☐ Tuesday ☒ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- ERT reacquired targets at 4733 Woodway
- MPV
  - AM sensor function test passed
  - Cued AM IVS data was collected with RTS and GPS.
  - Cued data was collected in the front yard of 4733 Woodway using RTS positioning
  - PM sensor function test and PM IVS were not collected due to lightning shut down
  - The team demobilized for the day at 1700

ERT will complete reacquisition at 4733 Woodway tomorrow. MPV will continue with cued data collection tomorrow as well.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 07 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-017

Project No: W912DR-15-D-0015

Location: Spring Valley

Date: 08 Sep 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☒ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- ERT finished reacquiring targets at 4733 Woodway
- MPV
  - AM sensor function test passed
  - Cued AM IVS data was collected with RTS and GPS.
  - Cued data was completed at 4733 Woodway using RTS positioning
  - Data was recollected over targets at 4720 Quebec
  - Follow-up TPC Inspection performed
  - PM sensor function test and PM IVS were collected using RTS and GPS positioning
  - The team demobilized for the day at 1800

The MPV team provided a list of additional targets that would need to be investigated at 4720 and 4740 Quebec as part of the CA for NCRs 001 and 002. These lists add approximately 75 targets to 4740 and 41 targets to 4720. Based on the current schedule, I recommend that these additional targets be resolved via intrusive investigation only. The MPV will not have time to collect cued data over these targets and the I do not believe it adds any value to the pilot study to collect cued TEMTADS data over these targets.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 08 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-018

Project No: W912DR-15-D-0015

Location: Spring Valley

Date: 09 Sep 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☒ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

MPV collected both cued and dynamic data over both a stainless steel and black steel small ISO80. Dynamic data was collected over the items in 3 orientations: horizontal along-line, horizontal cross track, and vertical. It was also collected at two separate heights: directly over the item and approximately 20cm over the item. General observations concluded that the stainless decay was much quicker and the signal amplitude was much smaller. Processed results will be included as part of the response to NCR003.

MPV was packed up an prepared for shipment.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 09 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study | Report No: DGQCR-019

Project No: W912DR-15-D-0015 | Location: Spring Valley | Date: 12 Sep 2016

☐ Sunday ☒ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- TEMTADS
  - AM sensor function test passed
  - Cued and dynamic IVS data were collected with RTS.
  - Cued data collection was completed for all remaining flags at 4740 Quebec using RTS positioning (see problems encountered below)
  - Dynamic data was collected over the missed seed #17 at 4740 to supplement the RCA for NCR002
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1630

III. Problems Encountered / Corrective Actions Taken

Many of the flags that had been reacquired at 4740 Quebec last week were missing or displaced when the team arrived on site this morning. ERT will reacquire the missing targets tomorrow morning. Target locations will also be verified for 4733 Woodway.

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 12 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study		Report No:	DGQCR-020
Project No: W912DR-15-D-0015	Location: Spring Valley	Date:	13 Sep 2016

☐ Sunday ☐ Monday ☒ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- TEMTADS
  - AM sensor function test passed
  - Cued IVS data were collected with RTS.
  - Cued data was collected at 4733 Woodway using RTS positioning. Approximately 40 targets remain
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1530
- ERT reacquired the missing targets at 4740 Quebec

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

Per discussion with CENAB, the targets selected in support of the corrective action for NCR002 will not be cued.

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 13 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-021

Project No: W912DR-15-D-0015 Location: Spring Valley Date: 14 Sep 2016

☐ Sunday ☐ Monday ☐ Tuesday ☒ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- TEMTADS
    - AM sensor function test passed
    - Cued IVS data were collected with RTS.
    - Cued data was completed at 4733 Woodway and 4740 Quebec using RTS positioning.
    - PM sensor function test passed and PM IVS was collected with RTS positioning
    - Follow-up TPC Inspection performed
    - The team demobilized for the day at 1530
- A handful of targets need to be recollected on 4720 and 4740 Quebec. The TEMTADS data processor may identify additional targets that need to be recollected from today's data, but will not have the final recollect list completed until the afternoon of 15 Sept. Due to the small number of targets that still need to be collected, there will be no field work performed on 15 Sept. Any necessary recollects will be collected on 16 Sept.

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 14 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study | Report No: DGQCR-022

Project No: W912DR-15-D-0015 | Location: Spring Valley | Date: 16 Sep 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☒ Friday ☐ Saturday

I. QC Input Provided By:

Elise Goggin	QC Geophysicist	ERT (TtEC)

II. Quality Control Activities

- TEMTADS
  - AM sensor function test passed
  - Cued IVS data were collected with RTS.
  - Cued recollects were completed at all properties.
  - PM sensor function test passed and PM IVS was collected with RTS positioning
  - The team demobilized for the day at 1400

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: Elise Goggin	Company/Title: Tetra Tech EC/ QC Geophysicist	Date: 16 September 2016

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study | Report No: DGQCR-023

Project No: W912DR-15-D-0015 | Location: Spring Valley | Date: 19 Sep 2016

☐ Sunday ☒ Monday ☐ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

James Stuby	QC Geophysicist	ERT

II. Quality Control Activities

- EM61
  - AM static function tests passed
  - Initial IVS data collection
  - Preliminary IVS data approved by T. Colozza via email response, and data collection can begin tomorrow at 4720 Quebec
  - The team demobilized early due to rain at 1:30 (forecast was for continuing showers through approximately 3:00 pm).

III. Problems Encountered / Corrective Actions Taken

None

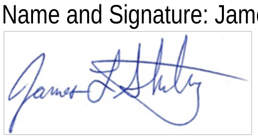
IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: James Stuby	Company/Title: ERT/ QC Geophysicist	Date: 19 September 2016
		

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study

Report No: DGQCR-024

Project No: W912DR-15-D-0015 Location: Spring Valley Date: 20 Sep 2016

☐ Sunday ☐ Monday ☒ Tuesday ☐ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

James Stuby	QC Geophysicist	ERT

II. Quality Control Activities

- EM61
  - AM static function tests and IVS/noise line passed
  - Completed supplemental EM61 survey of data gaps at 4720 Quebec Street. Navigation by RTS.
  - Collected data on all five blind seeds on the property, and all were detected.
  - PM static function tests and IVS/noise line passed

III. Problems Encountered / Corrective Actions Taken

None

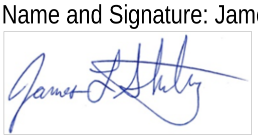
IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: James Stuby	Company/Title: ERT/ QC Geophysicist	Date: 20 September 2016
		

DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study   Report No: DGQCR-025

Project No: W912DR-15-D-0015   Location: Spring Valley   Date: 21 Sep 2016

☐ Sunday ☐ Monday ☐ Tuesday ☒ Wednesday ☐ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

James Stuby	QC Geophysicist	ERT

II. Quality Control Activities

- EM61
  - AM static function tests and IVS/noise line passed
  - Completed supplemental EM61 survey of data gaps at 4733 Woodway Ave. Navigation by RTS.
  - Collected data on all five blind seeds on the property. High site noise limited the ability to detect some seeds.
  - Two static noise tests were conducted (in front of house and in back).
  - Began supplemental EM61 survey of data gaps at 4740 Quebec Street, completing the driveway and a small gap in the front yard. Navigation by RTS.
  - All blind seeds at 4740 Quebec will be surveyed tomorrow (they are all in back yard).
  - PM static function tests and IVS/noise line passed

III. Problems Encountered / Corrective Actions Taken

None

IV. Directions Given / Received:

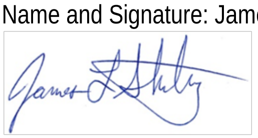
None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: James Stuby	Company/Title: ERT/ QC Geophysicist	Date: 21 September 2016



DAILY GEOPHYSICS QUALITY CONTROL REPORT

Project Name: SVFUDS Pilot Study | Report No: DGQCR-026

Project No: W912DR-15-D-0015 | Location: Spring Valley | Date: 22 Sep 2016

☐ Sunday ☐ Monday ☐ Tuesday ☐ Wednesday ☒ Thursday ☐ Friday ☐ Saturday

I. QC Input Provided By:

James Stuby	QC Geophysicist	ERT

II. Quality Control Activities

- EM61
  - AM static function tests and IVS/noise line passed
  - Completed supplemental EM61 survey of data gaps at 4740 Quebec Street. All work was in back yard. Navigation by RTS.
  - Collected data on all four blind seeds on the property. All were detected.
  - One static noise test was conducted in back yard.
  - PM static function tests and IVS/noise line passed

EM61 work for the pilot test is now complete.

III. Problems Encountered / Corrective Actions Taken

Part of data was affected by the nearby trampoline. The trampoline was moved and the data recollected.

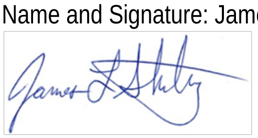
IV. Directions Given / Received:

None

V. Special Notes / Lessons Learned

None

VI. Approval

Name and Signature: James Stuby	Company/Title: ERT/ QC Geophysicist	Date: 22 September 2016
		

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Appendix C-3:

SUXOS Daily Reports

SUXOS DAILY REPORT – October 3, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	71	54	44	0

GOVERNMENT PERSONNEL:

JR Martin USACE Baltimore Operations Officer

WORK PERFORMED BY CONTRACTORS/SUBCONTRACTORS:

Contractor	Title	Hours	Description of Work	Company
Y Knowles	SUXOS	9	MEC Operations oversight	ERT
L George	UXOQC/SO	9	QC/Safety oversight	ERT
Jason Shippy	Tech III	9	UXO Team leader	ERT
Mel Lau	Tech II	9	UXO Team member	ERT
Shawn Cole	Tech II	9	UXO Team member	ERT
John Hayes	Tech I	9	UXO Team member	ERT
Dane McCarthy	Tech I	9	UXO Team member	ERT
Jim Stuby	Geophysicist	9	Site geophysicist	ERT
Lattie Smart	Community Outreach	9	Community relations	ERT
Visitors	None			

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	5.5
Schonstedt	262313	5.5
Whites	0001	5.5
Whites	0002	5.5

SUMMARY OF WORK PERFORMED:

1. Training of personnel in the trailer. Commenced intrusive operations at 4740 Quebec. Completed 43 intrusive digs. Reacquired targets ahead of dig team.

Team Leader	# of Intrusive Digs	MEC (# of Items)	MEC Approx. total Weight (lbs)	MD (# of Items)	MD Approx. total Weight (lbs)	NMRD* (# of items)	NMRD Approx. total Weight (lbs)
Shippy	43	0	0	0	0	48	1

* Non-Munitions Related Debris

QUALITY CONTROL INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed.
2. Conducted minimum 20% QC magnetometer inspections of all areas of intrusive operations.
3. Observed team conduct vehicle inspections, no discrepancies noted.
4. Completed an initial phase inspection and documented for intrusive operations.
5. Completed a preparatory inspection and documented, for concrete removal operations.

Summary of Deficiencies:
None noted.

Corrective Actions:
NA.

SAFETY INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Conducted weekly vehicle inspections for appropriate safety equipment. All vehicles contained the correct in date equipment.
3. Observed UXO intrusive personnel during operations. All personnel wore the correct PPE and safety equipment.

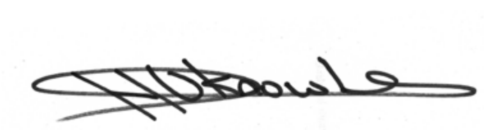
Summary of Deficiencies/Corrective Actions:
None noted.

ADDITIONAL REMARKS:

1. All personnel received Site Specific UXO Safety briefings from USCAE Baltimore, Site SUXOS and UXOQC/SO

CONTRACTOR'S VERIFICATION:

I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.



Howard "Yorky" Knowles, SUXOS
ERT Inc.

SUXOS DAILY REPORT – October 4, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	71	57	71	0

PERSONNEL PERFORMING WORK:

Contractor	Title	Hours	Description of Work	Company
Yorky Knowles	SUXOS	9	MEC Operations oversight	ERT
Lloyd George	UXOQC/SO	9	QC/Safety oversight	ERT
Jason Shippy	Tech III	9	UXO Team leader	ERT
Mel Lau	Tech II	9	UXO Team member	ERT
Shawn Cole	Tech II	9	UXO Team member	ERT
Jon Steier	Tech II	9	UXO Team member	ERT
John Hayes	Tech I	9	UXO Team member	ERT
Dane McCarthy	Tech I	9	UXO Team member	ERT
Jim Stuby	Geophysicist	9	Site geophysicist	ERT
Lattie Smart	Community Outreach	9	Community relations	ERT
Government Personnel or Visitors: Alex Zahl, CENAB PM				

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	5.5
Schonstedt	262313	5.5
Whites	0001	5.5
Whites	0002	5.5
Pavement Saw	NA	3

SUMMARY OF WORK PERFORMED:

1. Continued intrusive operations at 4740 Quebec. Completed 42 intrusive digs. Reacquired targets ahead of dig team. Started hardscape driveway target work.

Team Leader	# of Intrusive Digs Today	MEC (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD* (# of items)	NMRD Total Weight (lbs)
Shippy	42	0	0	0	0	47	5
TOTALS	**85**	**0**	**0**	**0**	**0**	**95**	**6**

* Non-Munitions Related Debris

<u>QUALITY CONTROL INSPECTIONS AND RESULTS:</u>

Completed inspections in the following areas:

1. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed.
2. Conducted minimum 20% QC magnetometer inspections of all areas of intrusive operations.
3. Conducted a follow up inspection on intrusive operations. No discrepancies were noted.

Summary of Deficiencies:
None noted.

Corrective Actions:
NA.

<u>SAFETY INSPECTIONS AND RESULTS:</u>

Completed inspections in the following areas:

1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Observed concrete removal operations personnel during operations. All personnel wore the correct PPE and safety equipment.

Summary of Deficiencies/Corrective Actions:
None noted.

<u>ADDITIONAL REMARKS:</u>

None.

CONTRACTOR'S VERIFICATION:
I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.

Howard "Yorky" Knowles, SUXOS
ERT Inc.

SUXOS DAILY REPORT – October 5, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	66	55	67	0

PERSONNEL PERFORMING WORK:

Contractor	Title	Hours	Description of Work	Company
Yorky Knowles	SUXOS	9	MEC Operations oversight	ERT
Lloyd George	UXOQC/SO	9	QC/Safety oversight	ERT
Jason Shippy	Tech III	9	UXO Team leader	ERT
Mel Lau	Tech II	9	UXO Team member	ERT
Shawn Cole	Tech II	9	UXO Team member	ERT
Jon Steier	Tech II	9	UXO Team member	ERT
John Hayes	Tech I	9	UXO Team member	ERT
Dane McCarthy	Tech I	9	UXO Team member	ERT
Jim Stuby	Geophysicist	9	Site geophysicist	ERT
Lattie Smart	Community Outreach	9	Community relations	ERT
Government Personnel or Visitors: None.				

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	8.5
Schonstedt	262313	8.5
Whites	0001	8.5
Whites	0002	8.5
Pavement Saw	NA	8
Jackhammer	NA	8

SUMMARY OF WORK PERFORMED:

1. Continued intrusive operations at 4740 Quebec. Completed 58 intrusive digs. Completed hardscape driveway target work. Reacquired targets ahead of dig team at 4733 Woodway Lane.

Team Leader	# of Intrusive Digs Today	MEC (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD* (# of items)	NMRD Total Weight (lbs)
Shippy	58	0	0	0	0	63	5
TOTALS	**143**	**0**	**0**	**0**	**0**	**158**	**11**

* Non-Munitions Related Debris

QUALITY CONTROL INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed.
2. Conducted minimum 20% QC magnetometer inspections of all areas of intrusive operations. All areas passed QC inspections, no discrepancies noted.
3. Conducted a follow up inspection on of concrete removal operations. No discrepancies were noted.
4. Conducted a follow up inspection on mab and dig intrusive operations. No discrepancies noted.

Summary of Deficiencies:
None noted.

Corrective Actions:
NA.

SAFETY INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Observed mag and dig intrusive operations. All personnel wore the correct PPE and safety equipment.

Summary of Deficiencies/Corrective Actions:
None noted.

ADDITIONAL REMARKS:

None.

CONTRACTOR'S VERIFICATION:
I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.

Howard “Yorky” Knowles, SUXOS
ERT Inc.

SUXOS DAILY REPORT – October 6, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	66	54	69	0

PERSONNEL PERFORMING WORK:

Contractor	Title	Hours	Description of Work	Company
Yorky Knowles	SUXOS	9	MEC Operations oversight	ERT
Lloyd George	UXOQC/SO	9	QC/Safety oversight	ERT
Jason Shippy	Tech III	9	UXO Team leader	ERT
Mel Lau	Tech II	9	UXO Team member	ERT
Shawn Cole	Tech II	9	UXO Team member	ERT
Jon Steier	Tech II	9	UXO Team member	ERT
John Hayes	Tech I	9	UXO Team member	ERT
Dane McCarthy	Tech I	9	UXO Team member	ERT
Jim Stuby	Geophysicist	9	Site geophysicist	ERT
Lattie Smart	Community Outreach	9	Community relations	ERT
Government Personnel or Visitors: JR Martin USACE Operations Officer				

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	8.5
Schonstedt	262313	8.5
Whites	0001	8.5
Whites	0002	8.5
Jackhammer	NA	0

SUMMARY OF WORK PERFORMED:

1. Completed intrusive operations at 4740 Quebec. Completed 41 intrusive digs. Reacquired targets ahead of dig team at 4733 Woodway Lane.
2. Commenced intrusive ops at 4733 Woodway Lane, completing 109 intrusive digs at this address.

4740 Quebec

Team Leader	# of Intrusive Digs Today	MEC (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD* (# of items)	NMRD Total Weight (lbs)
Shippy	41	0	0	0	0	45	0.5
TOTALS 4740	**184**	**0**	**0**	**0**	**0**	**203**	**11.5**

* Non-Munitions Related Debris

4733 Woodway

Team Leader	# of Intrusive Digs Today	MEC (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD* (# of items)	NMRD Total Weight (lbs)
Shippy	109	0	0	0	0	79	5.5
TOTALS 4733	**109**	**0**	**0**	**0**	**0**	**79**	**5.5**

QUALITY CONTROL INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed user checks.
2. Conducted minimum 20% QC magnetometer inspections of all areas of intrusive operations in both 4740 Quebec and 4733 Woodway. All areas passed QC inspections, no discrepancies noted.
3. Conducted a follow up inspection on mag and dig intrusive operations. No discrepancies noted.

Summary of Deficiencies:

None noted.

Corrective Actions:

NA.

SAFETY INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Observed intrusive operations. All personnel wore the correct PPE and safety equipment.

Summary of Deficiencies/Corrective Actions:

None noted.

ADDITIONAL REMARKS:

None.

CONTRACTOR'S VERIFICATION:

I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.

Howard "Yorky" Knowles, SUXOS
ERT Inc.

SUXOS DAILY REPORT – October 7, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	68	56	87	0

PERSONNEL PERFORMING WORK:

Contractor	Title	Hours	Description of Work	Company
Yorky Knowles	SUXOS	9	MEC Operations oversight	ERT
Lloyd George	UXOQC/SO	9	QC/Safety oversight	ERT
Jason Shippy	Tech III	9	UXO Team leader	ERT
Mel Lau	Tech II	9	UXO Team member	ERT
Shawn Cole	Tech II	9	UXO Team member	ERT
Jon Steier	Tech II	9	UXO Team member	ERT
Dane McCarthy	Tech I	9	UXO Team member	ERT
Jim Stuby	Geophysicist	9	Site geophysicist	ERT
Lattie Smart	Community Outreach	9	Community relations	ERT
Maya Werner	Community Outreach	3	Community relations	ERT
Government Personnel or Visitors: : Alex Zahl-CENAB PM, and JR Martin-USACE Operations Officier				

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	8.5
Schonstedt	262313	8.5
Whites	0001	8.5
Whites	0002	8.5

SUMMARY OF WORK PERFORMED:

1. Continued intrusive operations at 4733 Woodway. Completed all digs except for 5 target anomalies under the slate patio. Site inspection of 4740 completed by Outreach and Client.

4733 Woodway

Team Leader	# of Intrusive Digs Today	MEC (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD* (# of items)	NMRD Total Weight (lbs)
Shippy	110	0	0	0	0	88	8
TOTALS	**219**	**0**	**0**	**0**	**0**	**167**	**13.5**

* Non-Munitions Related Debris

<u>QUALITY CONTROL INSPECTIONS AND RESULTS:</u>

Completed inspections in the following areas:

1. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed daily user checks.
2. Conducted minimum 20% QC magnetometer inspections of all areas of intrusive operations, all areas passed QC inspections, no discrepancies noted.
3. Conducted a follow up inspection on mag and dig intrusive operations. No discrepancies noted.

Summary of Deficiencies:

None noted.

Corrective Actions:

NA.

<u>SAFETY INSPECTIONS AND RESULTS:</u>

Completed inspections in the following areas:

1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Observed require operations. All personnel wore the correct PPE and had correct in date safety equipment in their safety vehicle.
3. Observed mag and dig intrusive operations. All personnel wore the correct PPE and safety equipment.

Summary of Deficiencies/Corrective Actions:

None noted.

<u>ADDITIONAL REMARKS:</u>

None.

CONTRACTOR'S VERIFICATION:

I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.

Howard "Yorky" Knowles, SUXOS
ERT Inc.

SUXOS DAILY REPORT – November 14, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	59	51	76	0

PERSONNEL PERFORMING WORK:

Contractor	Title	Hours	Description of Work	Company
Yorky Knowles	SUXOS	9	MEC Operations oversight	ERT
Mike Bealer	UXOQC/SO	9	QC/Safety oversight	ERT
Jason Shippy	Tech III	9	UXO Team leader	ERT
Rick St Amand	Tech II	9	UXO Team member	ERT
Shawn Cole	Tech II	9	UXO Team member	ERT
Ignacio Soto	Tech II	9	UXO Team member	ERT
Dane McCarthy	Tech I	9	UXO Team member	ERT
John Hayes	Tech I	9	UXO Team member	ERT
Joshua Bair	Tech I	9	UXO Team member	ERT
Jim Stuby	Geophysicist	9	Site geophysicist	ERT
Lattie Smart	Community Outreach	6	Community relations	ERT
Rebecca Yahiel	Community Outreach	6	Community relations	ERT
Government Personnel or Visitors: : JR Martin USACE CENAB Operations Officer				

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	7.5
Schonstedt	262313	7.5
Whites	0001	7.5
Whites	0002	7.5
Jackhammer	NA	7

SUMMARY OF WORK PERFORMED:

1. Commenced intrusive operations at **4720 Quebec**. Completed a total of 104 intrusive operations. Of these 104, 7 were in the hardscape.
2. Target #129 was a 3 inch Stokes Mortar. This mortar was reported to the site OESS (Operations Officer) who took control of the item. One MD item also found.

Team Leader	# of Intrusive Digs Today	MPPEH\1 (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD\2 (# of items)	NMRD Total Weight (lbs)
Shippy	104	1	Unknown	1	0.50lbs	107	30
TOTALS	**104**	**1**	**0**	**1**	**0.50lbs**	**107**	**30**

\1 – Material Potentially Presenting an Explosive Hazard (Stokes Mortar to be formally categorized by EOD).
\2 - Non-Munitions Related Debris (in some cases, multiple items in single dig).

QUALITY CONTROL INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed daily user checks.
2. Conducted minimum 20% QC magnetometer inspections of all areas of intrusive operations, all areas passed QC inspections, no discrepancies noted.
3. Conducted initial and follow on inspections on mag and dig intrusive operations. No discrepancies noted.
4. Conducted initial and follow on inspection on hardscape removal operations. No discrepancies were noted

Summary of Deficiencies:
None noted.

Corrective Actions:
NA.

SAFETY INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

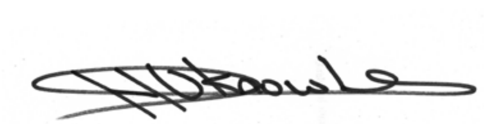
1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Observed re-acquire operations. All personnel wore the correct PPE and had correct in date safety equipment in their safety vehicle.
3. Observed mag and dig intrusive operations. All personnel wore the correct PPE and safety equipment.

ADDITIONAL REMARKS:

CENAB Operations Officer took control of the Stokes Mortar and notified EOD (out of Ft Belvoir). EOD x-rayed the item, then took it back to Ft Belvoir. A formal report containing more details on this item can be obtained through CENAB.

CONTRACTOR'S VERIFICATION:

I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.



Howard "Yorky" Knowles, SUXOS
ERT Inc.

Report Date: 11/15/2016
Project No: 3751
ERT, Inc. Report No: 0007

SUXOS DAILY REPORT – November 15, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	63	58	75	0

PERSONNEL PERFORMING WORK:

Contractor	Title	Hours	Description of Work	Company
Yorky Knowles	SUXOS	9	MEC Operations oversight	ERT
Mike Bealer	UXOQC/SO	9	QC/Safety oversight	ERT
Jason Shippy	Tech III	9	UXO Team leader	ERT
Rick St Amand	Tech II	9	UXO Team member	ERT
Shawn Cole	Tech II	9	UXO Team member	ERT
Ignacio Soto	Tech II	9	UXO Team member	ERT
Dane McCarthy	Tech I	9	UXO Team member	ERT
John Hayes	Tech I	9	UXO Team member	ERT
Joshua Bair	Tech I	9	UXO Team member	ERT
Jim Stuby	Geophysicist	9	Site Geophysicist	ERT
Rebecca Yahiel	Community Outreach	9	Community relations	ERT
Government Personnel or Visitors: : JR Martin USACE CENAB Operations Officer				

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	8.5
Schonstedt	262313	8.5
Whites	0001	8.5
Whites	0002	8.5
Jackhammer	NA	8.5

SUMMARY OF WORK PERFORMED:

1. Continued intrusive operations at **4720 Quebec**. Completed a total of 103 intrusive operations. 2 MD items found (frag).
2. Completed all hardscape intrusive operations.

Team Leader	# of Intrusive Digs Today	MPPEH\1 (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD\2 (# of items)	NMRD Total Weight (lbs)
Shippy	103	0	NA	2	0.50	97	15
TOTALS	**207**	**1**	**0**	**3**	**1.0 lbs**	**204**	**45**

\1 – Material Potentially Presenting an Explosive Hazard.
\2 - Non-Munitions Related Debris (in some cases, multiple items in single dig).

QUALITY CONTROL INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed daily user checks.
2. Conducted minimum 20% QC magnetometer inspections of all areas of intrusive operations, all areas passed QC inspections, no discrepancies noted.
3. Conducted follow inspections on mag and dig intrusive operations. No discrepancies noted.
4. Conducted follow inspection on hardscape removal operations. No discrepancies were noted.

Summary of Deficiencies:
None noted.

Corrective Actions:
NA.

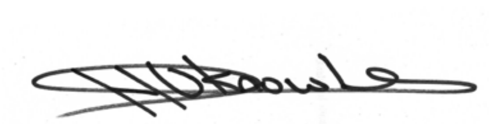
SAFETY INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Observed re-acquire operations, all personnel wore the correct PPE and had correct in date safety equipment in their safety vehicle.
3. Observed mag and dig intrusive operations, all personnel wore the correct PPE and safety equipment.

ADDITIONAL REMARKS:
Approximately 35 digs remain to be completed.

CONTRACTOR'S VERIFICATION:
I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.



Howard “Yorky” Knowles, SUXOS
ERT Inc.

Report Date: 11/16/2016
Project No: 3751
ERT, Inc. Report No: 0008

SUXOS DAILY REPORT – November 16, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	61	49	68	0

PERSONNEL PERFORMING WORK:

Contractor	Title	Hours	Description of Work	Company
Yorky Knowles	SUXOS	9	MEC Operations oversight	ERT
Mike Bealer	UXOQC/SO	9	QC/Safety oversight	ERT
Jason Shippy	Tech III	9	UXO Team leader	ERT
Rick St Amand	Tech II	9	UXO Team member	ERT
Shawn Cole	Tech II	9	UXO Team member	ERT
Ignacio Soto	Tech II	9	UXO Team member	ERT
Dane McCarthy	Tech I	9	UXO Team member	ERT
John Hayes	Tech I	9	UXO Team member	ERT
Joshua Bair	Tech I	9	UXO Team member	ERT
Jim Stuby	Geophysicist	5	Site geophysicist	ERT
Rebecca Yahiel	Community Outreach	9	Community relations	ERT
Government Personnel or Visitors: : JR Martin USACE CENAB Operations Officer				

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	8.5
Schonstedt	262313	8.5
Whites	0001	8.5
Whites	0002	8.5
Jackhammer	NA	8.5

SUMMARY OF WORK PERFORMED:

1. Completed a total of 44 intrusive operations today at 4720 Q, finishing the property.
2. Completed 7 intrusive operations on the hardscape at 4740 Q, finishing this property.
3. Commenced intrusive operations on the hardscape at 4733 W, completing 5 digs in the slate patio.

Team Leader	# of Intrusive Digs Today	MPPEH\1 (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD\2 (# of items)	NMRD Total Weight (lbs)
Shippy	56	0	NA	0	NA	63	20
TOTALS	**263**	**1**	**0**	**3**	**1.0lbs**	**267**	**65**

\1 – Material Potentially Presenting an Explosive Hazard.
\2 - Non-Munitions Related Debris (in some cases, multiple items in single dig).

QUALITY CONTROL INSPECTIONS AND RESULTS:
Completed inspections in the following areas:
1. Conducted minimum 20% QC magnetometer inspections of all areas of intrusive operations, all areas passed QC inspections, no discrepancies noted.
2. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed daily user checks.
3. Conducted follow inspections on mag and dig intrusive operations. No discrepancies noted.
4. Conducted follow inspection on hardscape removal operations. No discrepancies were noted.

Summary of Deficiencies:
None noted.

Corrective Actions:
NA.

SAFETY INSPECTIONS AND RESULTS:
Completed inspections in the following areas:
1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Observed mag and dig intrusive operations, all personnel wore the correct PPE and safety equipment.
3. Observed re-acquire operations, all personnel wore the correct PPE and had correct in date safety equipment in their safety vehicle.

ADDITIONAL REMARKS:
Only 4733 front sidewalk targets remain to be dug. Property Inspection of 4720 property scheduled for tomorrow with USACE and home owner.

CONTRACTOR'S VERIFICATION:
I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.

Howard "Yorky" Knowles, SUXOS
ERT Inc.

SUXOS DAILY REPORT – November 17, 2016

Spring Valley FUDS Pilot Study

Washington, DC

WORKDAY WEATHER:

Weather Description	High (°F)	Low (°F)	Humidity (%)	Rainfall (%)
Partly Cloudy	63	50	65	0

PERSONNEL PERFORMING WORK:

Contractor	Title	Hours	Description of Work	Company
Yorky Knowles	SUXOS	8	MEC Operations oversight	ERT
Mike Bealer	UXOQC/SO	8	QC/Safety oversight	ERT
Jason Shippy	Tech III	8	UXO Team leader	ERT
Rick St Amand	Tech II		De-mob	ERT
Shawn Cole	Tech II	8	UXO Team member	ERT
Ignacio Soto	Tech II		De-mob	ERT
Dane McCarthy	Tech I		De-mob	ERT
John Hayes	Tech I	8	UXO Team member	ERT
Joshua Bair	Tech I		De-mob	ERT
Rebecca Yahiel	Community Outreach	6	Community relations	ERT
Government Personnel or Visitors: : JR Martin USACE CENAB Operations Officer				

OPERATING EQUIPMENT DATA (Not hand tools):

Equipment	Equipment ID/TAG	Hours Used
Schonstedt	262312	4.5
Schonstedt	262313	4.5
Whites	0001	4.5
Whites	0002	4.5
Jackhammer	NA	4.5

SUMMARY OF WORK PERFORMED:

1. Conducted intrusive operations (4 targets) on the hardscape at 4733 W public sidewalk.

Team Leader	# of Intrusive Digs Today	MPPEH\1 (# of Items)	MEC Total Weight (lbs)	MD (# of Items)	MD Total Weight (lbs)	NMRD\2 (# of items)	NMRD Total Weight (lbs)
Shippy	4	0	NA	0	NA	1	0.25
TOTALS	**267**	**1**	**0**	**3**	**1.0 lbs**	**268**	**65.25**

\1 – Material Potentially Presenting an Explosive Hazard.
\2 - Non-Munitions Related Debris (in some cases, multiple items in single dig).

QUALITY CONTROL INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Observe personnel perform equipment checks on the analog detectors in the Instrument Verification Strip (IVS) prior to MEC intrusive operations. No discrepancies were noted, all instruments passed daily user checks.
2. Conducted follow inspections on mag and dig intrusive operations. No discrepancies noted.
3. Conducted follow inspection on hardscape removal operations. No discrepancies were noted Conducted minimum 15% QC magnetometer inspections of all areas of intrusive operations, all areas passed QC inspections, no discrepancies noted.

Summary of Deficiencies:
None noted.

Corrective Actions:
NA.

SAFETY INSPECTIONS AND RESULTS:

Completed inspections in the following areas:

1. Site specific Health and Safety brief given prior to commencement of daily operations.
2. Observed re-acquire operations, all personnel wore the correct PPE and had correct in date safety equipment in their safety vehicle. Observed mag and dig intrusive operations, all personnel wore the correct PPE and safety equipment.

ADDITIONAL REMARKS:
Field work is finished. Tomorrow will be rental equipment returns and de-mob of remaining personnel.

CONTRACTOR'S VERIFICATION:
I certify that to the best of my knowledge the above report is complete and correct. All material, equipment used, and work performed during this reporting period is in compliance with the contract plans and specifications except as noted above.

Howard "Yorky" Knowles, SUXOS
ERT Inc.

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Appendix D:
Non-Conformance and Root Cause Analysis Reports

NONCONFORMANCE REPORT (NCR)

Identification

Originator: Elise Goggin	Organization: ERT (TtEC)	Date: 8/28/16	Report Number: 001

Nonconformance Description (Describe the nonconformance; ensure the applicable requirements, planned activities, procedures, specifications, drawing, standards, serial numbers, etc. are noted. Indicate who documented the nonconformance.).

Requirement: All blind QC seeds must be detected and positioned within 40-cm radius of ground truth (QAPP Worksheet #22)

Condition: Blind Verification Seed #16 was not detected by the TEMTADS or the MPV at the **4720 Quebec** property. Both systems passed over the seed with more than one sensor. The seed is buried at approximately 7.5x diameter, which was assumed to be an acceptable depth. Seed information is below:

Seed	Description	Northing (SP)	Easting (SP)	Depth (ft)
16	large ISO	462920.62	1285758.22	2.55

Risk Level Major/Moderate

Steps to Prevent Inadvertent Use of the Item or Process

Corrective/Preventive Action and Disposition

Planned Corrective/Preventive Action (Describe for each cause what action(s) will be taken with the item or process, including, as applicable, the completion dates, disposition of material, and responsible staff for each action. Describe, as applicable, what actions are needed to prevent recurrence of the identified nonconformance, such as process improvement, procedure revisions, training plan, etc., and include completion dates and responsible staff for each action.).

Individual demonstrators will perform a root cause analysis and define an appropriate corrective action if applicable. This assessment will be completed no later than 31 August 2016.

ERT recommends that the teams proceed with cued data collection at this property prior to resolving the non-conformance due to schedule constraints. The blind seed will be added to the cued list and will be considered a training dig on the final ROC curve for both demonstrators.

Independent verification required? Yes ☒ **No** ☐

Person(s) Responsible for the Corrective/Preventive Action and Disposition	Approval of Corrective/Preventive Action and Disposition
Name *Date*	*Name* *Date*

Closing the Nonconformance

Action Completed	**Independent Verification Completed (if required)**
Name *Date*	*Name* *Date*

Distribution:

EMSMR/CFT Member Initial ☐ Final ☐

Root cause analysis for a missed seed in the MPV detection list for the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study

Summary

A quality control (QC) seed item was not included in the Man Portable Vector (MPV) derived detection list submitted for site 1 (4720 Quebec) of the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study in Spring Valley, Washington, D.C. The primary cause for the missed QC seed was the negative bias introduced to the data due to the application of a de-median filter. The missed seed was located beneath a short line of data that consisted primarily of signal due to the missed seed, and did not sample the background response over much of the line. A median filter was applied that overestimated the magnitude of the background response. Since the seed was relatively deep, the negative offset produced by the filtering artifact reduced the QC seed's anomaly peak value beneath the target picking threshold. This memo identifies causes for the missed seed, and specifies the corrective action taken.

Initial processing

A QC seed was missed in the initial detection analysis of the MPV data collected at Site 1 (4720 Quebec) of the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study. The missed item was a Large ISO at a depth of 2.5 feet (0.76m) and oriented horizontally, in an East-West direction. Dynamic MPV data were acquired along lines with a nominal line-spacing of 0.5 m. On the front yard of the house, data were positioned using Real Time Kinematic (RTK) GPS. In the back yard, limited GPS satellite coverage required the field crews to use Robotic Total Station (RTS) for positioning. Once the initial survey was completed, any data gaps were filled using RTS to navigate and position. The resulting instrument data files were converted to .csv files, which were then imported into the UXOLab software. Each receiver and receiver component were levelled using a de-median filter. Figure 1 plots an image of the data acquired at Site 1.

A data amplitude-based target picking algorithm applied to the profile data (i.e. not the gridded image) was used to detect anomalies. The detection algorithm was applied to Z-component data from all receiver cubes. Instead of using a single time channel for detection, a composite data channel that integrated the measured decay from time channels 3 to 8 was chosen for detection. The integrated channel was defined to increase the signal to noise ratio for detecting potential targets of interest (TOI). Data from each receiver were treated as a separate profile, with anomalies picked along each profile. Each anomaly was when inverted for dipole sources. The size and decay of the source polarizabilities were then used to eliminate anomalies small, thin walled scrap.

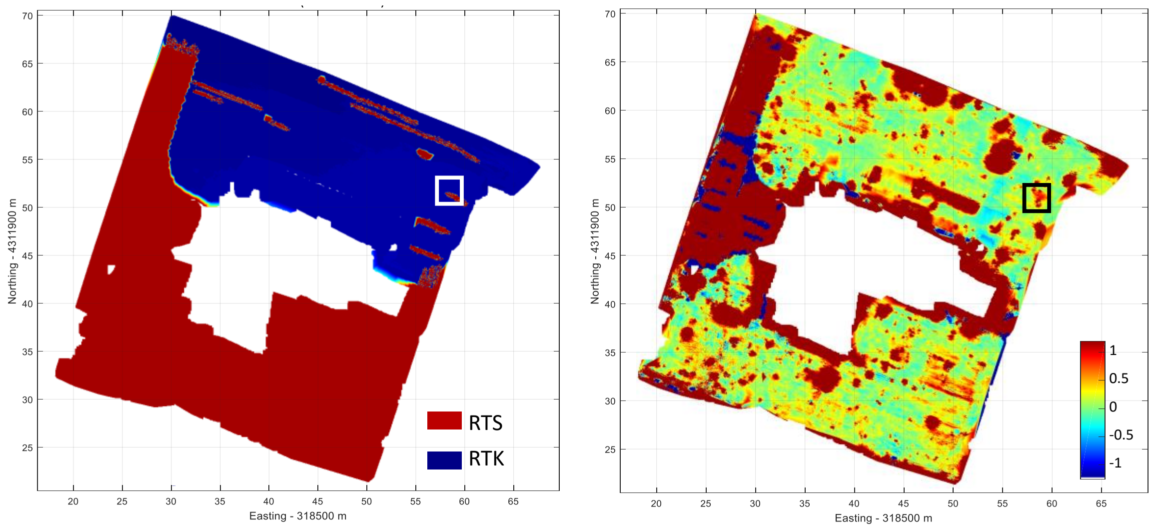


Figure 1 MPV dynamic data collected at Site 1 (4720 Quebec St). On the left is a plot indicating which areas of the yard were surveyed using GPS or RTS for positioning. On the right, is an image of the composite channel. The black square indicates where the missed QC seed was located.

The detection objective for this site was to detect a MarkIV booster at a depth of 30 cm. The data amplitude threshold for a MarkIV booster was calculated using the Detection Modeler software from SERDP MR-2226. Polarizabilities for the MarkIV booster were obtained from MPV test stand data acquired at the site. To calculate the threshold, we assume that the center of the MPV transmitter coil was 0.1 m above the ground (i.e. the bottom of the MPV sensor head has a ground clearance of approximately 2 inches), and that the maximum line spacing is 0.65 m. Based on these assumptions, the threshold for the composite channel is 1.19 mV/A (Figure 2).

(a) Polarizabilities for a MarkIV booster *(b) Depth response curve* *(c) Detection threshold*

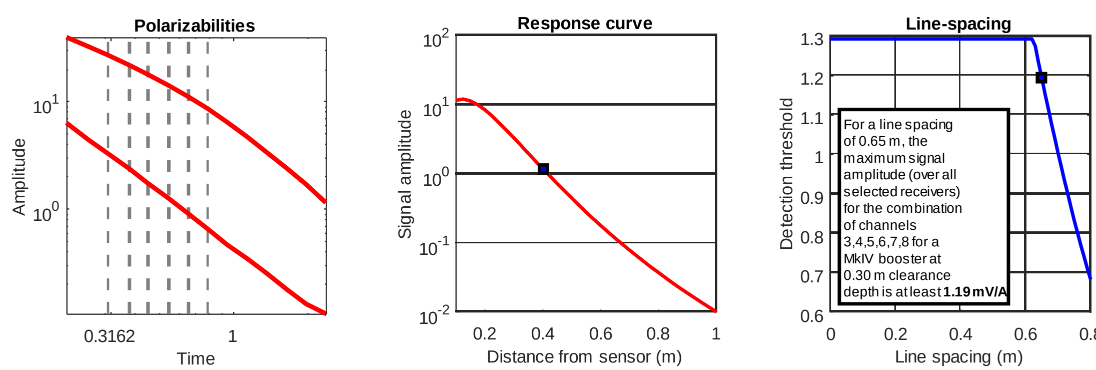


Figure 2. MarkIV booster modeling output from the SERDP MR-2226 Detection Modeler. These measurements assume the center of the z-transmitter coil is 0.10 cm above the surface. For a composite channel from time channel 3 (0.31 ms) to time channel 8 (0.79 ms), the threshold for a MarkIV booster at a depth of 0.3m is 1.19 mV/A.

Figure 3 plots the expected clearance depth for the small, medium and large ISO when the detection threshold for the composite channel is 1.19 mV/A. The clearance depth represents the deepest that a target can be and still be detected regardless of orientation. The small ISO has a similar set of polarizabilities as the MarkIV booster, and therefore has a similar the clearance depth. The medium ISO will be detected to a depth of 50 cm, and two Large ISOs types have clearance depths of 0.77m and 0.80m.

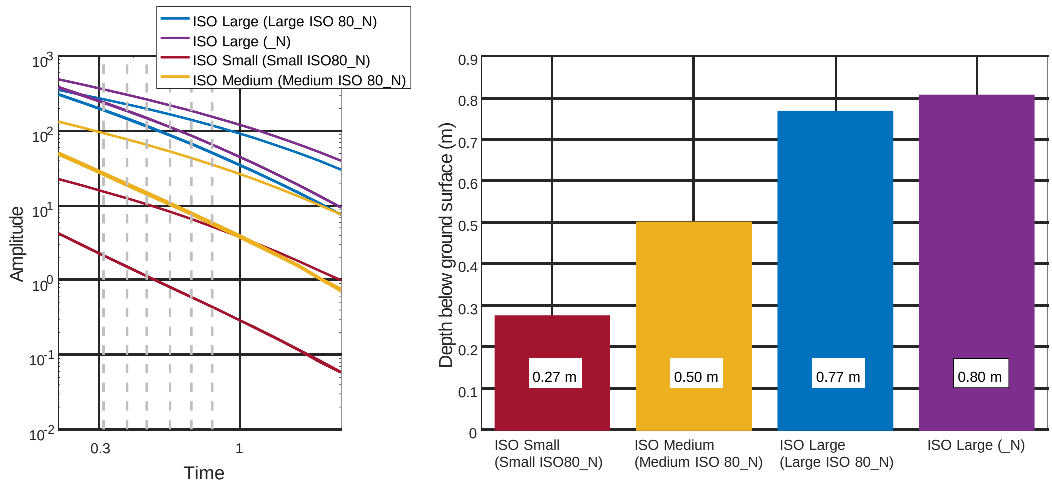


Figure 3 Clearance depth analysis for Small, Medium and Large ISOs. On the left are 2 Large ISO polarizabilities, a medium ISO polarizability, and a small ISO polarizability. The depths on the right indicate the clearance depth of each target type. We note that the depth of the missed large ISO is 0.76 m, which is approximately the same depth at which at which a large ISO data response is equal to the detection threshold.

Root Cause Analysis

A QC seed located at UTM (318558.96, 4311950.85)m was not included in the MPV detection list. The seed is a large ISO emplaced at a depth of 2.5 feet (76cm) and is horizontal. The detectability of the seed is first established through forward modeling. Figure 3 showed that the clearance depth for a large ISO is only slightly deeper than the emplacement depth of 76cm. The clearance depth for the large ISO is limited by the maximum lateral offset of the target (and therefore the line spacing of the survey). Modeling the response of the large ISO, shows the response of the large ISO as a function of cross-track offset. If the large ISO is within approximately 30 cm of the center of the MPV sensor head, a z-component receiver will measure a response greater than the threshold of 1.2 mV/A. If the MPV passes directly over the large ISO, the system will measure a response of 1.6 mV/A.

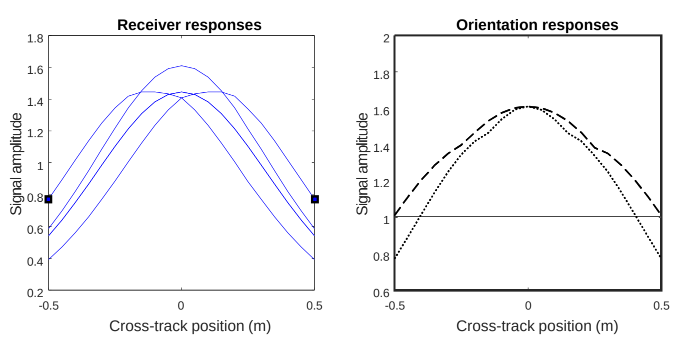


Figure 4 left Composite channel respone of the 5 MPV receivers. Right. Horizontal large ISO – cross track positioning is dashed, along track is dotted. The MPV will produce a signal exceeding the detection threshold, provided that lateral offset of the target is less than approximately 30 cm.

Figure 5 plots the composite channel, z-component data that was used for target picking. These data were levelled using an along line de-median filter. When the appropriate filter parameters are used, the anomaly amplitudes are preserved. This occurs when the median value within the moving filter is equal to the background. We chose a filter with a 5 m moving window, and 10 percent of the highest amplitude data omitted when calculating the window's median value.

The top panel of Figure 5 plots a gridded image of the z-component for the middle receiver. The missed seed is located just south of Line 297, and its location is indicated by a white triangle. Line 297 was acquired in order to fill a gap identified during internal review of the initial data collection. The bottom panel of Figure 5 plots the profiles of the z-component receivers. The east end of the line is negative, which is not expected for the z-component response (with the exception of the very near surface targets on the edge of the transmitter loop). The negative response indicates that Line 297 was poorly levelled due to overestimating the background response.

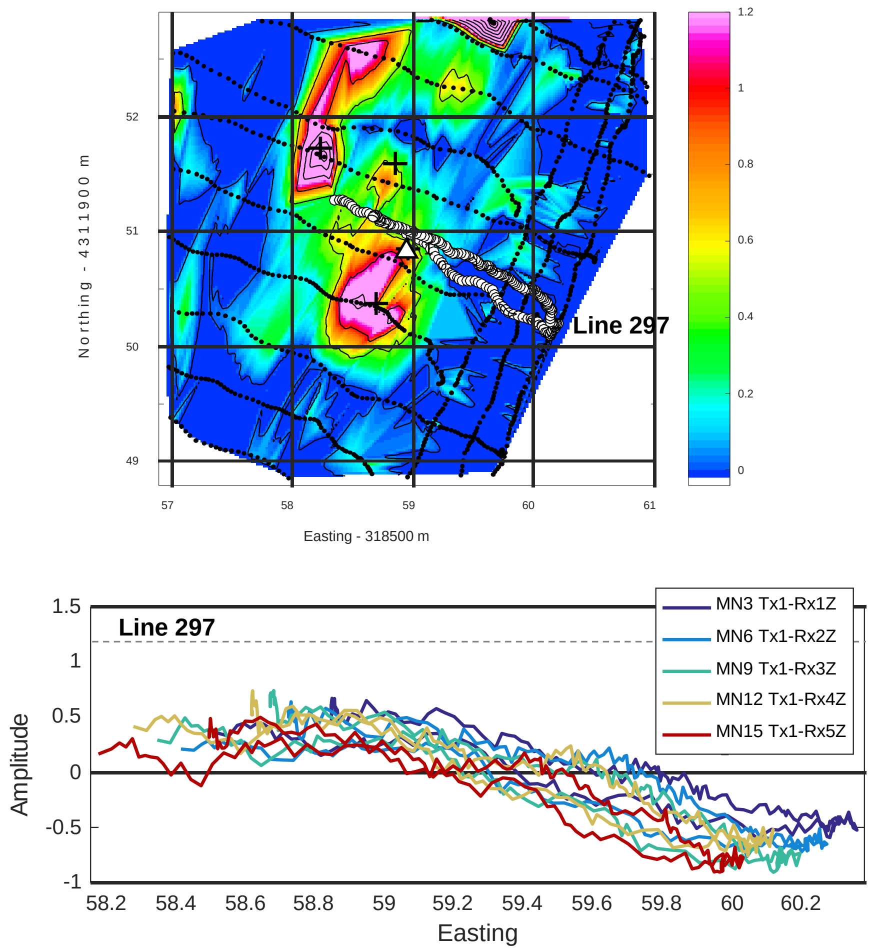


Figure 5 Intial detection data. These data were levelled using a de-median filter. Line 297 is located above the missed QC seeds. The total length of the line is approximately 4 m. Application of the median filter with our default settings over estimated the background response. Subtraction of the estimated background results in a section of data having a negative bias.

Figure 6 plots the anomaly and profile when Line 297 is shifted such that the east end of the line is approximately zero. Correct leveling of the Line 291 data results in the anomaly associated with the missing seed having amplitudes that exceed the detection threshold. The resulting data is consistent with the modeled data of Figure 4.

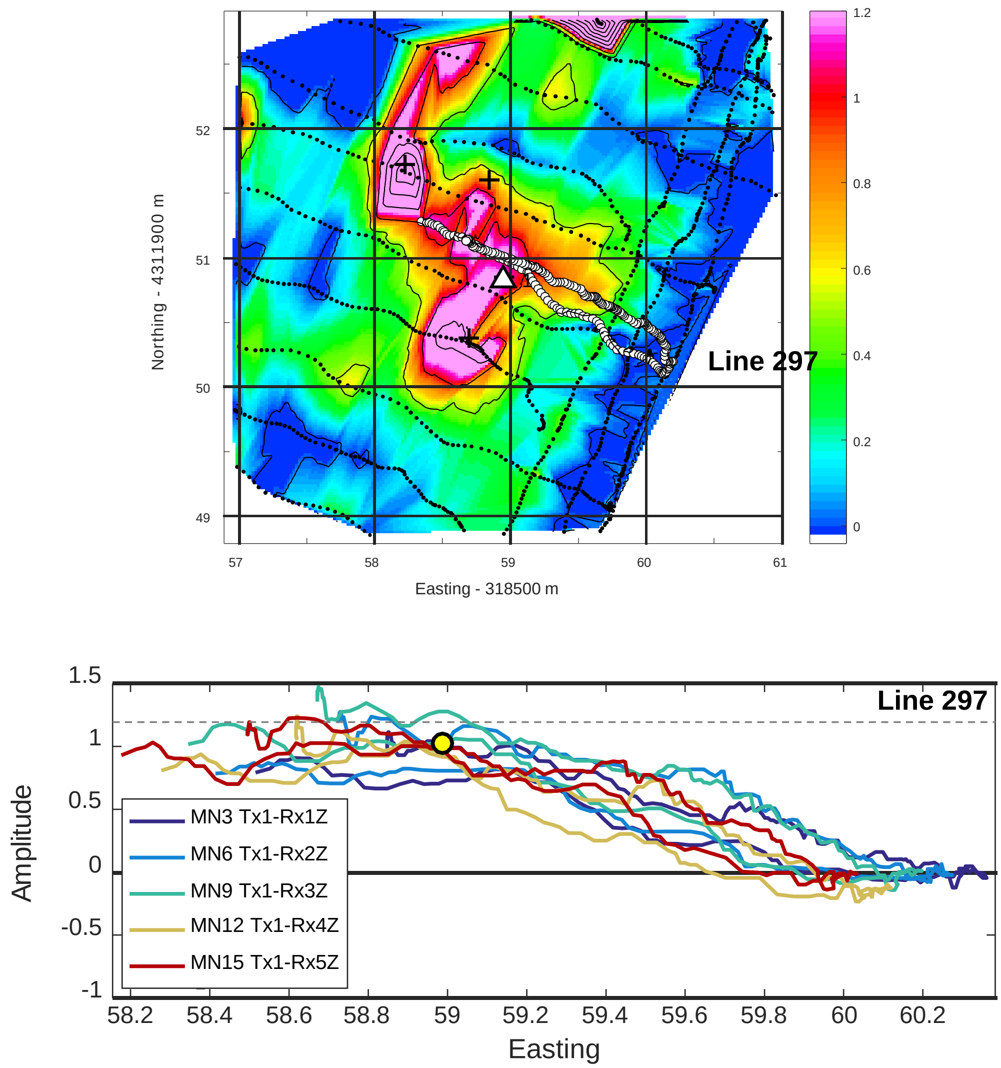


Figure 6 Detection data after re-filtering. We designed a filter that identifies low amplitude sections of data, and marks them as background regions. The constructed background response is then subtracted from the data.

For cases where the sensor response is only slightly above the threshold, a negative bias due to a filtering artifact can result in an anomaly not being identified for additional analysis and/or cued interrogation. We have developed a levelling filter for z-component data that identify low amplitude sections of a line, and estimates an offset to apply to the data such that the low amplitude sections are approximately zero. The filter defines an “envelope” based on the low amplitude sections of data, and uses the envelope as an estimate of the background response. This filter reduces artifacts in regions of high target density or other instances where the background response is poorly estimated.

Root Cause: The root-cause of the missed QC seed was the use of a line leveling filter that overestimated the background signal, producing a negative bias in the data. This type of filtering artifact occurs when the background is not sufficiently sampled within the filtering window.

Corrective Action

A de-median filter can produce filtering artifacts that reduce anomaly amplitudes. For the missed QC seed, the data amplitudes were reduced such that the peak amplitude of the anomaly fell below the detection threshold. To avoid future instances of missed targets, we suggest the following corrective action:

- The analyst should carefully review each line to determine if negative offsets were introduced due to median filtering artifacts.
- Re-level lines with a modified filtering approach appropriate for shorter lines and lines where the standard filtering may overestimate the background response.
- Repeat the target picking procedure using the newly levelled data.

Root Cause Analysis / Corrective Action Report

Regarding SV FUDS Pilot Project **NCR 001**, dated 08/28/2016.

Issue:

Blind Verification Seed #16, located at **4720 Quebec** Street, was not detected by the TEMTADS or the MPV at the 4720 Quebec property. Both systems passed over the seed with more than one sensor. The seed is buried at approximately 7.5x diameter, which was assumed to be an acceptable depth.

Root Cause Analysis:

Typically a missed item is due to poor data coverage. Figure 1 shows the coverage around the seed location. The solid black lines indicate the position of the sensor array over the missed seed with the blue dots showing the located position of the individual sensor coils. The sensor did cover the area sufficiently to meet the project-specific MQOs, but it was not sampled as densely or as uniformly as is normally achieved. The solid black lines indicate that the start of the lines going west began west of the missed seed when normally they would traverse over the area in question. These area would be typically filled in with lines from another direction, perhaps with north-south survey lines in this case. To maintain the project's data collection schedule, the data coverage was accepted for target selection.

Figure 1 – Tracklines for the TEMTADS 2x2 in the vicinity of Blind Seed #16. Black solid lines indicate the course over ground of the sensor array. The blue dots indicate the located positions of the individual sensors. The red circle is the location of Blind Seed #16.

Looking at the EMI data collected, the target response appears to be lower than would be expected. Using the forward model feature of UX-Analyze, a large ISO40 buried at a depth of 78 cm should have generated a response of approximately 2.2 mV/A, well above the detection threshold of 1.6 mV/A establish for this project. Two sensor profiles from survey line 00044 are shown in Figure 2. This was the survey line which made the closest approach to the buried seed. The monostatic Z data profile for time gate (0.137 ms) for survey line 00044 are shown for sensor coil #1 (top panel, forward port sensor) and coil 2 (bottom panel, forward starboard sensor). A small response over the seed was observed for Blind Seed #16 at fid 163, but it is lower than the detection threshold (1.6mV/A).

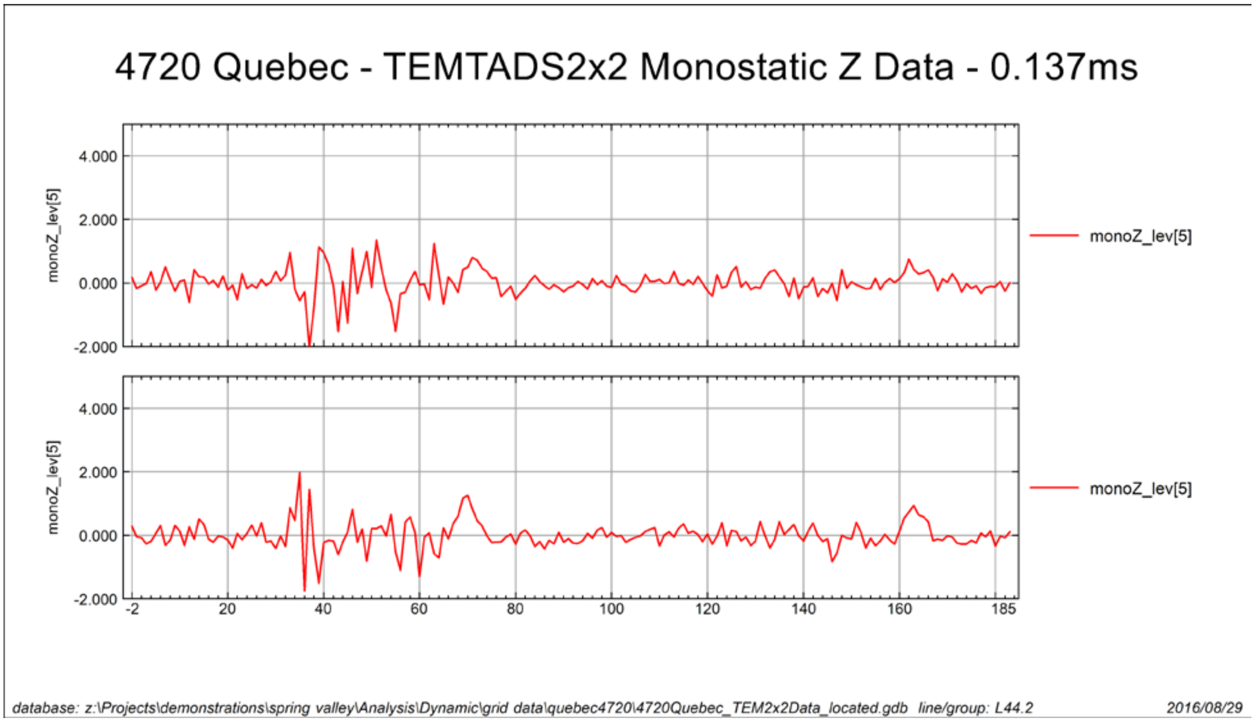


Figure 2 – Signal amplitude profiles for sensor coil #1 (top) and #2 (bottom) from survey line 00044. Blind Seed #16 was passed over around fiducial #163. Sensor #2 observed a small amplitude response, below the detection threshold.

Proposed Corrective Action:

As shown in Figure 1, the data coverage for vicinity of Blind Seed #16 was not ideal. It did meet the project-specific MQOs and was therefore accepted to maintain the project data collection schedule. Visually, the coverage is not as uniform or as dense as would be typically achieved in wide, open survey areas. Extra time and diligence to collect further data in such areas should be budgeted for schedule-wise moving forward. Additionally, as the available data suggests that the response amplitude of the item is lower than expected, ERT's recommendation to include Blind Seed #16 on the cued list is concurred with. The results of the cued data will aid in determining if there are any unique issues with this particular seed or location.

NONCONFORMANCE REPORT (NCR)

Identification

Originator: Elise Goggin	Organization: ERT (TtEC)	Date: 9/2/16	Report Number: 002

Nonconformance Description (Describe the nonconformance; ensure the applicable requirements, planned activities, procedures, specifications, drawing, standards, serial numbers, etc. are noted. Indicate who documented the nonconformance.).

Requirement: All blind QC seeds must be detected and positioned within 40-cm radius of ground truth (QAPP Worksheet #22)

Condition: Blind Verification Seed #17 was not detected by the TEMTADS and Seed #19 was not detected by the MPV at the **4740 Quebec** property. Maps are provided as an attachment to this NCR. Seed information is below:

Seed	Description	Orientation	Northing (SP)	Easting (SP)	Depth (ft)	Missed by
17	75mm Projectile	Horizontal	462898.40	1285520.91	1.89	TEMTADS
19	Small ISO	Horizontal	462920.19	1285514.26	0.62	MPV

Risk Level Major/Moderate

Steps to Prevent Inadvertent Use of the Item or Process

Corrective/Preventive Action and Disposition

Planned Corrective/Preventive Action (Describe for each cause what action(s) will be taken with the item or process, including, as applicable, the completion dates, disposition of material, and responsible staff for each action. Describe, as applicable, what actions are needed to prevent recurrence of the identified nonconformance, such as process improvement, procedure revisions, training plan, etc., and include completion dates and responsible staff for each action.).

Individual demonstrators will perform a root cause analysis (RCA) and define an appropriate corrective action if applicable. This assessment will be completed no later than 06 September 2016.

ERT recommends that the teams proceed with cued data collection at this property prior to resolving the non-conformance due to schedule constraints. The respective blind seed will be added to the cued list and will be considered a training dig on the final ROC curve for each demonstrator.

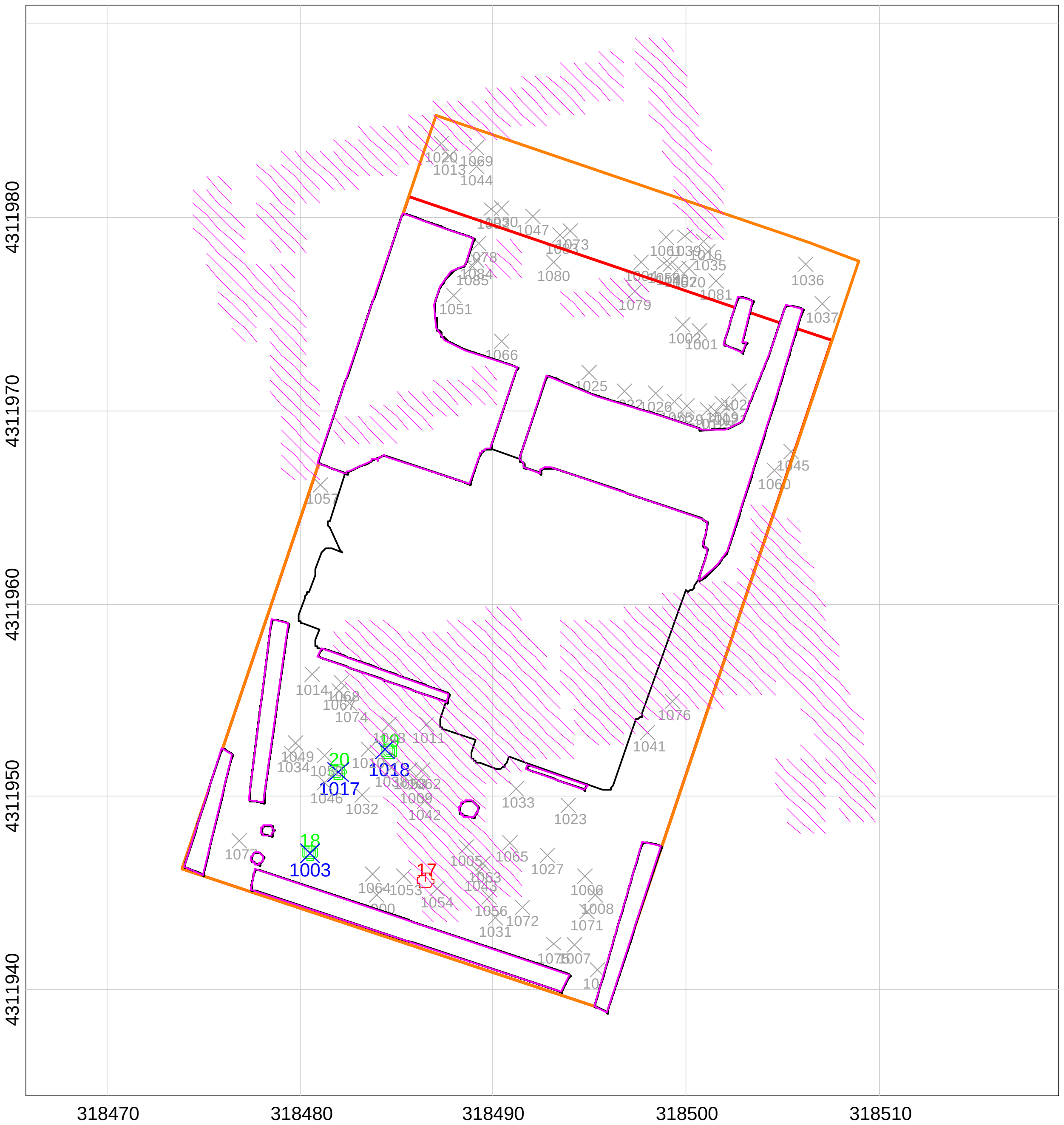
It is critical that the identity of Seed #17 remain blind to the MPV demonstrators and Seed #19 remain blind to the TEMTADS demonstrators. To maintain this firewall, all discussions with the demonstrators should be held on an individual basis.

Independent verification required? Yes ☒ No ☐

Person(s) Responsible for the Corrective/Preventive Action and Disposition	Approval of Corrective/Preventive Action and Disposition
Name *Date*	*Name* *Date*

Closing the Nonconformance

Action Completed	Independent Verification Completed (if required)
Name *Date*	*Name* *Date*



Spring Valley
Pilot Study
Verification Seed Results

4740 Quebec - TEMTADS

LEGEND

Total number of truth targets: 4

Targets found within radius of 0.30 - 0.40 : 0

Targets found within radius of 0.20 - 0.30 : 1

Targets found within radius of 0.0 - 0.20 : 2

Number of targets reported (seeded picks): 3 (75%)

Targets not found: 1 (25%)

Non-seeded picks: 208

Total Score: 8

Stats of the polar distance:

Min: 0.0344

Max: 0.263

Median: 0.0392

Mode: 0.0368

Map Scale: Scale 1:350 (meters) NAD83/UTM zone 18N

Grid North: 0°0'0"

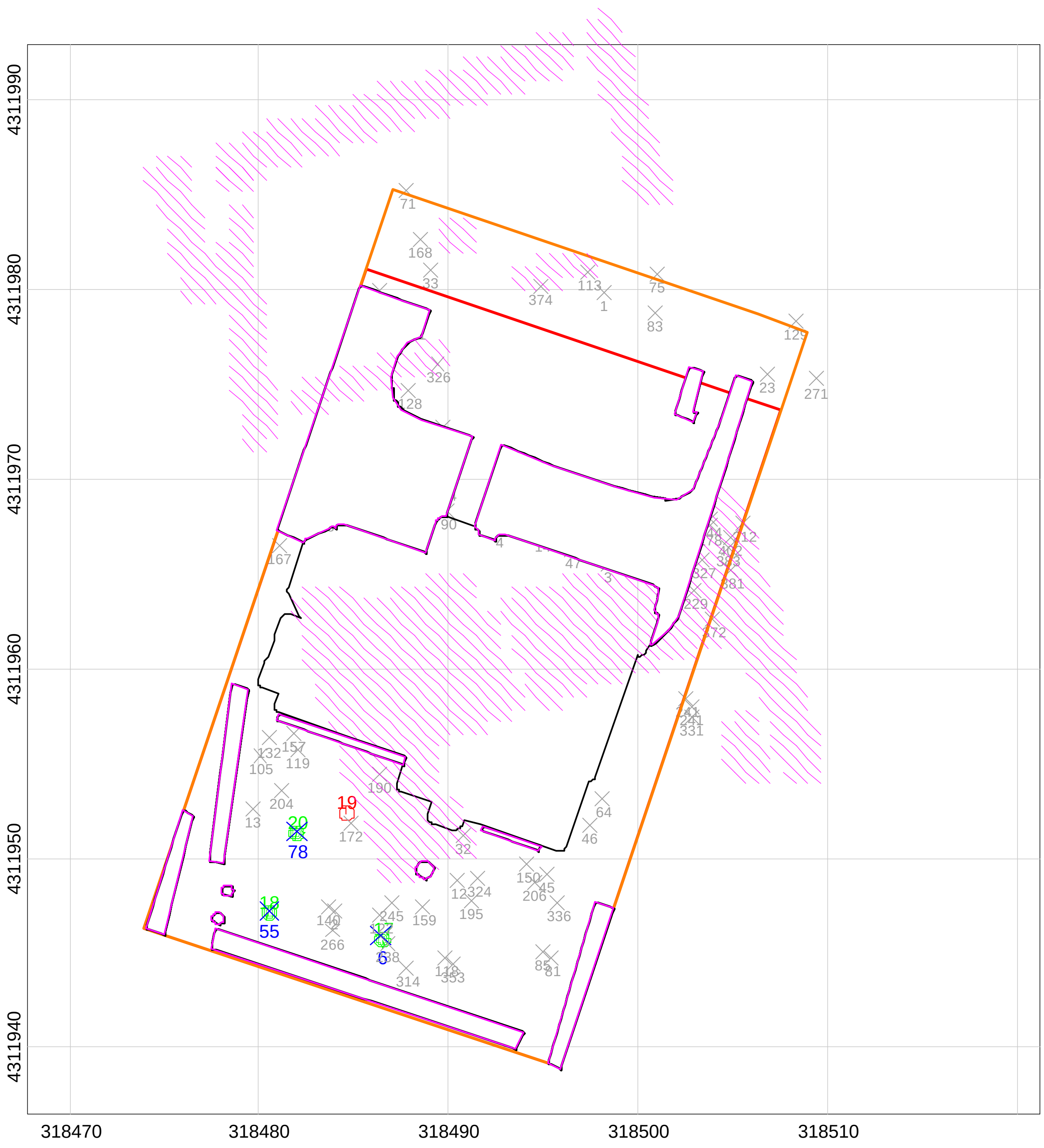
Client: USACE

Project: SVFUDS

Contractor: ERT

Created by: EMG

Date: 090216 | **File: 4740Quebec_TEM2x2Data_...**



Spring Valley
Pilot Study
Verification Seed Results

4740 Quebec - MPV

LEGEND

Total number of truth targets: 4

Targets found within radius of 0.30 - 0.40 : 0

Targets found within radius of 0.20 - 0.30 : 1

Targets found within radius of 0.0 - 0.20 : 2

Number of targets reported (seeded picks): 3 (75%)

Targets not found: 1 (25%)

Non-seeded picks: 79

Total Score: 8

Stats of the polar distance:

Min: 0.0496

Max: 0.2842

Median: 0.0838

Mode: 0.0667

Map Scale: Scale 1:350 (meters) NAD83/UTM zone 18N

N

Grid North: 0°0'0"

Client: USACE

Project: SVFUDS

Contractor: ERT

Created by: EMG	
Date: 090216	**File: MPV_4740_Targets**

Root cause analysis for a missed seed in the MPV detection list for the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study

Summary

A quality control (QC) seed item was not included in the Man Portable Vector (MPV) derived detection list submitted for the 4740 Quebec St property of the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study in Spring Valley, Washington, D.C. A source was picked near the location of the missed QC seed using the data amplitude-based target picking stage but was subsequently screened during the informed source selection stage. This memo provides an overview of the target picking approach, identifies causes for the missed seed, and specifies the corrective action taken.

Initial processing

A QC seed was missed in the initial detection analysis of the MPV data collected at 4740 Quebec of the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study. The missed item was a Small ISO at a depth of 0.62 feet (0.19m) and oriented horizontally. Dynamic MPV data were acquired along lines with a nominal line-spacing of 0.5 m using Robotic Total Station (RTS) for positioning. The resulting instrument data files were converted to .csv files, which were then imported into the UXOLab software. Each receiver and receiver component were leveled using a de-median filter. Figure 1 plots an image of the MPV data acquired at 4740 Quebec St.

A data amplitude-based target picking algorithm applied to the profile data (not the gridded data) was used to detect anomalies. The detection algorithm was applied to Z-component data from all receiver cubes. Instead of using a single time channel for detection, a composite data channel that integrated the measured decay from time channels 3 to 8 (0.31 to 0.79 ms) was chosen for detection. The integrated channel was defined to increase the signal to noise ratio for detecting potential targets of interest (TOI). Data from each receiver were treated as a separate profile, with anomalies picked along each profile. Each anomaly was then inverted for dipole sources. The size and decay of the source polarizabilities were then used to eliminate anomalies such as small, thin walled scrap.

The detection objective for this site was to detect a MarkIV booster at a depth of 30 cm. The data amplitude threshold for a MarkIV booster was calculated using the Detection Modeler software from SERDP MR-2226. Polarizabilities for the MarkIV booster were obtained from MPV test stand data acquired at the site. To calculate the threshold, we assume that the center of the MPV transmitter coil was 0.1 m above the ground (i.e. the bottom of the MPV sensor head has a ground clearance of approximately 2 inches), and that the maximum line spacing is 0.65 m. Based on these assumptions, the threshold for the composite channel is 1.19 mV/A (Figure 2).

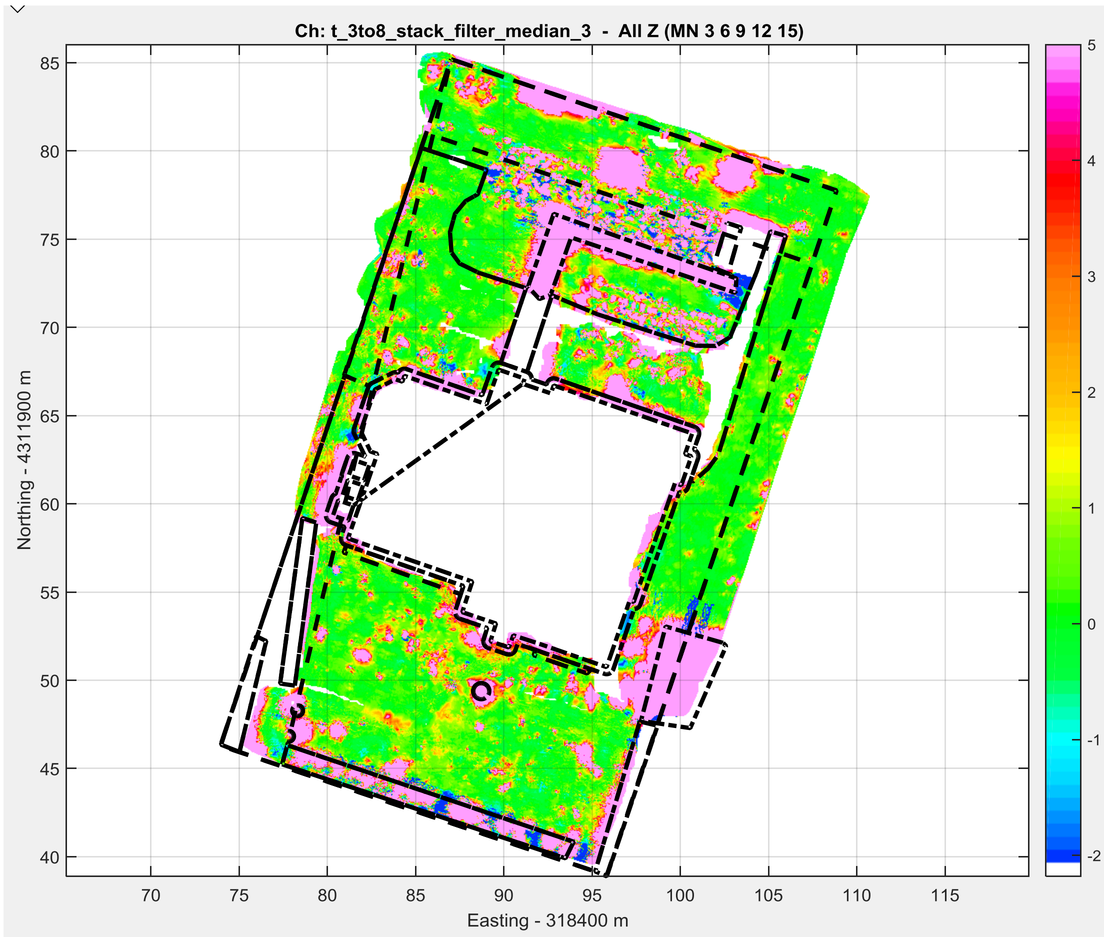


Figure 1 MPV dynamic data collected at 4740 Quebec St.

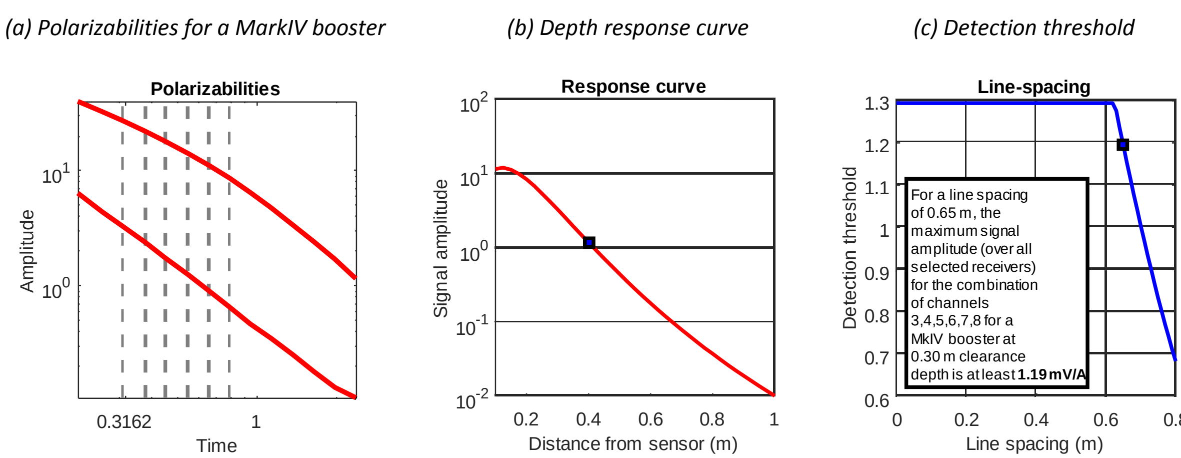
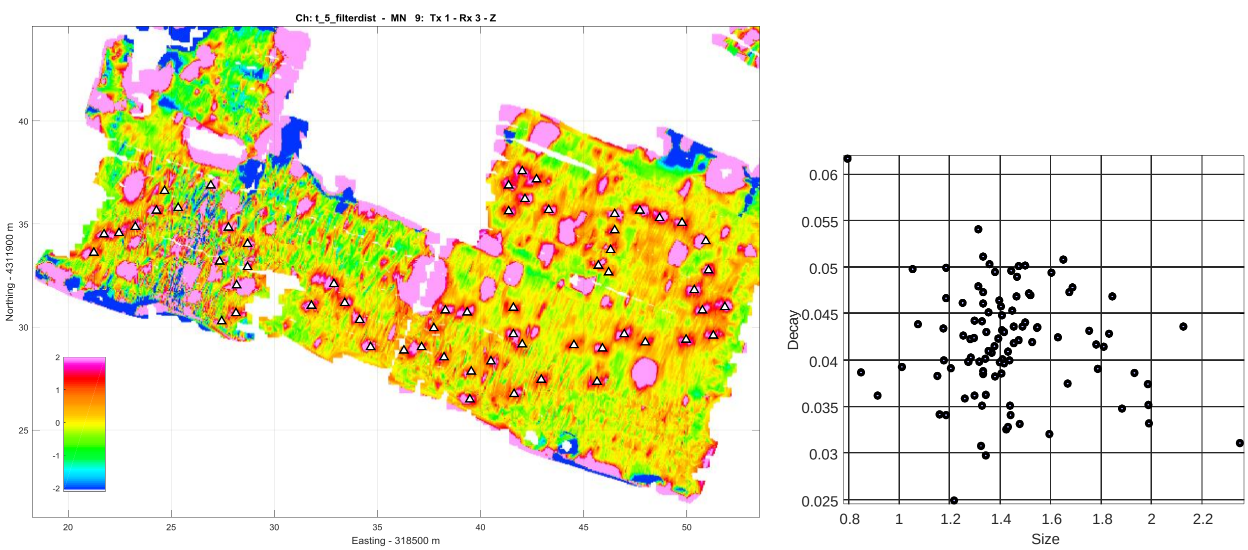


Figure 2. MarkIV booster modeling output from the SERDP MR-2226 Detection Modeler. These measurements assume the center of the z-transmitter coil is 0.10 cm above the surface. For a composite channel from time channel 3 (0.31 ms) to time channel 8 (0.79 ms), the threshold for a MarkIV booster at a depth of 0.3m is 1.19 mV/A.

In order to test the effectiveness of the target picking strategy, we use Monte Carlo style simulations. The threshold determined for the MarkIV booster via Detection Modeller was further verified by synthetically seeding Small ISOs into the dynamic data acquired at 4720 Quebec. The small ISO was found to be a reasonable proxy for the MarkIV booster based on the similarity of recovered polarizabilities. To forward model responses, we used Small ISO polarizabilities from the ESTCP library project. Each target was synthetically seeded into the 4720 Quebec data using anomaly avoidance. The Small ISO targets were synthetically seeded at a depth of 0.3 m (12 inches). The chosen Small ISO target depth corresponds to the expected clearance depth for the detection threshold. Targets were oriented randomly. Normally distributed random error with a standard deviation of 1 cm was added to the GPS positional information, and an error with a standard deviation of 1 degree was added to IMU.

Based on the Monte Carlo analysis, we concluded that the MarkIV booster at the depth of a foot would have sufficient signal to be detected. In addition, we concluded that a size parameter threshold of 0.7 would be suitable for screening.



(a) Map of synthetically seeded locations in backyard of 4720. (b) Distribution of Size/Decay parameters

Figure 3: Synthetically seeded targets for 4720 Quebec St. (a) Small ISO targets buried at a depth of 30cm were placed in the front and back yard of the home. (b) All targets were then inverted to determine the expected spread in size and decay parameters.

Root Cause Analysis

A gridded image of the data in the vicinity near the missed seed is presented in Figure 4. The missed seed location is marked by a yellow triangle at x=84.6 m, y=52.35 m. The gridded image in the left panel of Figure 4 shows filtered data of time channel 5 for the center cube. The line paths indicate the location of the center cube, and therefore the center of the MPV sensor head.

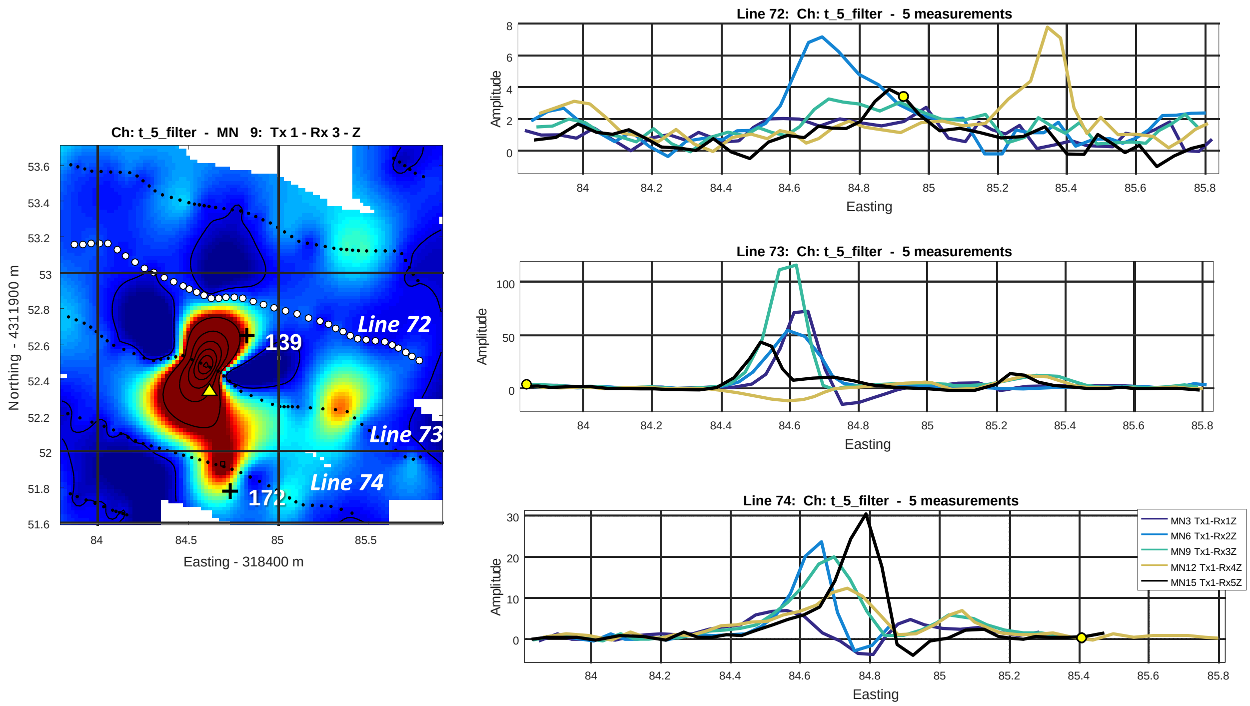


Figure 4 Time channel 5, Z-component data in the vicinity of the missed QC seed. On the left is a gridded image of the center receiver cube z-component data, with the QC seed location marked by a yellow triangle. The seed is located approximately between Targets 139 and 172. The profiles on the right plot the z-component data for all receivers.

To verify the detectability of the missed seed, we again used the detection modeling tool from SERDP MR-2226. Figure 5 plots the response of a horizontal small ISO buried at a depth of 0.19 m, when oriented along track (green line) and cross track (black line). For the noise observed at the 4740 Quebec site, the SNR of the seed is sufficient for detection. Figure 4 also includes line profiles for the three closest lines of data in the vicinity of the QC seed. The z-component data are plotted. The line passing closest to the seed (Line 73) measures a response exceeding 100 mV/A.

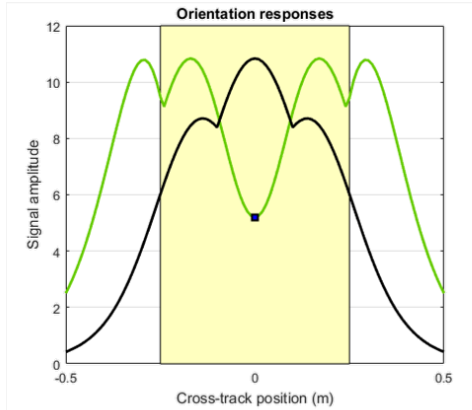


Figure 5. Modelled response of a horizontal, small ISO buried at a depth of 19 cm. We assume that the center of the sensor head is 10 cm above the ground surface. The green lines represent the response when the ISO is aligned cross-track to the direction of travel, and the black lines plot the response when the ISO is along track, i.e. parallel to the direction of travel.

There were two amplitude picks in the vicinity of the missed Small ISO seed: target 139 and target 172 (both are indicated by black plus symbols in Figure 4). Both of those amplitude based targets were then inverted and the recovered size and decay for the respective targets was used to make a screening decision for each target. Inversion information for the two nearby targets to the missed Small ISO seed are listed in Table 1.

Table 1 Summary of inversion results from Target picks 139 and 172. The distance of target picks 139 and 172 to the QC seed location is 0.36 m and 0.59 m, respectively.

Target	Source	Easting (m)	Northing (m)	Distance from Seed (m)	Depth (m)	Azi-muth (deg)	Dip (deg)	Rotation (deg)	Size	Decay
139	4	318484.81	4311952.28	0.22	0.36	101	96	358	2.60	0.009
	5	318484.62	4311952.51	0.16	0.05	67	51	89	0.91	0.004
	6	318485.19	4311952.13	0.63	0.06	191	71	346	0.59	0.020
172	4	318484.80	4311951.83	0.56	0.17	96	91	345	1.52	0.025
	5	318485.19	4311952.12	0.63	0.09	91	109	16	0.74	0.023
	6	318484.62	4311952.55	0.20	0.09	60	38	283	1.08	0.008

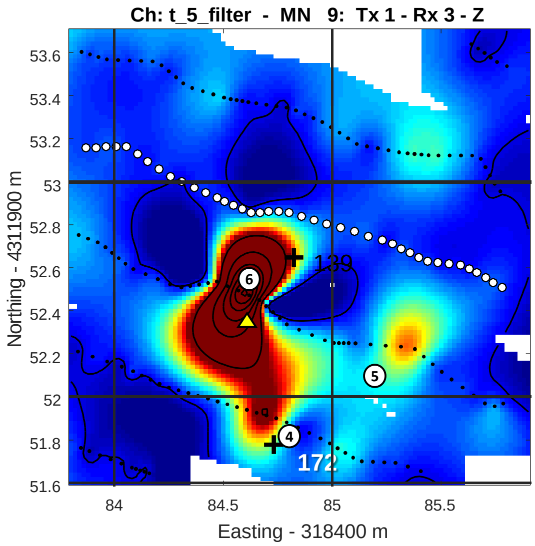
Target 172 was inverted and the recovered size and decay values as listed in Table 1. Figure 6 plots the seed locations and lists the predicted depth and dip for each target. The gray reference polarizabilities are for a small ISO 80. Source 6 is located closest to the seed (Δr=20cm). However, its polarizabilities do not match those of a small ISO. The estimated polarizabilities are smaller, and faster decaying than for a small ISO. Based on Monte Carlo analysis, we would, conservatively, expect the Size to be greater than 0.8 and decay to be greater than 0.01. Source 6 is at a shallower depth of 0.09m, and is oriented at a dip of 38 degrees rather than horizontal. Recall that the amplitude of the signal is significantly higher than was modeled in Figure 5. The high amplitude and inversion results suggest that there is a near surface metallic target near to the QC Seed location. Coincidentally, Source 4 located at the Target Pick 172 location is at the approximately the same depth, orientation, and approximate polarizability size as the Small ISO QC seed. We note that when inverting for a two source solution, Source 5 is not modelled.

Target 139 was also inverted and Source 5 was modeled 0.16 cm from the QC seed (Figure 7). The data fit is shown in Figure 8. Although the data is relatively well fit, the recovered polarizabilities for the source placed near the Small ISO seed are faster decaying than would be expected for a Small ISO and below the screening thresholds determined based on Monte Carlo simulations. The submitted cued list did not have Source 5 included, due to the fast decay (decay=0.004). When we learned that there was a seed at this location, several multi-source inversions were run with modified parameters to determine if a more accurate estimate of the Small ISO polarizabilities could be obtained. Typically we would obtain a source similar to Source 4; i.e. a slightly larger source at a greater depth (e.g. 36 cm). Perhaps due to noise and multiple targets, the data are unable to constrain the depth of a source related to the QC seed.

In a follow-up investigation, we ran 2 and 3 object inversions in an attempt to recover polarizabilities more representative of a Small ISO. We found that all multi object inversions consistently produced polarizabilities that were faster decaying than the screening thresholds established.

This inability to properly recover accurate decay information for the small ISO seed has led to determination that the accurate decay values cannot be reliably obtained through inversion of the dynamic MPV data. As a result, amplitude based target picks should not be screened based on recovered decay information. Size has shown to be a more robust and reliable inversion parameter, and the missed QC seed would have been picked if screening was carried out using size, but not decay. We therefore determined that the screening approach should be modified to screen source locations based solely on the recovered size.

Root Cause: The root-cause of the missed QC seed was the use of a screening threshold that required accurate recoveries of decay information



Target 172
3 source inversion

4: depth = 0.17 m, dip=91 deg
5: depth = 0.09 m, dip = 109 deg
6: depth = 0.09 m, dip = 38 deg

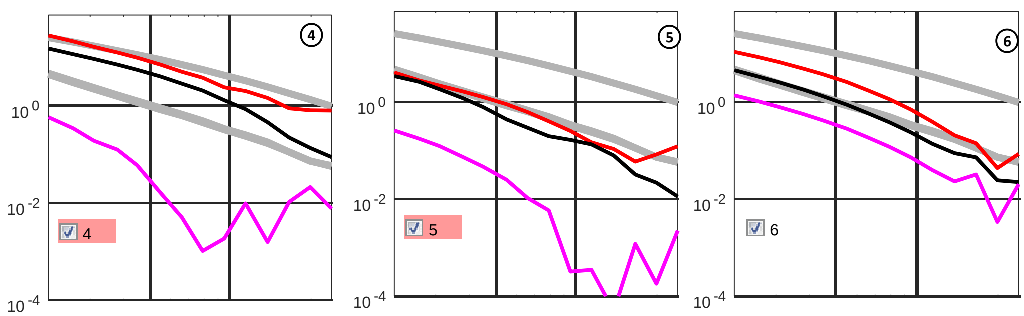


Figure 6. 3 source inversion result for target 172. The sources are numbered 4 to 6, because the single source and two source inversion sources were labelled 1, 2, and 3

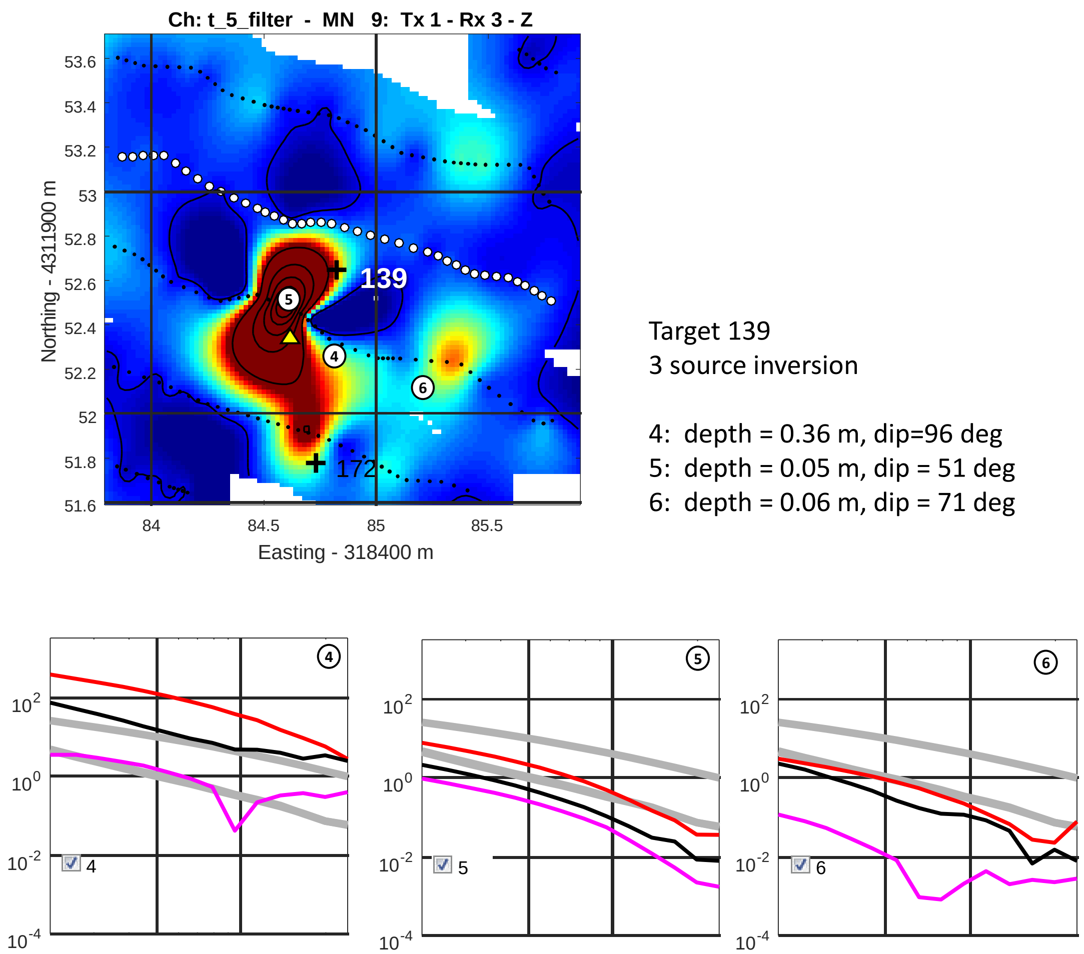


Figure 7 Three source inversion result for Target 139. Sources 5 and 6 for Target 139, corresponds to Source 6 and 5, respectively in Figure 5.

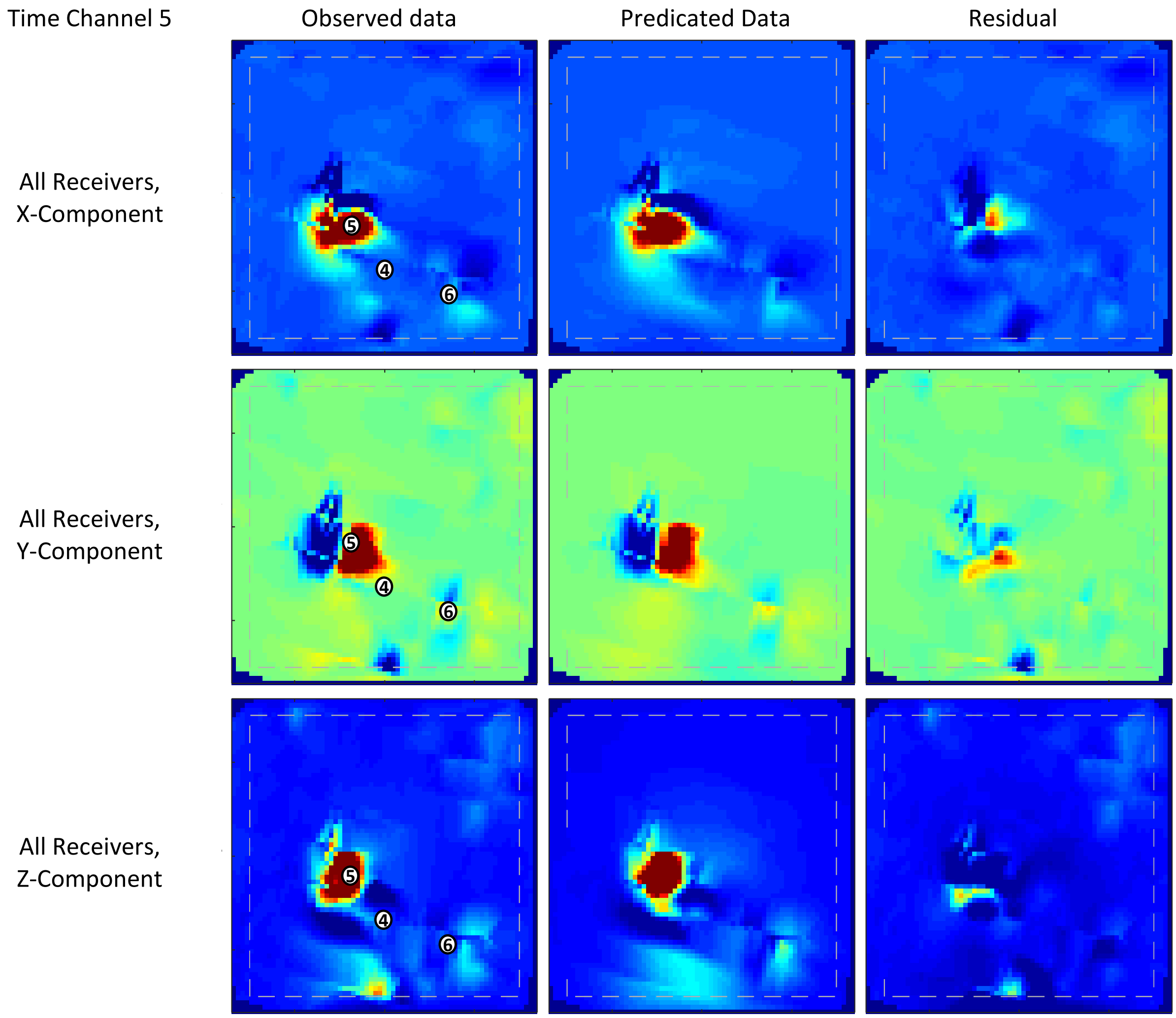


Figure 8 Data fit when inverting Target 139. Sources 4, 5, and 6 are indicated by the labelled circles. Each image is a 2m x 2m square of data.

Corrective Action

For the missed Small ISO QC seed, the recovered decay fell below the screening threshold. To avoid future instances of missed targets, we suggest the following corrective action:

- Screening of sources should be based on size alone with no dependence on decay. This will introduce extra cued measurements but the elevated noise levels present at Spring Valley appear to reduce the ability to recover reliable decay information.

Root Cause Analysis / Corrective Action Report

Regarding SV FUDS Pilot Project **NCR 002**, dated 09/02/2016.

Issue:

Blind Verification Seed #17, located at **4740 Quebec** Street, was not detected by the TEMTADS at the 4740 Quebec property. The seed is buried at approximately 7.7x the diameter, which was assumed to be an acceptable depth.

Root Cause Analysis:

Typically a missed item is due to poor data coverage. Figure 1 (left) shows the coverage around the seed location. The solid black lines indicate the position of the sensor array over the missed seed. The sensor covered the area sufficiently to meet the project-specific MQOs in the roughly east-west survey direction, with additional coverage in the roughly north-south direction.

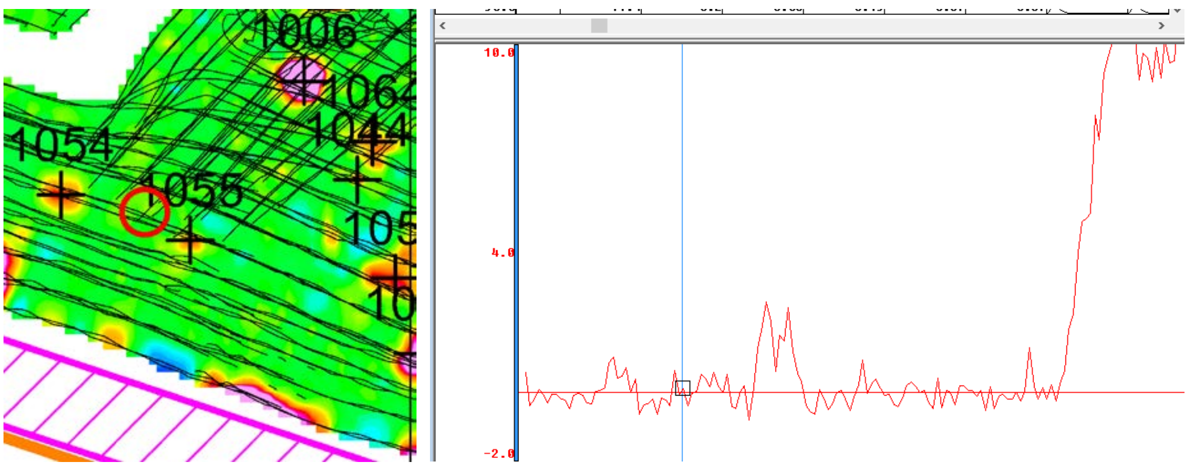


Figure 1 – (left) Tracklines for the TEMTADS 2x2 in the vicinity of Blind Seed #17. Black solid lines indicate the course over ground of the sensor array. The red circle is the location of Blind Seed #17. (right) An Oasis montaj screenshot of the profile data from one of the coils passing directly over the seed (blue line).

Looking at the EMI data collected, an Oasis montaj screenshot of the profile data from one of the coils passing directly over the seed (blue line) is shown in Figure 1 (right). A response from the seed item is not visible in the data. The data are somewhat noisier that observed under more remote conditions, but not enough to make a difference in the data leveling (background subtraction) process.

Using the forward model feature of UX-Analyze, a 75mm projectile buried horizontally at a depth of 58 cm should have generated a response of approximately 2.2 mV/A, well above the detection threshold of 1.6 mV/A establish for this project. The emplaced seed item is shown in Figure 2.

Figure 2 – Digital photograph of Blind Seed #17, as emplaced at 4740 Quebec Street.

Figures 3 – 5 show sensor profiles mapped over the resultant data grids for all data and then broken out by survey direction. The monostatic Z data profile for time gate (0.137 ms) are shown. The small peak in the anomaly map at the seed location has an amplitude of ~0.5 mV/A, well below the 1.6 mV/A detection threshold established for the project. Comparing the east-west survey data (Figure 4) to the north/south data (Figure 5), the 0.5 mV/A peak originates from the north/south data where the survey lines start roughly over the seed item. In the east/west data which starts and stops well away from the item, the peak is not observable in the data.

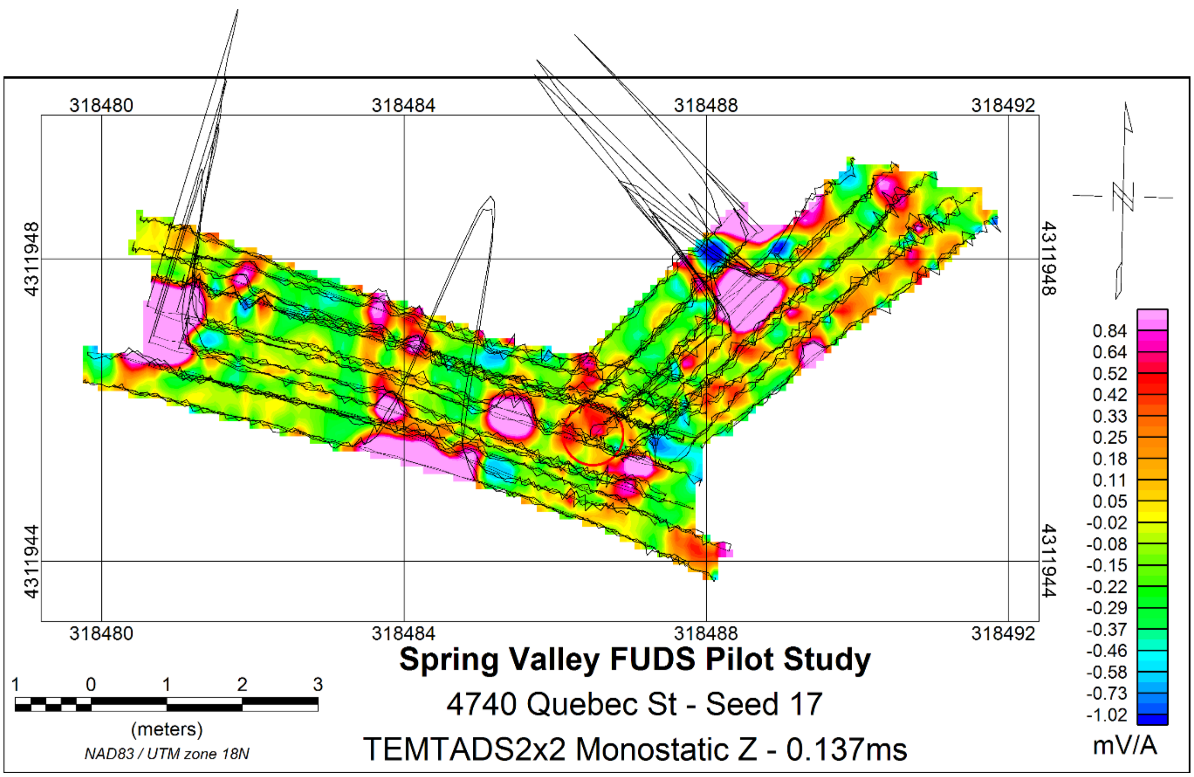


Figure 3 – Signal amplitude profiles for all TEMTADS data collected around the vicinity of Blind Seed #17. The location of Blind Seed #17 is shown as a red circle.

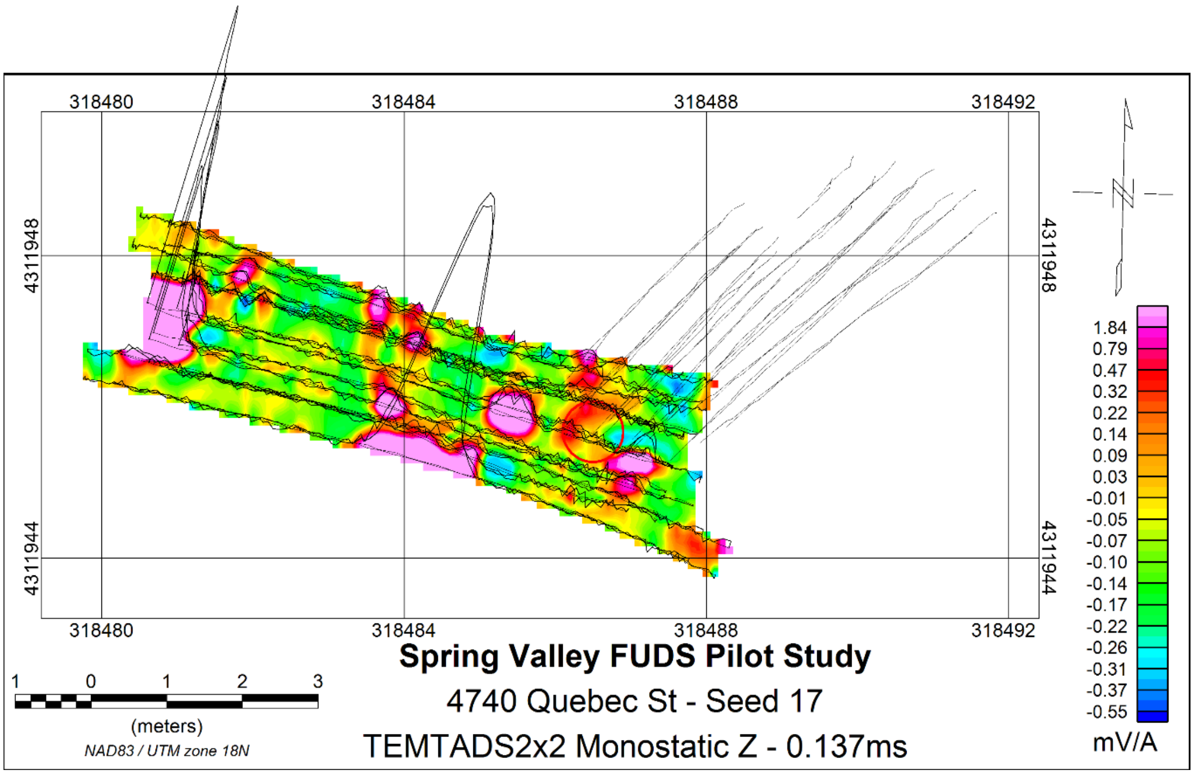


Figure 4 – Signal amplitude profiles for the TEMTADS data collected along east-west transects around the vicinity of Blind Seed #17. The location of Blind Seed #17 is shown as a red circle.

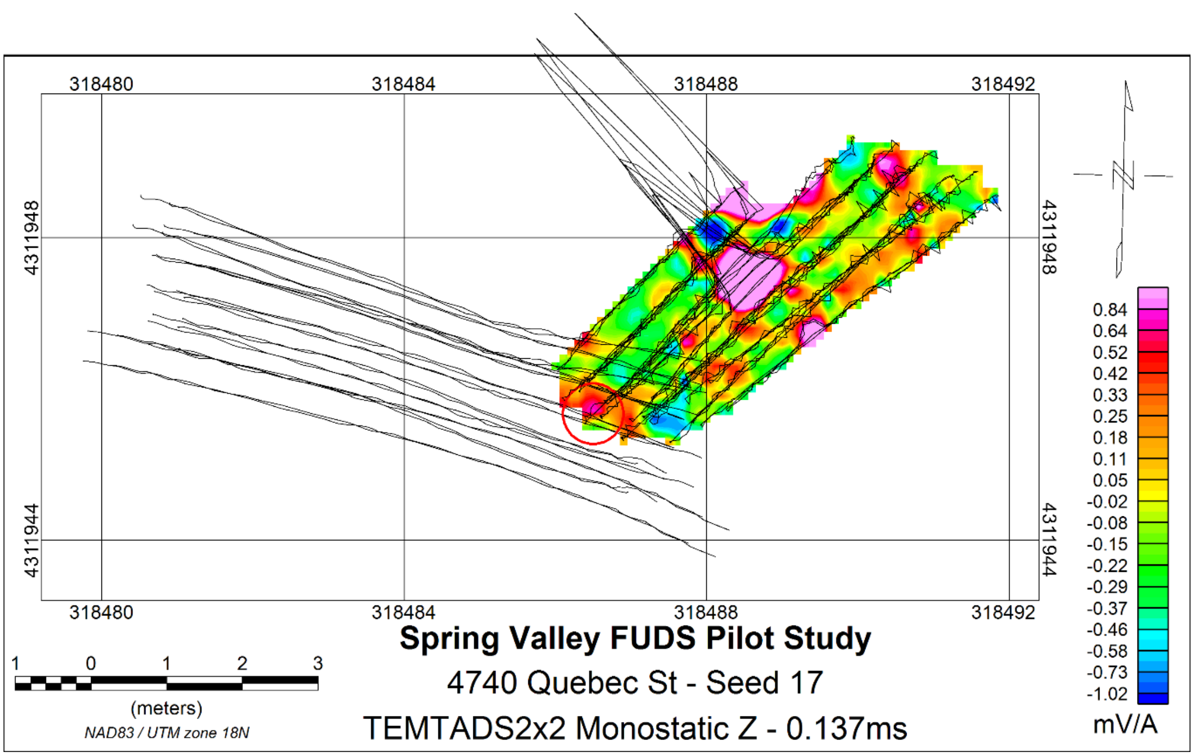


Figure 4 – Signal amplitude profiles for the TEMTADS data collected along north-south transects around the vicinity of Blind Seed #17. The location of Blind Seed #17 is shown as a red circle.

Proposed Corrective Action:

As shown in Figure 1, the data coverage for vicinity of Blind Seed #17 was good. It did meet the project-specific MQOs. The response amplitude of the item from the collected data is lower than expected. As this project is a pilot project in nature, intended to validate the techniques being used and their appropriateness in the urban environment of the Spring Valley FUDS, we would request that the seed item (and blind seed item #16 from 4720 Quebec) be recovered, the burial depth verified, and the seed items returned to the Federal property so that we can make careful measurements of both items under controlled conditions to confirm that the signal responses from these items are as predicted. If this course of action is acceptable, the TEMTADS team would like to have a member present when the item is uncovered to observe.

NONCONFORMANCE REPORT (NCR)

Identification

Originator: Elise Goggin	Organization: ERT (TtEC)	Date: 9/7/16	Report Number: 003

Nonconformance Description (Describe the nonconformance; ensure the applicable requirements, planned activities, procedures, specifications, drawing, standards, serial numbers, etc. are noted. Indicate who documented the nonconformance.).

Requirement: All blind QC seeds must be detected and positioned within 40-cm radius of ground truth (QAPP Worksheet #22)

Condition: Both TEMTADS and MPV missed multiple seeds at 4733 Woodway. Seed information is below:

Seed #	Description	MPV	TEMTADS	Comment
7	75mm, vert, 0.7ft	Pass	Fail	Outside of TT coverage
8	Stokes, horz, 1.1 ft	Pass	Pass	
9	Small ISO ws, horz, 0.8ft	Pass	Fail	
10	Small ISO ss, horz, 0.6ft	Fail	Fail	Might be due to stainless steel vs. black steel
11	Med ISO, horz, 1.5ft	Fail	Fail	In a very noisy area, potential underground utility

Risk Level Major/Moderate

Steps to Prevent Inadvertent Use of the Item or Process

Corrective/Preventive Action and Disposition

Planned Corrective/Preventive Action (Describe for each cause what action(s) will be taken with the item or process, including, as applicable, the completion dates, disposition of material, and responsible staff for each action. Describe, as applicable, what actions are needed to prevent recurrence of the identified nonconformance, such as process improvement, procedure revisions, training plan, etc., and include completion dates and responsible staff for each action.).

Individual demonstrators will perform a root cause analysis (RCA) and define an appropriate corrective action if applicable. This assessment will be completed no later than 12 September 2016.

ERT recommends that the teams proceed with cued data collection at this property prior to resolving the non-conformance due to schedule constraints. The respective blind seed will be added to the cued list and will be considered a training dig on the final ROC curve for each demonstrators.

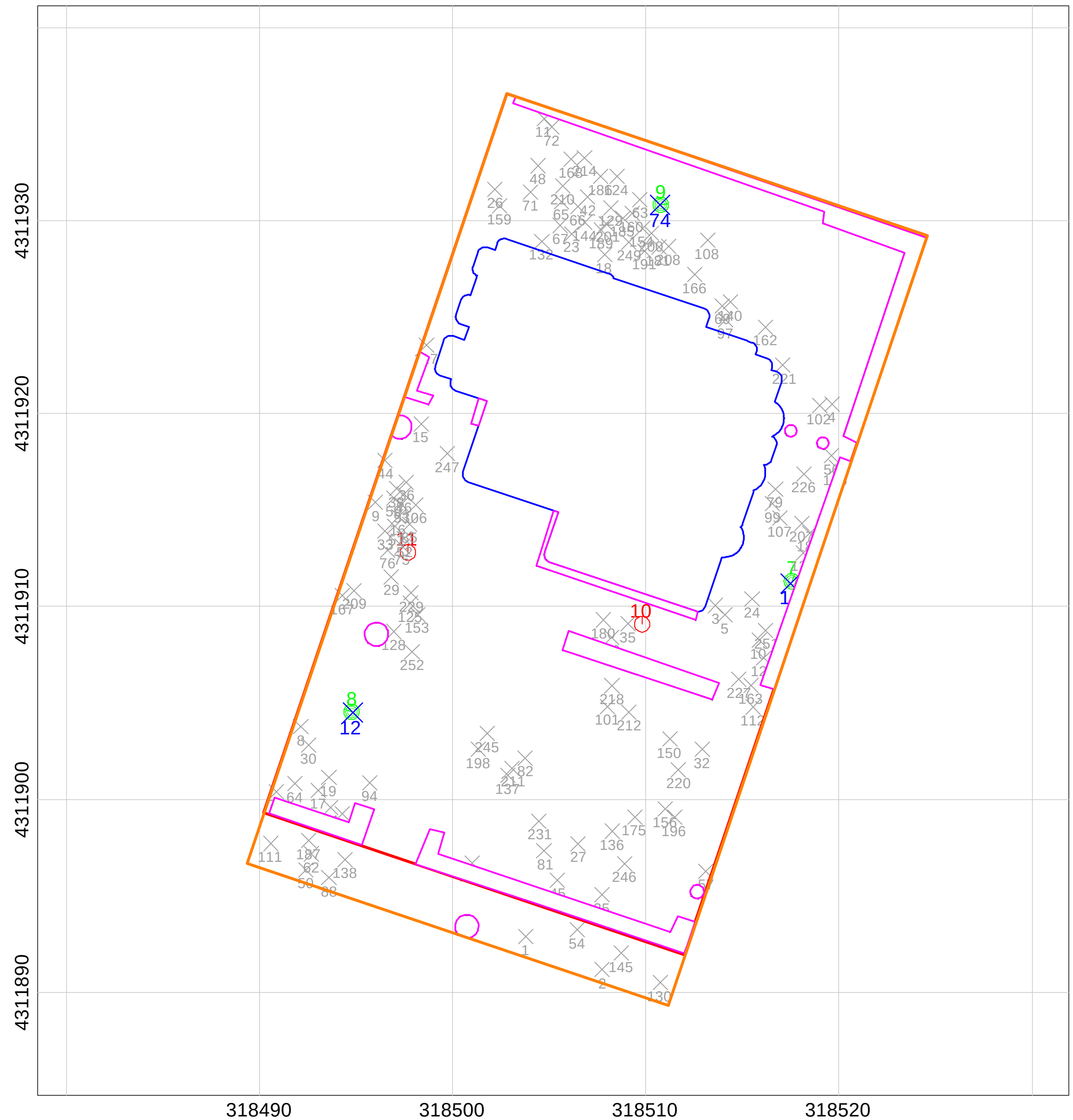
It is critical that the identity of the seeds remain blind to the demonstrators. To maintain this firewall, all discussions with the demonstrators should be held on an individual basis.

Independent verification required? Yes ☒ No ☐

Person(s) Responsible for the Corrective/Preventive Action and Disposition	Approval of Corrective/Preventive Action and Disposition
Name *Date*	*Name* *Date*

Closing the Nonconformance

Action Completed	Independent Verification Completed (if required)
Name *Date*	*Name* *Date*



Spring Valley Pilot Study Verification Seed Results

4733 Woodway - MPV

LEGEND

Total number of truth targets: 5
Targets found within radius of 0.30 - 0.40 : 0
Targets found within radius of 0.20 - 0.30 : 0
Targets found within radius of 0.0 - 0.20 : 3
Number of targets reported (seeded picks): 3 (60%)
Targets not found: 2 (40%)
Non-seeded picks: 130
Total Score: 9

Stats of the polar distance:
Min: 0.0326
Max: 0.1342
Median: 0.0813
Mode: 0.0569

Map Scale: Scale 1:350 (meters) NAD83 / UTM zone 18N

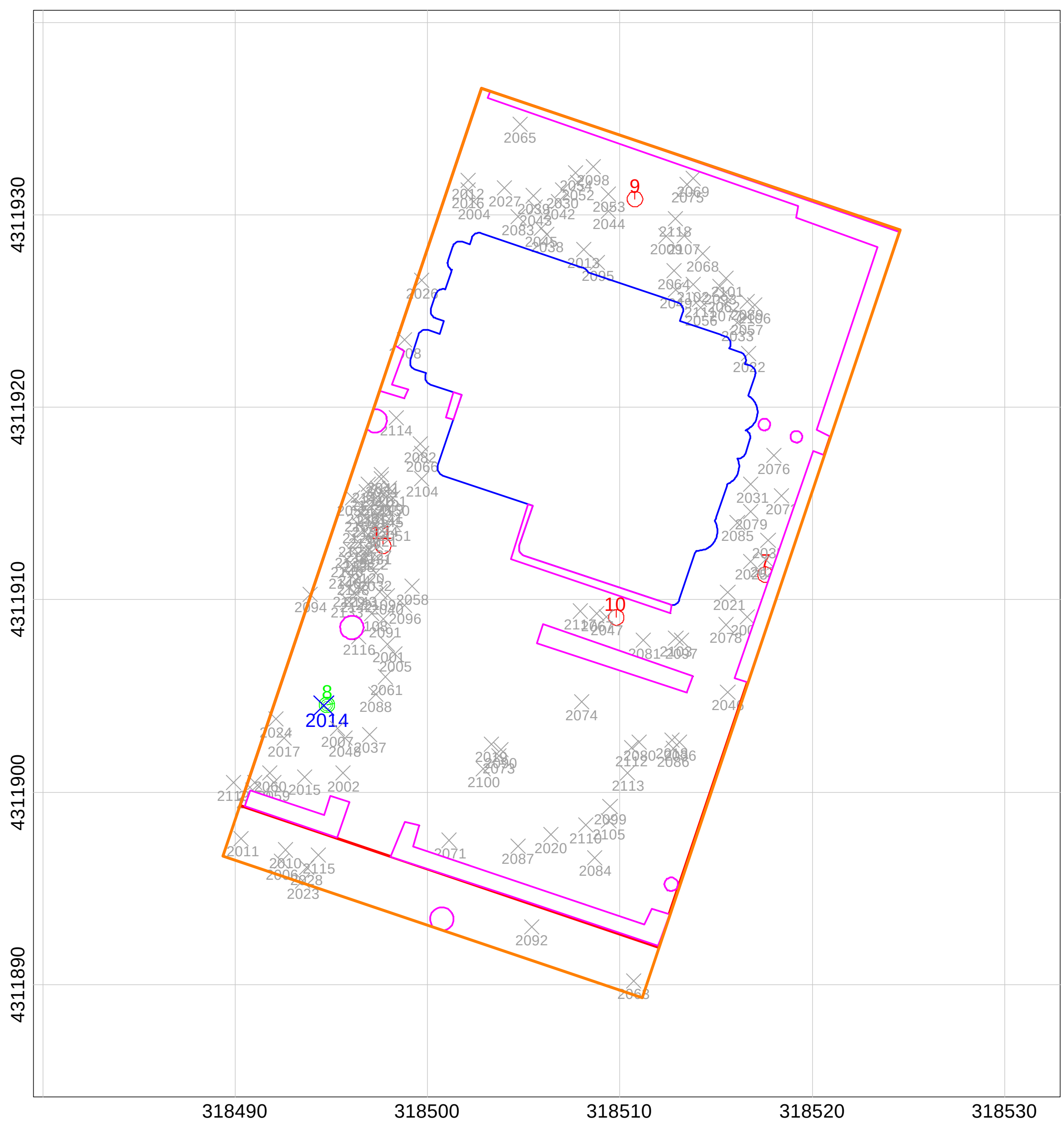
Grid North: 0°0'0''
Mag North: 0°0'0''

Client: USACE

Project: SVFUDS

Contractor: ERT

Created by: EMG	
Date: 9/7/16	**File: Woodway_MPV_Targets**



Spring Valley
Pilot Study
Verification Seed Results

4733 Woodway - TEMTADS

LEGEND

Total number of truth targets: 5
Targets found within radius of 0.30 - 0.40 : 0
Targets found within radius of 0.20 - 0.30 : 0
Targets found within radius of 0.0 - 0.20 : 1
Number of targets reported (seeded picks): 1 (20%)
Targets not found: 4 (80%)
Non-seeded picks: 643
Total Score: 3

Stats of the polar distance:
Min: 0.1652
Max: 0.1652
Median: 1.165
Mode: 0.6652

Map Scale: Scale 1:350 (meters) NAD83 / UTM zone 18N

Grid North: 0°0'0"
Mag North: 0°0'0"

Client: USACE

Project: SVFUDS

Contractor: ERT

Created by: EMG

Date: 8/7/16 | **File: 4733Woodway_TEM2x2Dat...**

Black Tusk
GEOPHYSICS

401 / 1755 West Broadway
Vancouver, BC, V6J 4S5
Canada

Canada

Principal Investigator	Kevin Kingdon, Black Tusk Geophysics Inc
To	Elise Goggin, TetraTech
CC	
Date	12-Sep-2015
Re:	Root-cause analysis for a missed QC Seed at Spring Valley Formerly Used Defense Site (SVFUDS)

Dear Ms. Goggin,

The attached document presents a Root Cause Analysis (RCA) for two missed Quality Control (QC) seeds at the Spring Valley Formerly Used Defense site. We have identified the root-cause of the problem and have recommended appropriate corrective action.

Should you have questions or require additional information, please feel free to contact me at 604-441-6491 or by email at kevin.kingdon@btgeophysics.com.

Regards

Kevin Kingdon

Root cause analysis for two missed seeds in the MPV detection list for the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study

Summary

Two quality control (QC) seed items were not included in the Man Portable Vector (MPV) derived detection list submitted for the 4733 Woodway St property at the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study in Spring Valley, Washington, D.C. This memo provides an overview of the target picking approach, identifies causes for the missed seed, and specifies the corrective action taken.

Initial processing

Two QC seeds were missed in the initial detection analysis of the MPV data collected at 4733 Woodway Lane of the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study. The first missed item was a small ISO at a depth of 0.62 feet (19 cm) and oriented vertically. This particular seed was a stainless steel Small ISO rather than the standard black welded steel. The second missed seed was a medium ISO at a reported depth of 1.53 feet (46.6 cm). The recorded depths for both missed seeds were measured to the top of the target rather than the center of mass. Dynamic MPV data were acquired along lines with a nominal line-spacing of 0.5 m using Robotic Total Station (RTS) for positioning. The resulting instrument data files were converted to .csv files, which were then imported into the UXOLab software. Each receiver and receiver component were leveled using a de-median filter. Figure 1 plots an image of the MPV data acquired at 4733 Woodway St.

A data amplitude-based target picking algorithm applied to the profile data (not the gridded data) was used to detect anomalies. The detection algorithm was applied to Z-component data from all receiver cubes. Instead of using a single time channel for detection, a composite data channel that integrated the measured decay from time channels 3 to 8 (0.31 to 0.79 ms) was chosen for detection. The integrated channel was defined to increase the signal to noise ratio for detecting potential targets of interest (TOI). Data from each receiver were treated as a separate profile, with anomalies picked along each profile. Each anomaly was then inverted for dipole sources. The size of the source polarizabilities were then used to eliminate anomalies such as small, thin walled scrap. Decay information from inversions of dynamic MPV data was not used for screening at the 4733 Woodway property.

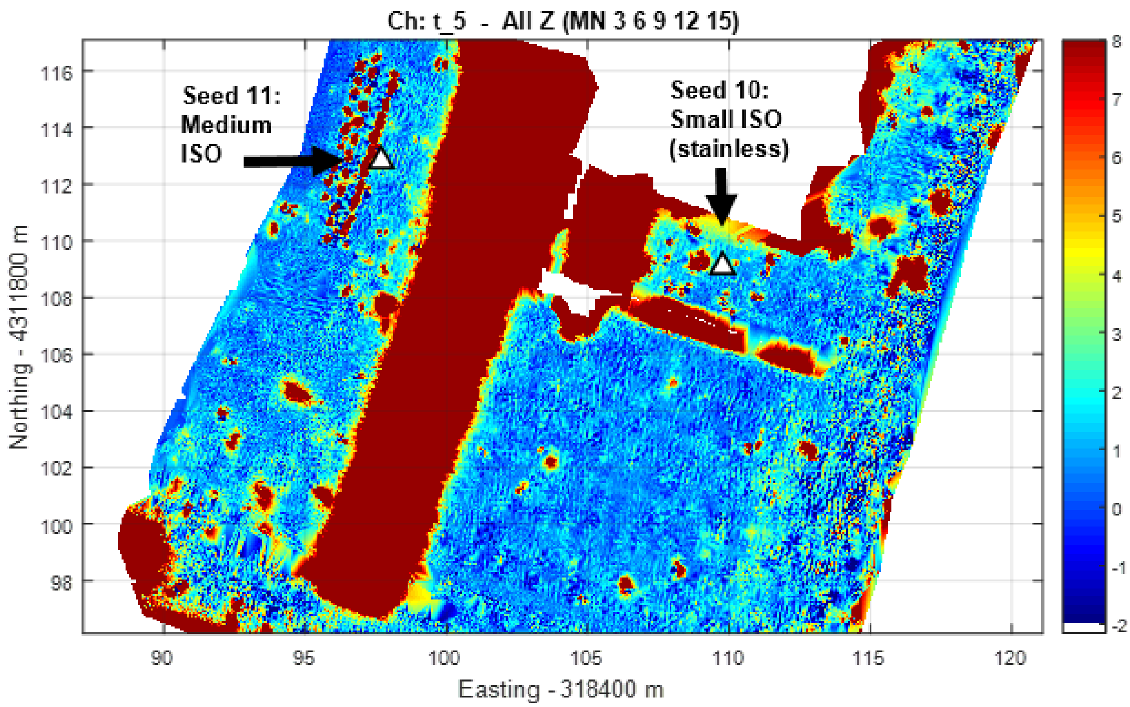


Figure 1: MPV dynamic data collected at 4733 Woodway and the location of two missed blind quality control seeds.

Root Cause Analysis

number	Item	orientation	Location	northing	easting	elevation	depth (ft)
10	small ISO (s.s.)	vertical	top center	462780.0708	1285599.99	325.2431	0.618099
11	medium ISO	horizontal	top center	462791.4078	1285559.973	321.3543	1.524916

Table 1: Details on missed blind QC seeds.

A gridded image of the data in the vicinity of the two missed seeds described in Table 1 is presented in Figure 2. The missed seed location is marked on the gridded images with a black + symbol with a white dot indicating the nearest MPV data point to the seed location. The yellow dots on the profile views show the corresponding profile location for the white dot shown on the gridded image. The gridded images in the Figure 2 display filtered z-component data of the detection channel (i.e. integrated channels 3 to 8) for the center cube. The line paths indicate the location of the center cube, and therefore the center of the MPV sensor head.

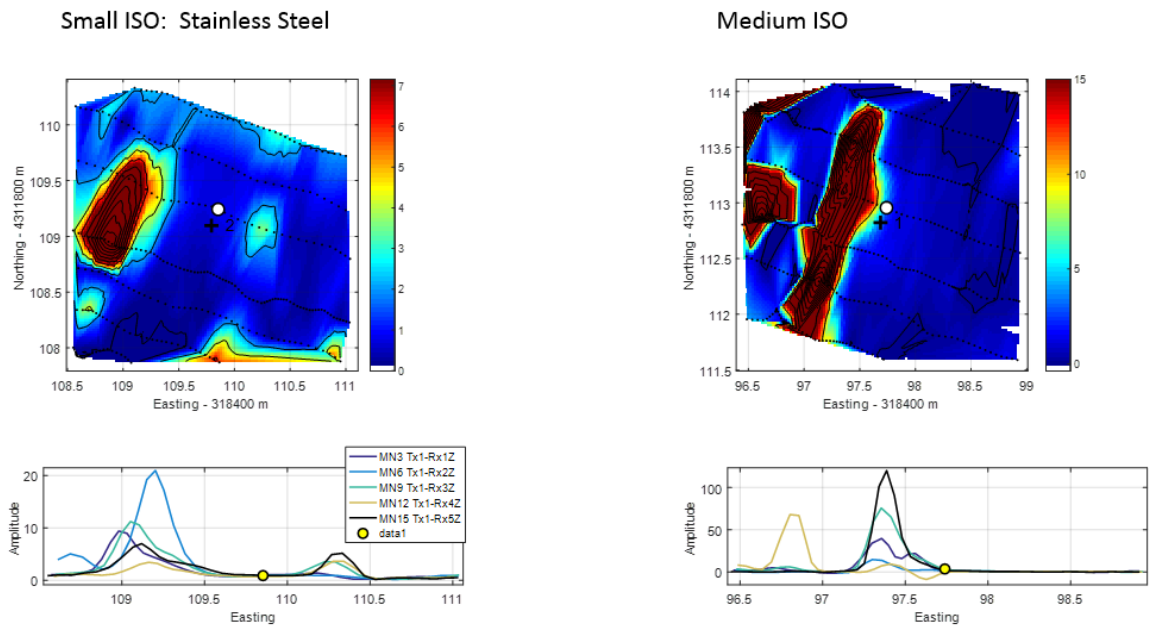


Figure 2: Detection channel (integrated time channels 3 to 8), Z-component data in the vicinity of the missed QC seeds: stainless steel small ISO (on left) and medium ISO (on right). Gridded images are of the center receiver cube z-component data, with the QC seed location marked by a black + (the closest MPV data point is shown as a white dot on the gridded images and as a yellow dot on profile view). The profiles plot the z-component data for all receivers.

There is virtually no response above the noise in the dynamic MPV data at the reported location for the stainless steel small ISO seed. Measurements were performed at the IVS using a stainless steel small ISO from the same batch as the seed that was placed in the ground. Cued measurements were made at the background location of the IVS with both the stainless steel small ISO and the standard welded black steel small ISO. Polarizabilities were obtained from inversion of these test stand measurements and the polarizabilities of the stainless steel small ISO were much lower than those of the black steel small ISO (see Figure 3). Dynamic data was also acquired over both the stainless steel and black welded steel small ISOs at the Spring Valley IVS for comparison. In order to try and simulate the detection scenario for the missed stainless steel small ISO seed, the small ISO (first stainless steel, then black welded steel) were placed vertically on the surface (over the cleared background location) and a series of short dynamic data lines were collected over each target with the sensor raised approximately 20cm to simulate the burial depth of the missed seed (0.62 feet). The resulting dynamic data is illustrated in Figure 4 where the difficulty of detecting the stainless steel small ISO is again apparent. The polarizabilities derived for the stainless steel small ISO were imported into the Detection Modeler developed in SERDP 2226. The fast decaying polarizabilities translated into a detection depth of only 1cm for the stainless steel small ISO based on the detection threshold for Spring Valley which was based on the MKIV booster at 30cm.

The second missed at 4733 Woodway was a medium ISO buried at 1.53 feet (46.6cm). The clearance depth for a medium ISO corresponding to the Spring Valley detection threshold of a MKIV booster at 30cm was calculated to be 50cm. It is further noted that in the missed details of Table 1, The reported depth was to the top of the item, meaning that the depth to center of mass (which is what is modelled via detection modeler) is actually deeper by half of the medium ISO diameter so that the actual depth of the center of mass for the missed medium ISO seed is 49.6cm. That proximity to the 50cm clearance depth of the medium ISO coupled with the location of the seed immediately adjacent to a high amplitude region of cultural targets (see Figure 1, right panel of Figure 2) made this seed challenging to detect. A more conservative approach would have been to apply a mask around areas where cultural targets generate high amplitude regions.

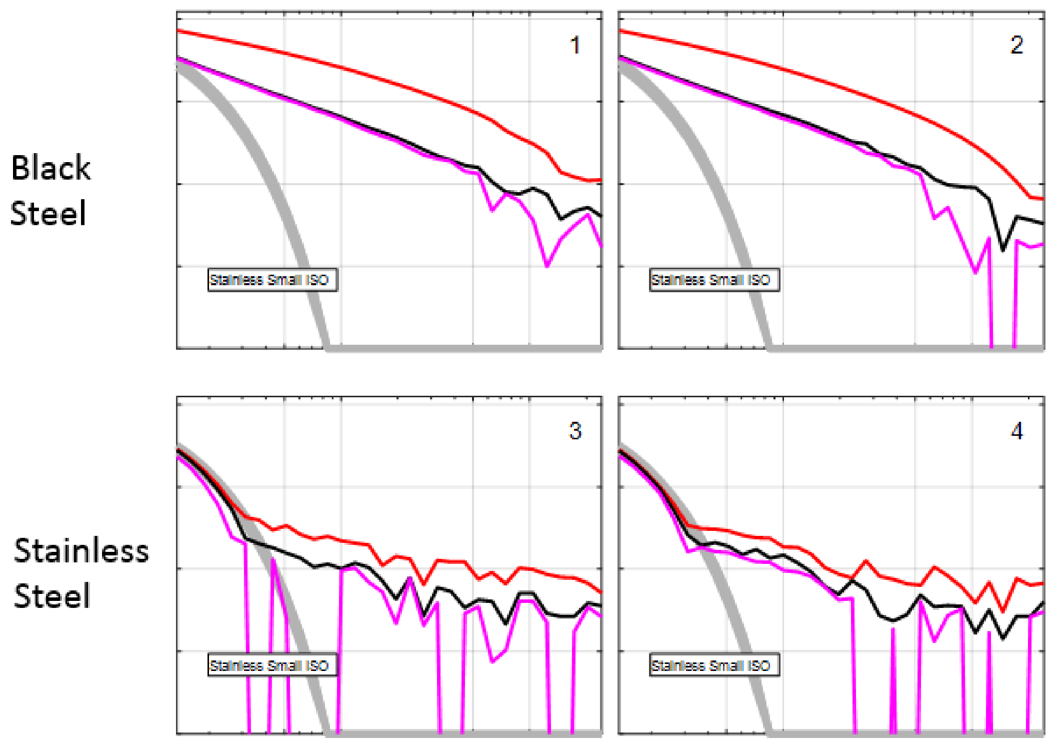


Figure 3: Test stand measurements made at the Spring Valley IVS background location for a stainless steel small ISO and a black welded steel small ISO. Polarizabilities for the stainless steel ISO are much faster decaying than those for the black welded steel small ISO.

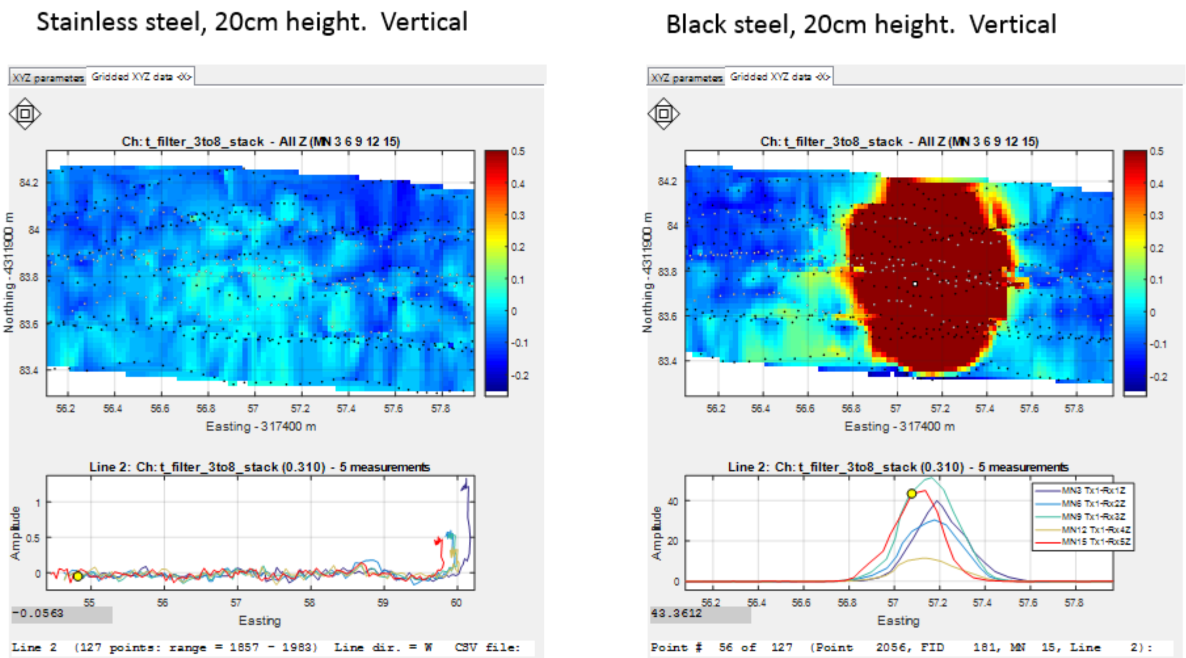


Figure 4: Comparison of dynamic data acquired over two vertically oriented small ISO targets placed on the surface with the sensor raised ~20cm above the surface. Response for the stainless steel small ISO (on left) is undetectable while the black welded steel small ISO (on right) produces a strong response.

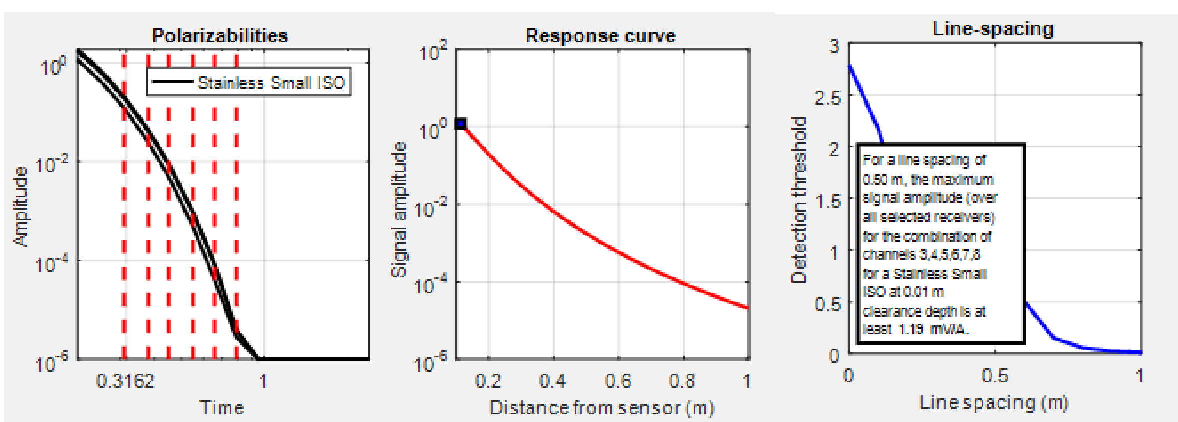


Figure 5: Stainless steel small ISO modeling output from the SERDP MR-2226 Detection Modeler. These measurements assume the center of the z-transmitter coil is 0.10 cm above the surface. For a composite channel from time channel 3 (0.31 ms) to time channel 8 (0.79 ms). The detection depth for a stainless steel small ISO is 1cm based on the Spring Valley threshold for a MarkIV booster at a depth of 0.3m being 1.19 mV/A.

Corrective Actions

For the missed stainless steel Small ISO QC seed, the amplitude response of the target was not detectable. To avoid future instances of missed targets, we suggest the following corrective action:

- Seeds should be buried at a depths where the target produces a signal that can be detected above the accepted detection threshold. In the case of the stainless steel small ISO, it's amplitude response is significantly less and recovered polarizabilities much smaller and faster decaying than the black welded steel small ISO and therefore needs to be buried shallower to be detected.

For the missed medium ISO QC seed, the proximity of the seed location to the medium ISO detection depth combined with nearby high amplitude cultural targets meant the target was not detectable. To avoid future instances of missed targets, we suggest the following corrective action:

- Define a conservative mask around edges of high amplitude cultural responses where we do not have a high confidence in successful detection.

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Root Cause Analysis / Corrective Action Report

Regarding SV FUDS Pilot Project **NCR 003**, dated 09/08/2016.

Issue:

Blind Verification Seeds #7, 9, 10, and 11, located at 4733 Woodway Lane NW, were not detected by the TEMTADS at the 4733 Woodway property. The seeds were buried over a range of depths from approximately 3x to 8x their diameters, which were assumed to be acceptable depths. The details of the missed blind seeds are given in Table 1.

Table 1 – Blind seeds missed by the TEMTADS 2x2 at 4733 Woodway

number	item	orientation	location	northing	easting	elevation	depth (ft)
7	75 mm	vertical	top center	462787.9292	1285625.237	325.0759	0.702443
9	Sm. ISO (w.s.)	horizontal	top center	462851.4584	1285601.599	325.4727	0.874665
10	Sm. ISO (s.s.)	vertical	top center	462780.0708	1285599.99	325.2431	0.618099
11	Med. ISO	horizontal	top center	462791.4078	1285559.973	321.3543	1.524916

Root Cause Analysis:

Figure 1 shows the 4733 Woodway property schematically with the dynamic TEMTADS 2x2 data overlaid.

Blind Seed #7 is located on the eastern edge of the property and positioned such that the TEMTADS 2x2 was not able to fully sample the seed location. The beginnings of an anomaly were visible in the EMI data that was collected. As the peak shape was not fully developed in the available data, it was not selected.

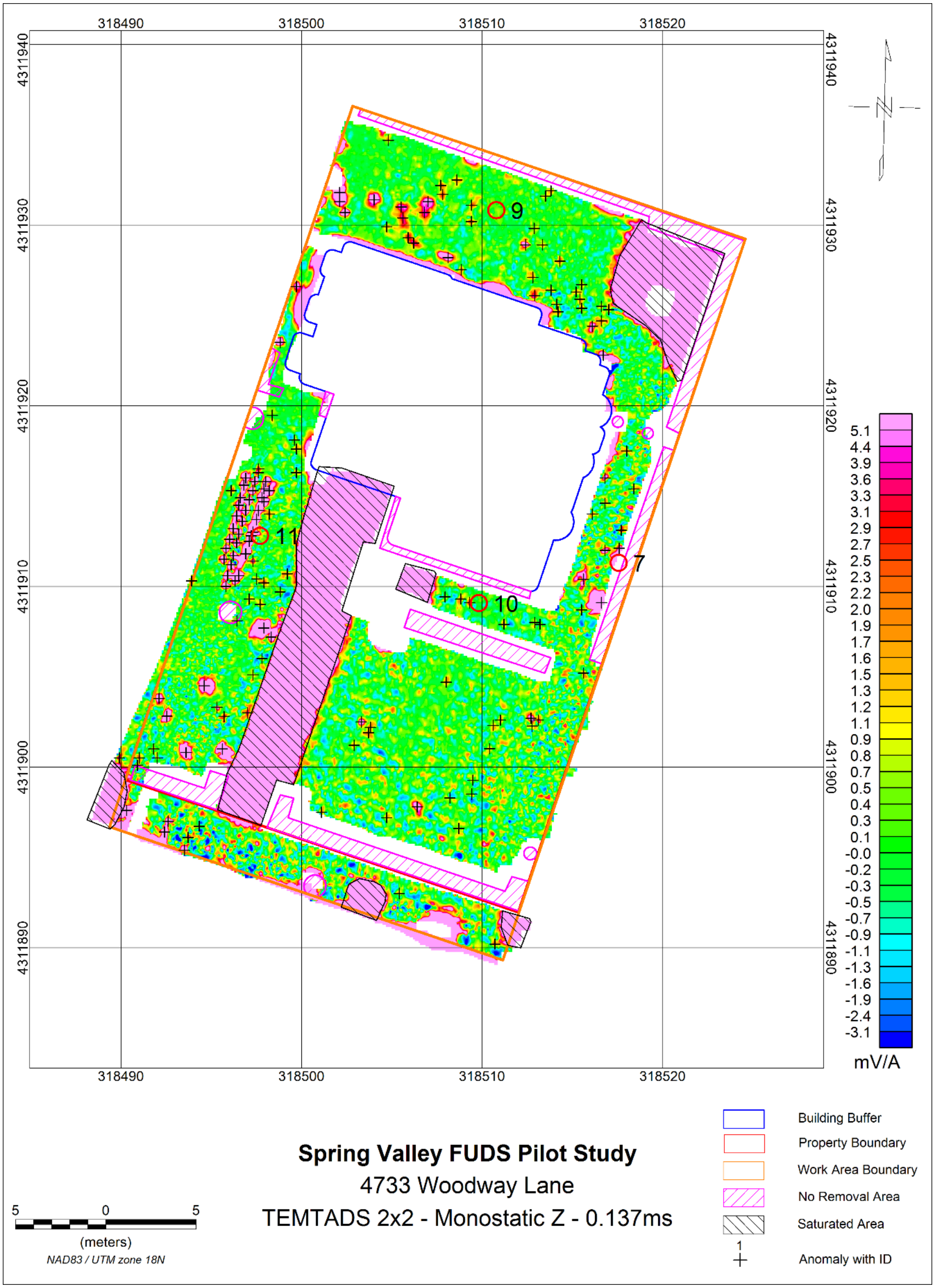

Figure 1 – Dynamic TEMTADS 2x2 data from 4733 Woodway with property features shown schematically. The locations of the four missed blind seeds are highlighted with red circles.

Blind Seed #9 is located in the backyard of the property, as shown in Figure 1. Figure 2 is an expanded view of Figure 1, showing specifically the location of Blind Seed #9. The path of the TEMTADS sensors are shown as black lines, and the data samples of two lines/coils that traversed directly over the item are shown as red “+”s. The northern line highlighted is line 32 - coil 1 and the southern is line 31 – coil 2.

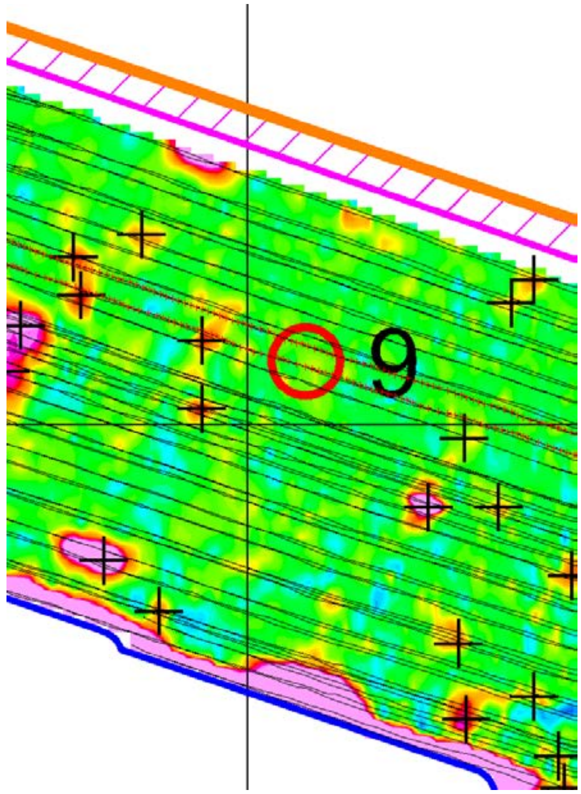

Figure 2 – TEMTADS anomaly map for the area surrounding the location of blind seed #9. The black lines indicate the path of the TEMTADS sensors. The most relevant data is highlighted as red “+”s.

Figures 3 and 4 are screenshots of the profile data for the two line/coil combinations referenced above. The lower profile (green) is the monostatic Z coil 0.137ms data. The data were fairly noisy, but for this property, they were collected in what was actually the quietest area. The noise makes leveling (background subtracting) the data difficult because it is hard to determine where the baseline is. After the data is leveled, it is also difficult to select targets in the noise that are near the detection threshold. The response we would expect for this item is 2.7 mV/A. The RMS noise in this area was about 0.8 mV/A which results in an expected SNR of 3.4. This is below the SNR of 5 normally required when picking targets.

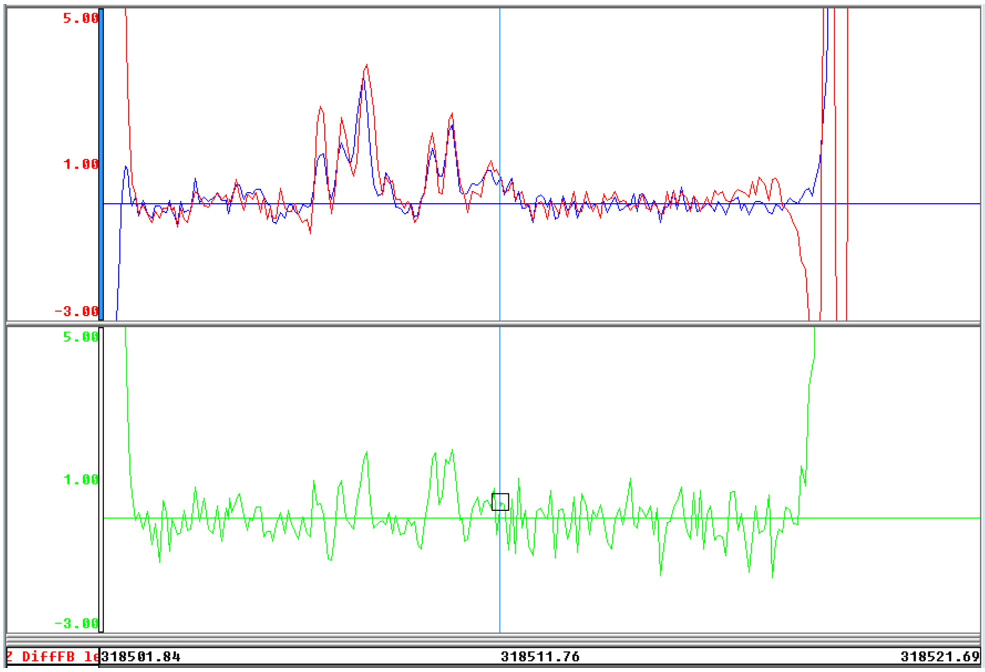

Figure 3 – Blind Seed #9, northern line of data shown in profile. The lower profile is the leveled TEMTADs data. The upper profiles are the profiles of the two differenced data sets.

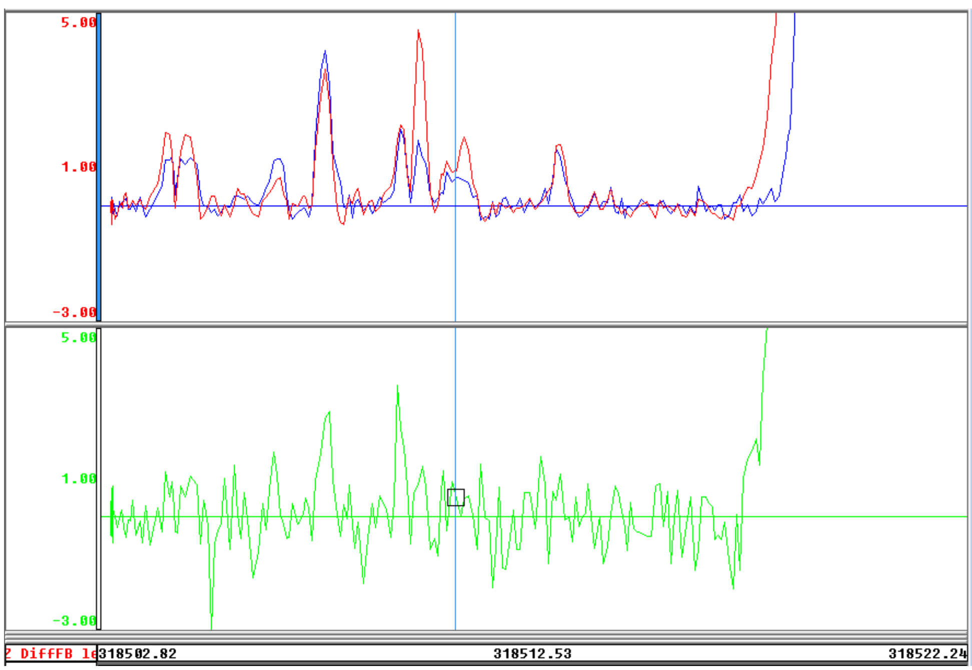

Figure 4 – Blind Seed #9, southern line of data shown in profile. The lower profile is the leveled TEMTADs data. The upper profiles are the profiles of the two differenced data sets.

In order to combat the powerline noise, a differencing technique was applied to the data. Common cube components are subtracted front-to-back and left-to-right (cube #1 - #2, #4 - #3, #1 - #4, and #2 - #3). The upper profiles in Figures 3 and 4 show the results of this differencing. The front-to-back difference data are plotted in red and the left-to-right are plotted in blue. The noise is reduced using this technique, but this technique has the drawback of reducing the amplitude of deeper items. Overall at this property, the reduced noise in the difference channels more than compensates for the reduced amplitude. The amplitude of Blind Seed #9, using the differenced channels, is ~1.5mV with some variability depending on if the F-B or the L-R data are used. Our data analyst processed the lines of data around Blind Seed #9 using the differencing technique. When he ran the basic targeting picking algorithm that simply identified Z component amplitude peaks using the differenced data, it more than doubled the number of picks. If the difference data were run through an advanced detection filter which uses the X, Y and Z components of the data and inverts the data to generate a model coherence surface to select targets, the number of targets is greatly reduced.

Blind Seed #10 is located in an area with acceptable coverage by the TEMTADS 2x2 system. However, the item emplaced was a stainless steel pipe similar to an ISO in shape and size. ISOs are fabricated from black steel. It is our understanding that this seed item, or one similar to it, have been revisited since the NCR was issued by the MPV team and as predicted, the response amplitude for the stainless steel item is significantly smaller than the corresponding black steel ISO.

Blind Seed #11 was located at the edge of an apparent EMI noise source on the west side of the house. Based on the utility markings in the yard, this is the location of a buried power line. Due to this utility noise we did not attempt to refined and add any picks in the affected area. The data does show a partial anomaly in this location, but it was not pick because of the utility noise and the lack of a complete peak shape (e.g. the signal amplitude did not return to baseline around the entire peak). In later discussions, the selected targets from this area were removed from the cued list by ERT. However, since the TEMTADS target list did not include a pick within 40cm of the location of this blind seed, a missed seed failure was generated.

Proposed Corrective Action:

Blind Seed #7 was located on the edge of the area that the TEMTADS could survey. A response was seen in the data closest to the seed location. The response did not form a complete peak, making it difficult to estimate a location. As such, the anomaly was not placed on the target list. We suggest that this blind seed be removed from the list of ones that the TEMTADS was expected to locate.

Blind Seed #9 was located in perhaps the quietest (from an EMI perspective) portion of the property, with a noise level of 0.8 mV/A. This noise level is still higher than observed at other sites. The expected response for this seed, using our forward model, would be 2.7 mV/A. However, the signal-to-noise (SNR) ratio would be small, 3.4, below the desired SNR ratio of 5. A differencing technique that has shown some promise in areas with correlated powerline noise was present were tested. While they were successful in recovering this blind seed as a target, they would double the number of targets identified for cued interrogation. This suggests that in this location and other similarly noisy locations that the objectives regarding detection of deeper targets may need to be revised.

Blind Seed #10 was fabricated from stainless steel. The response characteristics of stainless steel objects are not well documented for advanced EMI sensors, but preliminary data indicates that response amplitudes would be significantly lower than for black steel. Therefore, we suggest that this blind seed be removed from the list of ones that the TEMTADS and MPV were expected to locate.

Blind Seed #11 was located in an area of elevated EMI noise, presumably resulting from the buried power line that runs through it. A partial anomaly was visible in the data, but did not form a complete peak, making it difficult to estimate a location. As such, the anomaly was not placed on the target list. We understand that the area was later removed from consideration by the project team. We suggest that this blind seed be removed from the list of ones that the TEMTADS was expected to locate. We would attempt to coordinate more extensively with the rest of the project team regarding areas that should be included and excluded prior to the submission of target lists.

NONCONFORMANCE REPORT (NCR)

Identification

Originator: Elise Goggin	Organization: ERT (TtEC)	Date: 11/23/16	Report Number: 004

Nonconformance Description (Describe the nonconformance; ensure the applicable requirements, planned activities, procedures, specifications, drawing, standards, serial numbers, etc. are noted. Indicate who documented the nonconformance.).

Requirement: 100% of QC and validation seeds placed on dig list (QAPP Worksheet #22);

Condition: Seed #17 was incorrectly classified by MPV.

Property	Seed	Description	Northing (SP)	Easting (SP)	Depth (ft)
4740	17	75mm	462898.4025	1285520.91	1.88

Risk Level Major/Moderate

Steps to Prevent Inadvertent Use of the Item or Process

Corrective/Preventive Action and Disposition

Planned Corrective/Preventive Action (Describe for each cause what action(s) will be taken with the item or process, including, as applicable, the completion dates, disposition of material, and responsible staff for each action. Describe, as applicable, what actions are needed to prevent recurrence of the identified nonconformance, such as process improvement, procedure revisions, training plan, etc., and include completion dates and responsible staff for each action.).

Individual demonstrators will perform a root cause analysis (RCA) and define an appropriate corrective action if applicable. This assessment will be completed no later than 29 November 2016.

It is critical that the identity of the seeds remain blind to the demonstrators. To maintain this firewall, all discussions with the demonstrators should be held on an individual basis.

Independent verification required? Yes ☒ No ☐

Person(s) Responsible for the Corrective/Preventive Action and Disposition	**Approval of Corrective/Preventive Action and Disposition**
Name *Date*	*Name* *Date*

Closing the Nonconformance

Action Completed	**Independent Verification Completed (if required)**
Name *Date*	*Name* *Date*

401 / 1755 West Broadway
Vancouver, BC, V6J 4S5
Canada

Canada

Principal Investigator	Kevin Kingdon, Black Tusk Geophysics Inc
To	Elise Goggin, TetraTech
CC	Herb Nelson
Date	29-Nov-2015
Re:	Root-cause analysis for a missed classification of a QC Seed at Spring Valley Formerly Used Defense Site (SVFUDS)

Dear Ms. Goggin,

The attached document presents a Root Cause Analysis (RCA) for a missed classification of a Quality Control (QC) seed at the Spring Valley Formerly Used Defense site. We have identified the root-cause of the problem and have suggested a corrective action.

Should you have questions or require additional information, please feel free to contact me at 604-428-3382 or by email at kevin.kingdon@btgeophysics.com.

Regards

Kevin Kingdon

Root cause analysis for a missed seed in the MPV dig list for the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study

Summary

A quality control (QC) seed item was not included in the Man Portable Vector (MPV) derived dig list submitted for the 4740 Quebec St property of the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study in Spring Valley, Washington, D.C. This seed was located in a region of particularly high noise levels with characteristics similar to sites with a strong background geology response. A source was picked near the location of the missed QC seed during the target detection stage but was not designated as TOI on the dig list generated during the classification stage. This memo provides an overview of the classification approach, identifies causes for the missed seed, and suggests a corrective action.

Background

A QC seed was missed in the dig list for the MPV data collected at 4740 Quebec of the Spring Valley Formerly Used Defense Site (SVFUDS) Pilot Study. The missed item was a 75mm projectile at a depth of 1.88 feet (0.57m) and oriented horizontally. Dynamic MPV data were acquired along lines with a nominal line-spacing of 0.5 m using Robotic Total Station (RTS) for positioning. Figure 1 plots an image of the MPV detection data acquired at 4740 Quebec St near the vicinity of the missed seed.

While seed #17 was detected, the dynamic data shown in Figure 1 indicates the challenge for both detecting and classifying this particular target among the observed site specific noise levels. There is no amplitude pick within the required distance of seed #17. The two closest amplitude picks (6, 236) to seed #17 both produced source locations (obtained from inversion of dynamic data) that pushed the reported cued acquisition locations closer to seed #17 and in the case of the source associated with pick #6, resulted in a cued location within the required MQO of <40cm from seed #17.

Note that the MPV detection threshold for all three Spring Valley properties was consistent at 1.2 mV/A to try and provide consistent detection depths at all three properties. The site specific noise levels varies over the three properties and the implication of that variation in noise is that for properties where the noise levels are elevated, the achievable detection depths are reduced. Note that the noise level in the portion of the 4740 Quebec site near seed #17 was 0.6 mV/A (noise near seed #17 was especially high, remainder of the backyard at 4740 Quebec was in the 0.4-0.45mV/A range) meaning that target picking is occurring at approximately 2-3 times the noise.

The data amplitude threshold for a 75mm projectile at 57cm was calculated using the Detection Modeler software from SERDP MR-2226. To calculate the threshold, we assume that the center of the MPV transmitter coil was 0.1 m above the ground (i.e. the bottom of the MPV sensor head has a ground clearance of approximately 2 inches), and that the maximum line spacing is 0.65 m. Based on these assumptions, the threshold for the composite channel used in target picking is 1.31 mV/A (Figure 2). The detection signal recorded in the vicinity of seed #17 location was in the range of 1.3-1.8 mV/A, close to the modelled detection limit. In spite of the successful detection, the source locations shown in Figure 1 illustrate that the locations which the MPV would return to for cued measurements (black squares) are not well centered over seed #17. For a deep target close to the detection threshold, classification performance would benefit from a sounding directly over seed #17 rather than off to the side. For shallower high SNR targets, in field QC capabilities can often guide the operator to center sensor over correct source location but in field QC results are not as reliable for deeper targets with low SNR.

Root Cause Analysis

The informed source selection process led to a pair of cued measurement locations within 40 cm of the seed (Figure 3). Cued measurement 1077 was acquired 0.37 m Northwest of the Seed, and cued location 1076 was 0.19 m to the East of the seed.

Prior to inverting the cued measurements, an estimate of the background signal is subtracted from the data. The nearest background measurement was located 1.65 m away. To verify that no metallic targets were in the vicinity of the background measurement location, we compared a measurement at the background location with measurements at 4 locations surrounding the background location. Figure 4 compares the 5 background verification measurements. The similarity of the 5 measurements suggest that the background is suitable for processing.

Figure 5 shows the result of inverting the cued data. The location of dipole sources from inverting data from cued measurements 1076 and 1077, are indicated by yellow and white circles, respectively. The single source inversion of 1076 predicts a horizontal target at a depth of 62 cm, and located 18 cm to the North and west of the reported seed location. The recovered polarizabilities are compared to 75 mm polarizabilities that were derived from IVS measurements. Although the location and orientation of the target is well estimated, the recovered polarizabilities are noisy and not a good match to the 75 mm polarizability in the ordnance library.

The poor recovery of the 75 mm polarizability is due to the low SNR of the data. The noise at the 4740 Quebec site is the highest of the three homes surveyed at Spring Valley. A comparison of the z-component transmitter background data acquired at the 4740 Quebec location and the IVS is shown in Figure 6. The amplitude of the 4740 Quebec background measurements are generally larger than those acquired at the IVS location. Several receivers have a late time “flattening” of the decay (i.e. constant amplitude as a function of time), possibly due to the stacking of low frequency noise at the site. In addition to an elevated amplitude, the 4740 Quebec backgrounds have the decay and symmetry characteristics of ground coupling. In particular, there is a power law decay in the z-component receivers and the radial components. The azimuthal components and the horizontal components at the center of the circular loop measure only noise.

To understand how the increased noise level at 4740 Quebec in the vicinity of seed #17 affects our ability to estimate polarizabilities, we synthetically seed a horizontal 75 mm projectile in noise that is characteristic of the site. We obtain estimates of the background corrected response by using one of the 5-point backgrounds as background signal, then use an adjacent measurement for background correction. Since there are 5 measurements, this results in 20 different combinations of noise models for synthetic seeding.

There are two different sets of 5 point measurements we use for modelling. The first set of 5 point measurements were acquired at the IVS background location, and the second set was the background location used to correct data for the soundings collected in the vicinity of the seed (i.e. 1076 and 1077). Figure 7 summarizes the results of the modeling study. In each panel, there are 20 sets of polarizabilities plotted, representing the 20 different noise realizations. The leftmost column plots the recovered polarizabilities of a horizontal 75 mm projectile at a depth of 57 cm, in noise typical at the location of the IVS. We note that we defined the depth here as being from the ground surface to the center of the target, rather than to the top of the target. Three results are presented: zero offset (i.e. MPV directly above the target, and offset of 10cm in both x and y direction (14 cm from the MPV center) and an offset of 20 cm in both x and y direction (i.e. 28 cm from the MPV center). When the MPV is directly over the target, the polarizabilities are well constrained. As the target moves away from the center of the MPV, the SNR of the signal decreases and the excitation of the target changes. For the noise levels at the IVS, however, the signal is sufficiently strong to maintain good recovery of the polarizabilities for both the 14 and 28 cm offsets.

In the middle and rightmost columns of the Figure 7, the modeling results for a 75 mm projectile seeded in noise characteristic of 4740 Quebec. In the middle column, we plot the polarizabilities for the 75 mm buried at 45 cm. Similar to the IVS noise results, there is good recovery of polarizabilities at 0, 14, and 28 cm offset.

In the right column, we plot the results of inverting data from the 75mm buried at 57 cm. When the MPV is directly over the target, the recovered polarizabilities are very noisy due to the low SNR, and the ability to use a library matching classification would be limited. As the target offset increases, the ability to constrain the polarizabilities deteriorate further. The SNR is not sufficient to produce polarizabilities that could reliably classify the target.

Root Cause: The root-cause of the missed 75mm classification was that the elevated noise values at the 4740 Quebec property were too high to reliably detect and classify a 75mm target at 57cm with the MPV.

Corrective Action

The noise present at the three Spring Valley properties surveyed varies from site to site. The ability to recover polarizabilities is effected by noise. Reliable classification of a horizontal 75 mm projectile at 57 cm depth with the MPV is not expected for the site specific noise present near seed #17 at 4740 Quebec. We recommend that depth detection objectives at Spring Valley be modified to reflect the site specific noise.

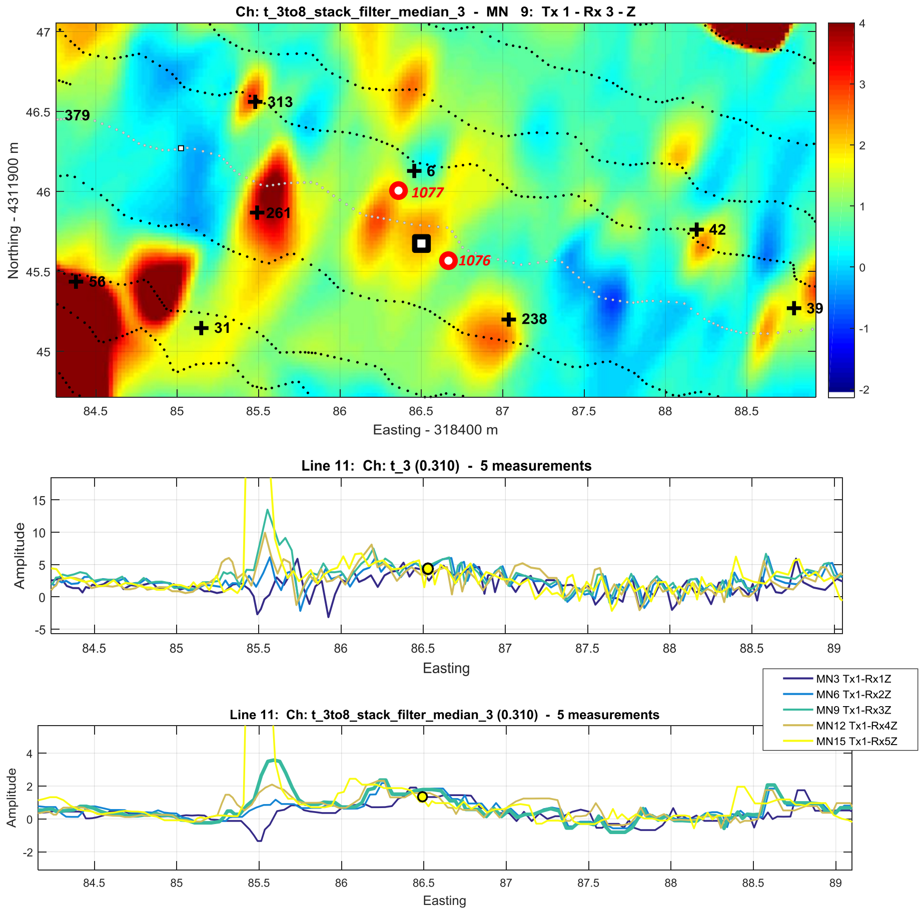

Figure 1: Detection map near missed seed #17 marked with a black square. The black plus symbols associated with 6 and 238 represent the two closest initial amplitude picks to seed #17. The red circles indicate source locations derived from inversion of dynamic data; cued measurements where acquired at these locations. The middle plot shows the data at the third time channel for all 5 MPV receiver cubes on the survey line passing closest to seed #17. The bottom plot shows profiles for the composite channel used for picking the data.

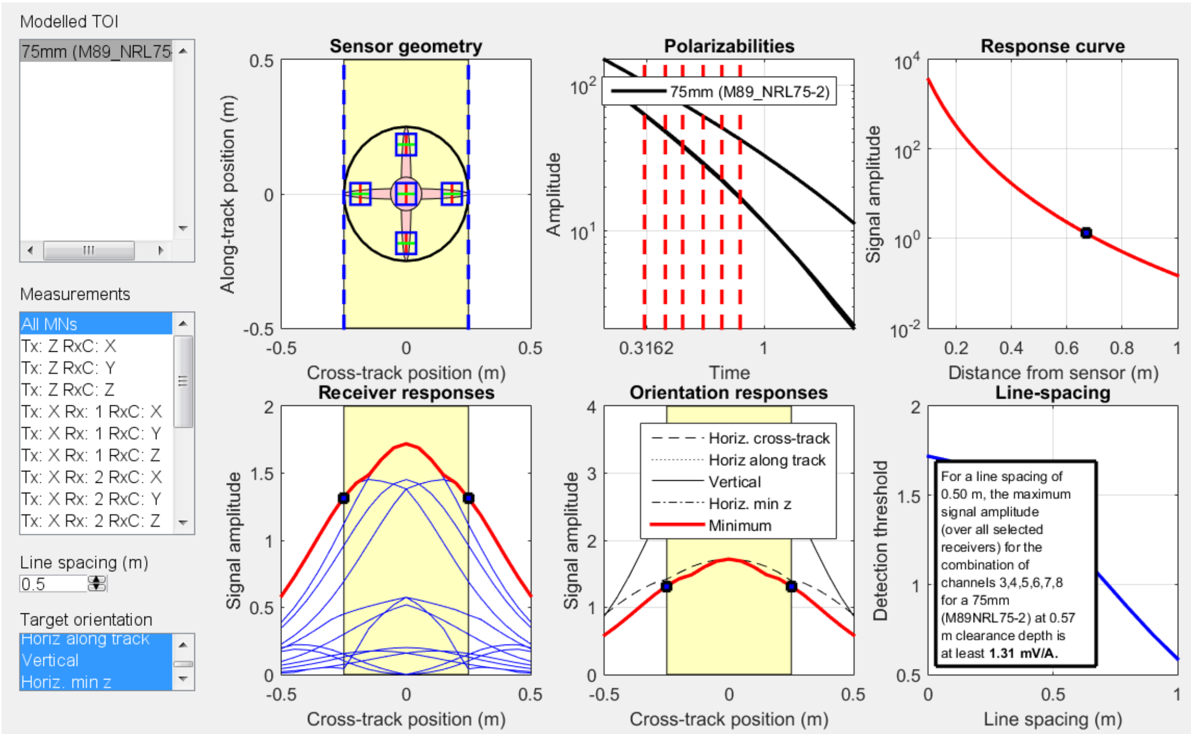

Figure 2: 75mm modeling output from the SERDP MR-2226 Detection Modeler. These measurements assume the center of the z-transmitter coil is 0.10 cm above the surface. For a composite channel from time channel 3 (0.31 ms) to time channel 8 (0.79 ms), the threshold for a 75mm at a depth of 0.57m is 1.31 mV/A. The detection threshold was 1.2 mV/A, the noise level was 0.45 in that part of the property.

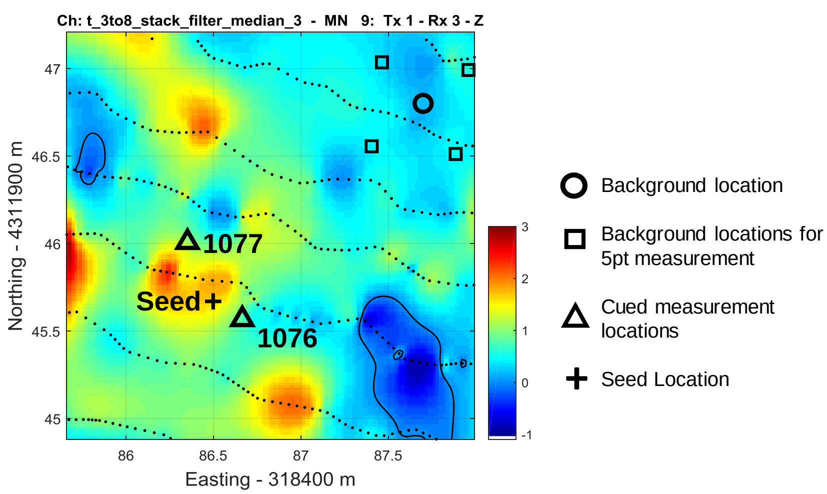

Figure 3. Relative locations of the missed Seed 17, cued measurement locations 1076 and 1077, and the background location. The z-component of the center cube is plotted here.

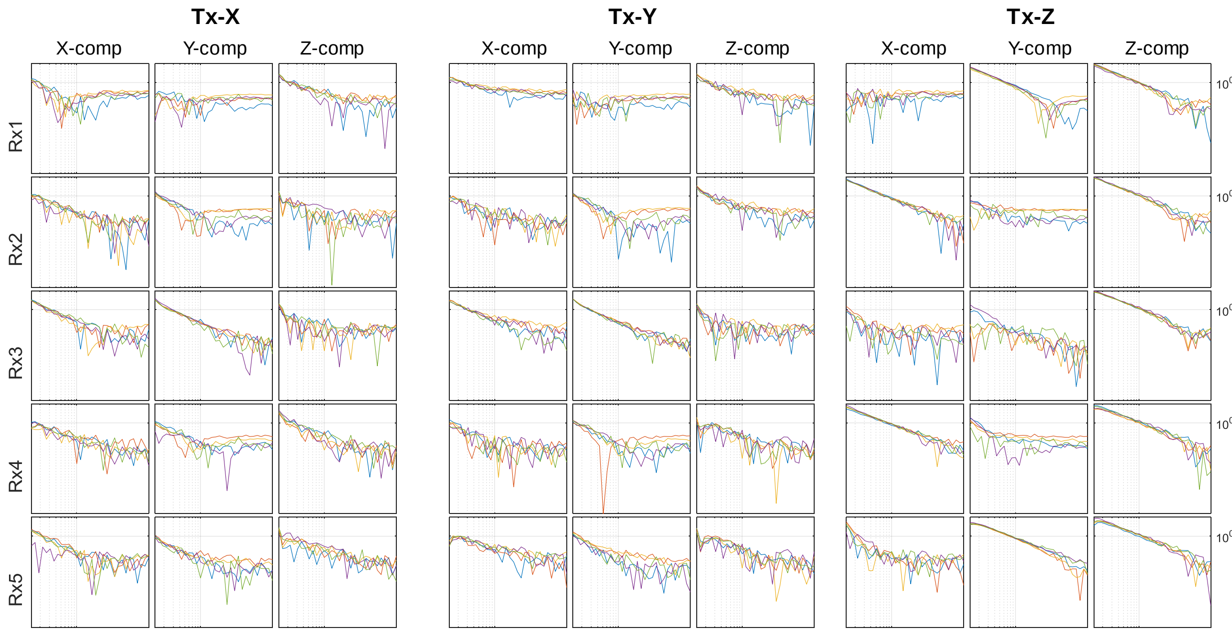

Figure 4. 5pt background verification measurements for background location used to process cued locations 1076 and 1077. The power law decays – particularly evident in the Z component data – and characteristic of ground coupling.

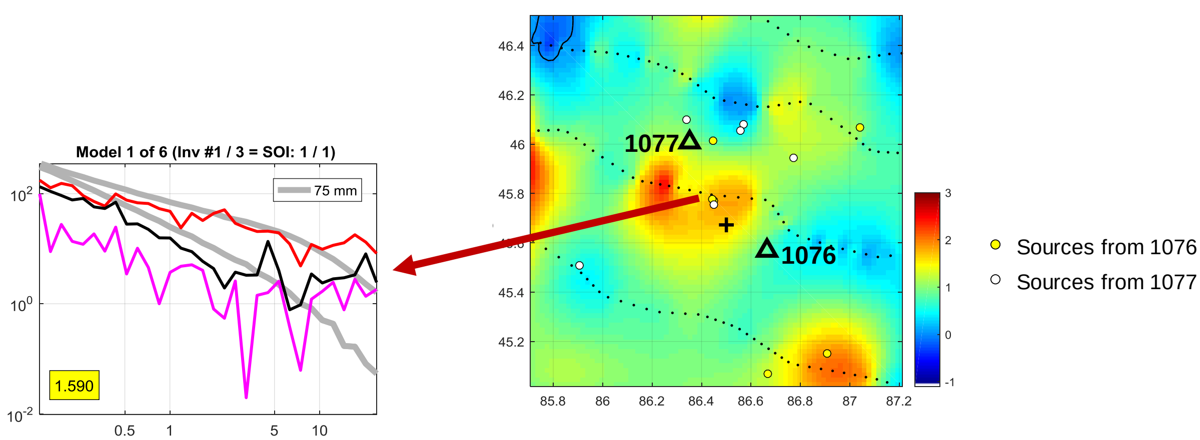

Figure 5 Cued inversion result. One, two, and three source inversions were carried out at cued locations 1077 and 1076. The model that best matched the 75 mm seed is shown at the left. The inversion predicts a horizontal target whose center is 62 cm deep. Due to the site noise, the recovered polarizabilities are noisy.

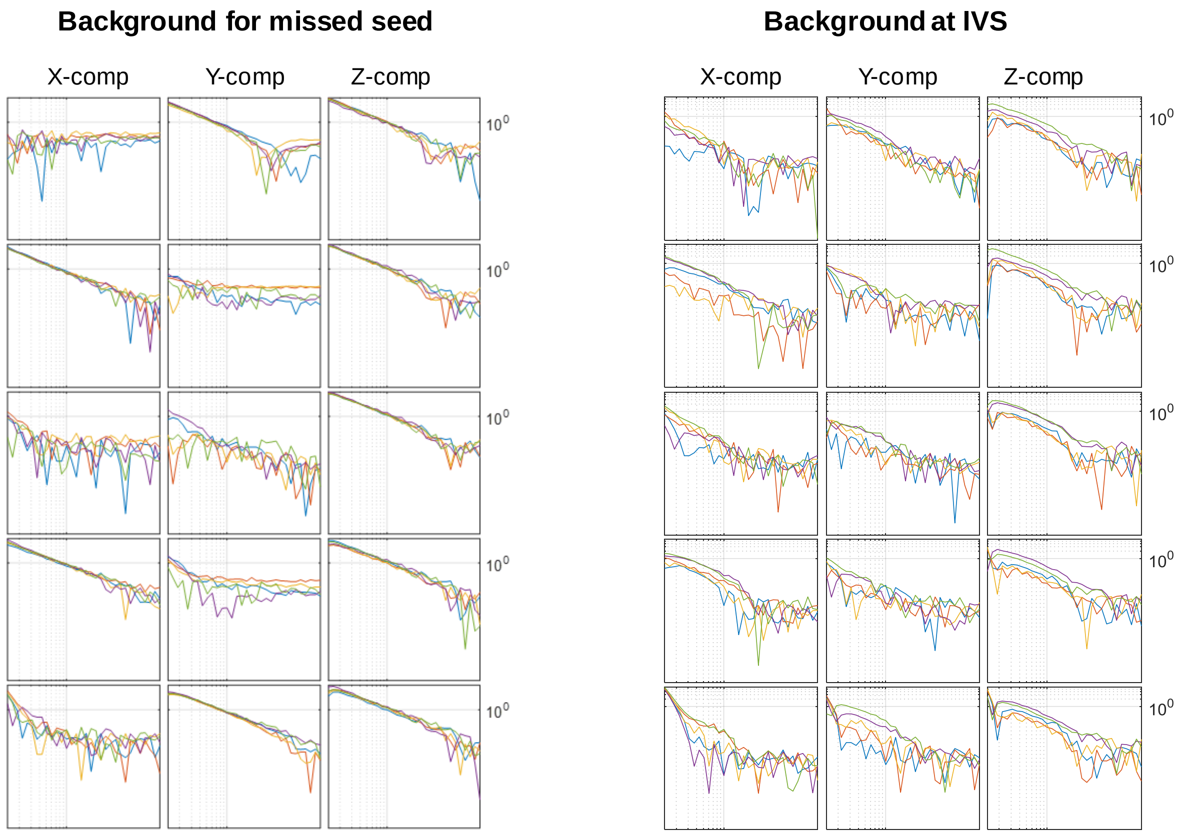

Figure 6. Comparison of a background responses measured at 4740 Quebec. Each of the 5-point background measurements are shown here. The background data at the IVS has lower amplitude and does not have the decay characteristics of a ground response. At 4740 Quebec, a late time "flattening' of the decay is evident in several of the receivers.

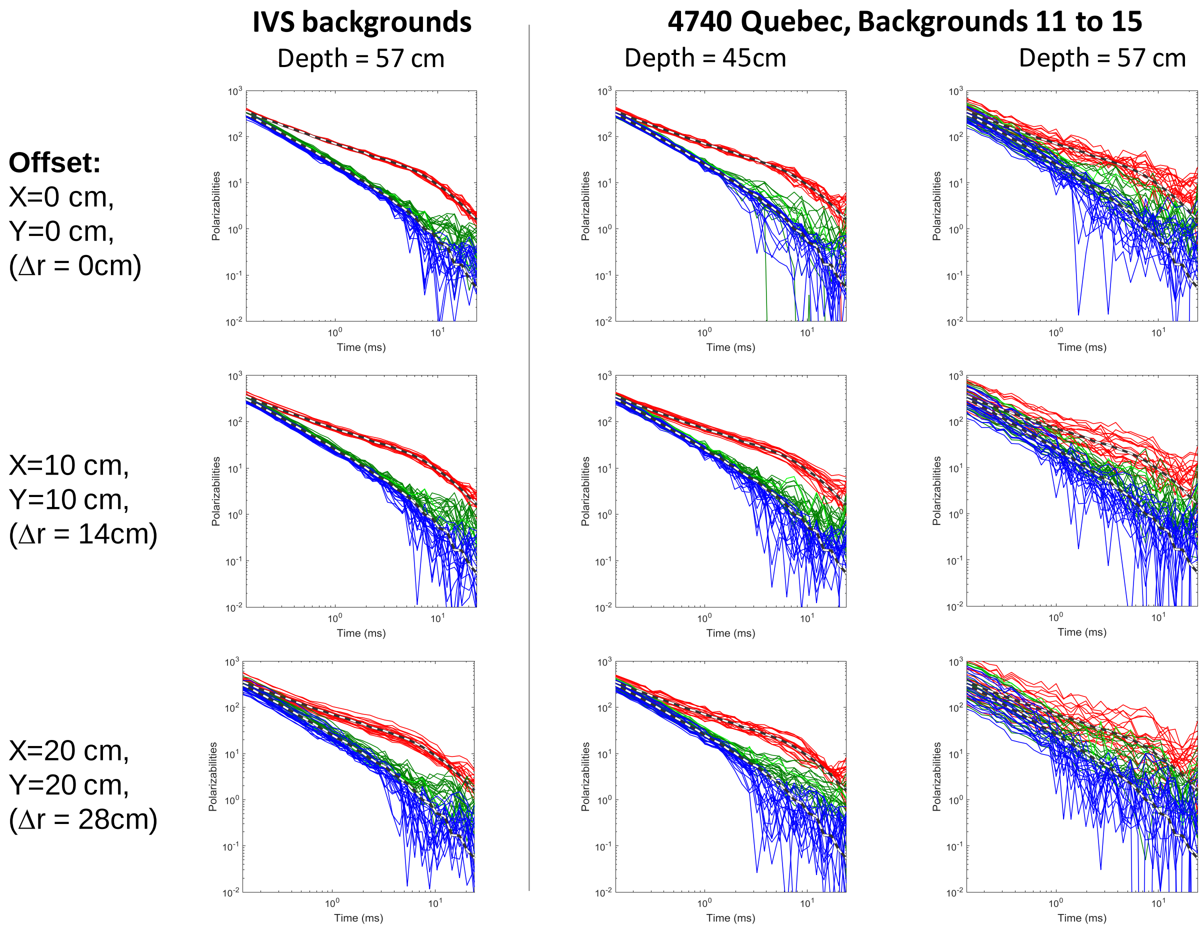

Figure 7. Results from inverting synthetically seeded 75 mm projectile data in noise characteristic of the IVS strip and of the 4740 back yard.

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Appendix E: Dig Sheets

4720 Quebec Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1	1285666.08	462975.27	8.27		MkIV booster	0	scrap	8	pipe, 2 in long	N	15-Nov
2	1285673.33	462972.71	5.51		MkIV booster	3 E	scrap	3	nail, 3 in long	N	14-Nov
3	1285674.45	462973.01	-1.57			2 N	scrap	3	nail, 3 in long	N	14-Nov
4	1285676.43	462972.33	4.33			3 NE	scrap	4	nail, 6 in long	N	14-Nov
5	1285678.70	462973.03	17.76			4 S	scrap	1	nail	N	14-Nov
6	1285678.50	462975.50		233		2 N	scrap	2	reinforcement in concrete	Y	14-Nov
7	1285692.00	462970.50		53.0		12 E	scrap	0	angle iron in concrete	Y	14-Nov
8	1285677.50	462969.00		17.2		-	no contact	-	dug to 12 in, nothing found	-	14-Nov
9	1285673.03	462969.01	7.87		ISO M40	0	scrap	4	reinforcement in concrete	Y	14-Nov
10	1285672.76	462967.85	7.48			6 N	scrap	4	reinforcement in concrete	Y	14-Nov
11	1285674.76	462963.32	16.14			4 E	scrap	8	large soda can	N	14-Nov
12	1285672.09	462961.92	13.39		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	15-Nov
13	1285670.73	462959.71	38.58			6 NW	other	18	reinforcement in wall	Y	15-Nov
14	1285675.22	462954.97	12.20		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
15	1285680.40	462950.93				4 SE	scrap	4	wire, 1 in long	N	15-Nov
16	1285687.00	462951.00		18.0		-	no contact	-	dug to 12 in, nothing found	-	14-Nov
17	1285687.82	462949.72	2.76			0	seed	4	blind seed 14 - small ISO	N	14-Nov
18	1285684.20	462941.62				-	no contact	-	dug to 12 in, nothing found	-	14-Nov
19	1285680.35	462945.84	9.84		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
20	1285676.31	462943.64	-3.54			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
21	1285670.99	462950.73	3.15		MkIV booster	2 E	scrap	6	nail, 6 in long	N	14-Nov
22	1285670.02	462952.27	19.69			6 E	scrap	16	metal in brick	N	15-Nov
23	1285670.01	462950.94	11.42		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
24	1285669.11	462949.39	12.99		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
25	1285670.49	462947.36	22.83			3 S	scrap	5	screw, 2 in long	N	14-Nov
26	1285670.30	462945.48	13.39		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
27	1285667.62	462940.31	21.26			4 S	scrap	18	steel, 1 in x 2 in	N	14-Nov
28	1285667.94	462939.18	19.29		ISO M40	2 W	scrap	20	conduit, 3 in long	N	14-Nov
29	1285666.87	462935.99	9.45		MkIV booster	0	scrap	8	banding, 5 in long	N	14-Nov
30	1285663.65	462936.00	8.74			-	no contact	-	dug to 12 in, nothing found	-	14-Nov

4720 Quebec Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
31	1285663.54	462932.28	9.45		MkIV booster	0	scrap	6	2 in diam. pipe nipple	N	14-Nov
32	1285666.01	462930.64	11.81		MkIV booster	0	scrap	16	conduit, steel banding	N	14-Nov
33	1285666.94	462929.36	25.20			4 W	scrap	12	conduit, 5 in long	N	14-Nov
34	1285667.66	462927.32	27.95		Stokes mortar	-	no contact	-	dug to 36 in	-	14-Nov
35	1285668.16	462928.51	17.72			2 SE	scrap	12	banding, 12 in long	N	14-Nov
36	1285667.82	462929.75	19.69			0	scrap	24	banding, 12 in long	N	14-Nov
37	1285668.91	462934.65	20.87		75 mm	4 N	scrap	14	nail, 3 in long	N	14-Nov
38	1285673.98	462936.34	12.20		MkIV booster	2 SE	hot rock	8	rock	N	14-Nov
39	1285674.37	462932.02	8.66		MkIV booster	0	scrap	12	banding, 9 in long	N	14-Nov
40	1285673.07	462929.89	19.69		75 mm	0	scrap	16	sheet metal, 6 in x 6 in	N	14-Nov
41	1285672.26	462928.47	5.51			4 NW	scrap	6	bolt, 4 in long	N	14-Nov
42	1285675.43	462924.21	0.79		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
43	1285679.87	462927.81	2.36		ISO S80	3 S	scrap	5	nail, 6 in long	N	15-Nov
44	1285682.47	462930.04	7.48		MkIV booster	6 E	scrap	9	pipe flange, 3 in diameter	N	15-Nov
45	1285682.65	462931.48	-0.79			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
46	1285686.50	462935.00		34.7		-	no contact	-	dug to 12 in, nothing found	-	15-Nov
47	1285690.78	462937.44	6.30		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	15-Nov
48	1285691.12	462938.59	-1.97			3 S	scrap	2	nail, 3 in long	N	14-Nov
49	1285691.07	462939.60	9.45			2 E	scrap	4	wire, 2 in long	N	14-Nov
50	1285695.02	462938.90	-0.79			4 SE	scrap	3	chain link, 3 in long	N	14-Nov
51	1285698.79	462942.27				-	no contact	-	dug to 12 in, nothing found	-	14-Nov
52	1285701.33	462946.81	14.96		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	15-Nov
53	1285699.47	462950.21	18.50		75 mm	4 N	scrap	6	rebar	Y	14-Nov
54	1285699.04	462951.28	7.87			0	scrap	8	rebar	Y	14-Nov
55	1285697.30	462951.64	23.62			3 N	scrap	6	wire, 8 in long	N	14-Nov
56	1285696.67	462954.68	8.90			3 NE	scrap	6	conduit, 8 in long	N	14-Nov
57	1285699.04	462956.39				4 W	scrap	10	sheet metal, 2 in x 2 in	N	15-Nov
58	1285707.28	462953.32	12.99			0	scrap	10	pipe, 3 in long	N	14-Nov
59	1285711.27	462952.96	10.24		MkIV booster	3 E	scrap	8	steel scrap, 1 in x 2 in	N	15-Nov
60	1285712.15	462953.66	1.18			5 NE	scrap	6	wire in concrete	Y	15-Nov

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Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
61	1285712.08	462959.19	1.97		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	15-Nov
62	1285713.30	462958.44	-1.97			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
63	1285719.64	462951.27	15.91			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
64	1285727.50	462947.00		24.3		-	other	-	under sidewalk and below gas utility (not dug)	-	15-Nov
65	1285729.00	462953.00		1457		-	no contact	-	dug to 12 in, nothing found	-	15-Nov
66	1285729.88	462952.44	3.94		ISO M40	0	other	0	gas utility cap (not dug)	Y	15-Nov
67	1285732.48	462953.91	3.94			0	scrap	8	steel scrap, 10 in x 6 in	N	15-Nov
68	1285736.41	462951.57	5.12			4 S	scrap	7	steel scrap, 9 in x 3 in	N	15-Nov
69	1285735.50	462950.50		37.3		3 E	scrap	6	bent pipe, 1 in diameter, 9 in long	N	15-Nov
70	1285735.67	462948.49	0.00			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
71	1285743.16	462950.45	20.87			3 NE	other	6	reinforcement within curb	Y	15-Nov
72	1285743.35	462944.80	6.69		MkIV booster	3 SW	scrap	3	fence trim piece	N	14-Nov
73	1285744.56	462944.14	8.27			0	scrap	6	steel spike, 26 in long, 1 in diam. (same as 74)	N	14-Nov
74	1285745.58	462945.02	10.24		75 mm	0	scrap	6	steel spike, 26 in long, 1 in diam. (same as 73)	N	14-Nov
75	1285747.79	462948.09	5.12		MkIV booster	2 E	scrap	3	wire, 12 in long	N	14-Nov
76	1285749.50	462947.00		24.8		-	no contact	-	dug to 12 in, nothing found	-	15-Nov
77	1285752.75	462946.14	7.09			0	other	6	power cable	Y	15-Nov
78	1285754.91	462945.79	15.35			3 NE	other	4	reinforcement within curb	Y	15-Nov
79	1285762.50	462942.00		57.6		3 NE	other	4	reinforcement within curb	Y	15-Nov
80	1285747.78	462942.63	9.06		MkIV booster	4 NE	scrap	6	wire in concrete	Y	15-Nov
81	1285747.49	462940.53	1.18		MkIV booster	0	scrap	4	wire in concrete	Y	15-Nov
82	1285748.00	462939.64	2.36			0	scrap	4	wire in concrete	Y	15-Nov
83	1285747.00	462939.00		300		12 SW	other	0	hand rail	Y	15-Nov
84	1285744.90	462931.21	23.23		Livens Horiz		other	0	hand rail	Y	15-Nov
85	1285744.44	462929.89	1.18			12 NE	other	0	hand rail	Y	15-Nov
86	1285742.09	462931.45	10.63		ISO M40	-	no contact	-	dug to 12 in, nothing found	-	15-Nov
87	1285740.17	462927.10	1.97			-	no contact	-	dug to 12 in, nothing found	-	14-Nov

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
88	1285738.82	462927.49	9.06		MkIV booster	6 SW	scrap	6	steel scrap, 3 in x 3 in	N	16-Nov
89	1285726.49	462924.58	7.87		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
90	1285720.10	462923.95	2.76		MkIV booster	6 S	other	0	reinforcement in wall	Y	14-Nov
91	1285719.51	462926.68	2.36		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
92	1285723.35	462933.16	7.17			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
93	1285716.12	462936.45				-	no contact	-	dug to 12 in, nothing found	-	14-Nov
94	1285718.79	462942.06	8.66		MkIV booster	0	MD	12	irregular fragment, 8 in long	N	14-Nov
95	1285720.00	462944.00		25.9		-	no contact	-	dug to 12 in, nothing found	-	14-Nov
96	1285715.89	462940.90	1.97		MkIV booster	6 E	scrap	4	metal conduit	N	14-Nov
97	1285712.98	462940.87	9.21			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
98	1285709.13	462940.51	11.02		MkIV booster	4 SW	scrap	9	pipe fragment	N	14-Nov
99	1285702.01	462925.43	0.00		ISO S80	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
100	1285701.28	462923.13	11.81		MkIV booster	0	scrap	4	wire, 7 in long	N	14-Nov
101	1285703.58	462917.06	-1.18			4 SW	other	1	cable	Y	14-Nov
102	1285716.83	462920.29	24.80			6 N	scrap	0	light fixture	Y	14-Nov
103	1285717.93	462922.28	-5.51			12 S	other	0	metal post	Y	15-Nov
104	1285722.80	462917.14	15.35		75 mm	0	scrap	10	wire in concrete	Y	15-Nov
105	1285722.86	462916.15	19.69			0	scrap	10	wire in concrete	Y	15-Nov
106	1285725.80	462912.11	7.87		MkIV booster	6 E	scrap	4	nail, 3 in long	N	14-Nov
107	1285725.18	462910.23	10.24			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
108	1285729.46	462909.15	9.06		MkIV booster	3 E	scrap	6	steel scrap, 3 in x 2 in	N	14-Nov
109	1285736.52	462906.13	17.95			2 W	scrap		nail, 3 in long	N	14-Nov
110	1285738.56	462906.93	-2.36			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
111	1285740.85	462909.40	-1.97			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
112	1285741.90	462909.07	0.79		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
113	1285746.09	462910.85	1.18		MkIV booster	2 S	scrap	1	nail, 2 in long	N	14-Nov
114	1285747.06	462913.54	3.54			3 E	scrap	5	nail, 6 in long	N	14-Nov
115	1285748.34	462913.75	14.96		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
116	1285755.67	462923.63	3.15		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
117	1285756.45	462925.43	6.02			0	scrap	4	bent wire, 4 in long	N	14-Nov

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
118	1285757.77	462923.05	35.75			2 W	scrap	6	steel scrap, 2 in x 0.5 in	N	14-Nov
119	1285756.50	462920.50		17.9		-	no contact	-	dug to 12 in, nothing found	-	14-Nov
120	1285757.35	462919.01	8.27			4 NE	scrap	8	steel spike, 8 in long	N	14-Nov
121	1285758.13	462910.37	3.94			3 SE	scrap	3	vent piping, ~20 in long	N	14-Nov
122	1285758.32	462908.33	8.27			4 E	scrap	4	gutter downspout, 2 pieces	N	14-Nov
123	1285756.11	462910.61	4.17			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
124	1285750.34	462909.31	1.57			1 S	scrap	4	steel scrap, 3 in x 2 in	N	14-Nov
125	1285749.00	462906.59	2.36			4 SW	scrap	3	nail, 3 in long	N	14-Nov
126	1285751.17	462902.27	6.81			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
127	1285748.19	462901.78	10.75			-	no contact	-	dug to 12 in, nothing found	-	14-Nov
128	1285746.39	462901.81	5.12		ISO M40	-	no contact	-	dug to 12 in, nothing found	-	16-Nov
129	1285745.46	462901.22	4.33			0	MPPEH	3	Stokes Mortar, 3 in diam., unfuzed	N	14-Nov
130	1285743.58	462898.51	5.12		MkIV booster	4 NW	scrap	7	nail, 8 in long	N	14-Nov
131	1285738.98	462898.18	3.94		ISO S80	5 S	scrap	3	nail, 9 in long (same as 132)	N	16-Nov
132	1285738.17	462897.00	2.36			3 N	scrap	3	nail, 9 in long (same as 131)	N	16-Nov
133	1285743.03	462896.20	33.46			-	no contact	-	dug to 40 inches, nothing found	-	14-Nov
134	1285745.13	462892.08	0.00		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
135	1285753.41	462896.61	-1.18			2 SW	scrap	3	nail, 3 in long	N	14-Nov
136	1285753.86	462895.23	9.84		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
137	1285750.55	462884.16	10.24			4 W	scrap	7	steel scrap, 8 in x 2 in	N	14-Nov
138	1285744.89	462876.49	18.90		Livens Vertical	6 S	scrap	2	pliers	N	15-Nov
139	1285732.06	462878.43	12.60		75 mm	-	no contact	-	dug to 18 in, nothing found	-	16-Nov
140	1285729.90	462873.35	10.24			3 N	scrap	4	steel scrap, 5 in x 2 in	N	15-Nov
141	1285738.66	462864.53	5.31			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
142	1285740.10	462863.03	3.54			2 N	scrap	2	wire, 9 in long	N	15-Nov
143	1285728.66	462863.26	1.18			3 SE	scrap	6	steel scrap, 4 in x 1 in	N	15-Nov
144	1285725.22	462865.61	0.39		MkIV booster	0	scrap	6	metal within concrete	Y	15-Nov
145	1285721.57	462864.71	1.57			6 NE	other	0	yard feature (bird feeder)	Y	15-Nov
146	1285717.00	462860.50		10279		4 N	other	0	yard feature (bird feeder)	Y	16-Nov
147	1285715.23	462864.25	5.63			0	scrap	4	steel scrap, 8 in x 2 in	N	16-Nov

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148	1285711.58	462866.55	15.35			-	no contact	-	dug to 12 in, nothing found	-	16-Nov
149	1285712.84	462867.69	6.69		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	16-Nov
150	1285716.50	462875.79	4.33		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	15-Nov
151	1285715.67	462878.58	7.48		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	16-Nov
152	1285707.28	462882.06	18.50		Stokes mortar	0	scrap	16	6 x steels scrap, 12 in x 2 in	N	16-Nov
153	1285705.21	462881.18	2.76			-	no contact	-	dug to 12 in, nothing found	-	16-Nov
154	1285707.76	462862.62	4.72			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
155	1285703.50	462860.50		43.1		-	no contact	-	dug to 12 in, nothing found	-	15-Nov
156	1285702.69	462859.79	3.54		MkIV booster	4 NE	scrap	8	steel scrap, 6 in x 4 in	N	15-Nov
157	1285698.95	462863.86	18.50			0	seed	16	blind seed 13 - Stokes mortar	N	15-Nov
158	1285698.39	462857.07	3.94			0	scrap	5	steel scrap, 2 in x 2 in	N	15-Nov
159	1285689.75	462859.98	11.42		Livens Horiz	4 W	other	0	fence/gate	Y	15-Nov
160	1285682.80	462863.58	12.99		MkIV booster	2 W	scrap	2	nail, 2 in long	N	15-Nov
161	1285679.77	462864.12	14.69			4 E	scrap	2	nail, 3 in long	N	15-Nov
162	1285679.42	462867.98	33.86			-	no contact	-	dug to 40 inches	-	15-Nov
163	1285668.82	462868.71	4.72			3 SE	scrap	6	steel scrap, 3 in x 3 in	N	15-Nov
164	1285664.21	462865.87	12.99		MkIV booster	4 SW	scrap	19	valve, bracket, wire	N	15-Nov
165	1285662.60	462868.58	1.18			3 E	scrap	2	nail, 3 in long	N	15-Nov
166	1285657.79	462869.73	3.54			2 W	scrap	1	nail, 6 in long	N	15-Nov
167	1285650.65	462881.00	19.69		75 mm	-	no contact	-	dug to 26 inches, close to wire plant basket	-	16-Nov
168	1285649.57	462880.94	-1.57			-	no contact	-	dug to 12 in, nothing found	-	16-Nov
169	1285650.98	462882.98	5.39			4 SE	scrap	2	nail, 2 in long	N	16-Nov
170	1285653.79	462882.58	11.93			-	no contact	-	dug to 12 in, nothing found	-	16-Nov
171	1285661.93	462884.47	13.66			4 NE	scrap	1	screw, 1 in long	N	16-Nov
172	1285654.97	462887.23	16.54			6 S	scrap	12	banding, 12 in long	N	16-Nov
173	1285652.76	462893.00	7.87			0	scrap	6	angle iron	Y	16-Nov
174	1285650.24	462890.41	4.33			4 E	scrap	6	pipe, 5 in long, 1 in diam.	N	16-Nov
175	1285642.13	462894.20	0.28			6 E	other	0	hand rail	Y	16-Nov
176	1285639.04	462895.48	-5.51			-	no contact	-	dug to 12 in, nothing found	-	16-Nov

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177	1285637.05	462895.34	20.87		75 mm	6 NE	other	0	reinforcement in wooden wall	Y	16-Nov
178	1285639.39	462893.19	0.39		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	16-Nov
179	1285641.60	462892.39	-10.63			-	no contact	-	dug to 12 in, nothing found	-	16-Nov
180	1285638.95	462884.62	1.97			2 SW	scrap	2	bolt, 4 in long (same as 181)	N	16-Nov
181	1285640.11	462884.66	1.97		MkIV booster	2 NE	scrap	2	bolt, 4 in long (same as 180)	N	16-Nov
182	1285643.59	462876.48	4.72		MkIV booster	4 E	scrap	2	nail, 2 in long	N	15-Nov
183	1285641.76	462871.80	11.81			0	seed	12	blind seed 15 - M353 TPT Projectile	N	15-Nov
184	1285639.03	462867.84	14.06			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
185	1285629.55	462858.41	17.32		Stokes mortar	0	scrap	12	utility (pipe)	Y	15-Nov
186	1285631.31	462857.61	18.90		Livens Vertical	0	scrap	12	utility (pipe)	Y	15-Nov
187	1285636.14	462855.60	25.98		Livens Horiz	0	other	12	utility (pipe)	Y	16-Nov
188	1285637.96	462857.92	8.66			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
189	1285641.37	462858.96	5.12			0	scrap	6	steel scrap, 4 in x 2 in	N	15-Nov
190	1285648.62	462861.67	7.87		MkIV booster	-	other	-	utility line (not dug)	Y	15-Nov
191	1285650.10	462862.58	9.84			-	other	-	utility line (not dug)	Y	15-Nov
192	1285653.02	462865.08	15.04			-	other	-	utility line (not dug)	Y	15-Nov
193	1285651.17	462857.98	2.76		MkIV booster	-	other	-	utility line (not dug)	Y	16-Nov
194	1285652.41	462854.63	6.30		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	16-Nov
195	1285650.64	462852.17	5.67			-	no contact	-	dug to 12 in, nothing found	-	16-Nov
196	1285654.46	462853.03	2.76			-	no contact	-	dug to 12 in, nothing found	-	16-Nov
197	1285660.62	462856.17	4.25			6 NE	scrap	2	nail, 3 in long	N	16-Nov
198	1285663.18	462857.65	5.28			4 E	scrap	7	steel scrap, 3 in x 3 in	N	15-Nov
199	1285671.76	462858.17	5.12			3 SW	scrap	6	steel scrap, 3 in x 3 in	N	15-Nov
200	1285672.78	462858.31	19.69		75 mm	-	no contact	-	dug to 26 inches	-	15-Nov
201	1285682.13	462859.52	11.81			6 NE	MD	8	fragment (2 pieces), total 6 in long	N	15-Nov
202	1285684.44	462858.92	15.75		75 mm	4 S	MD	8	fragment, 4 in x 3 in	N	15-Nov
203	1285685.36	462855.68	2.36		MkIV booster	2 S	scrap	2	nail, 3 in long	N	15-Nov
204	1285686.43	462853.84	7.36			0	scrap	5	steel scrap, 2 in x 2 in	N	15-Nov
205	1285696.24	462847.47	2.36			3 E	scrap	1	nail, 0.5 in long	N	15-Nov
206	1285698.54	462848.25	5.91			4 SW	hot rock	4	rock	N	15-Nov

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207	1285705.91	462850.15	0.00			6 NE	scrap	2	nail, 3 in long	N	15-Nov
208	1285707.42	462852.71	5.12			3 SE	scrap	2	nail, 3 in long	N	15-Nov
209	1285709.69	462858.12	3.54			4 N	scrap	5	steel scrap, 4 in x 1 in	N	15-Nov
210	1285714.31	462857.27	3.15			2 SE	hot rock	2	rock	N	15-Nov
211	1285717.82	462854.94	4.72			4 W	scrap	3	wire, 4 in long	N	15-Nov
212	1285723.69	462844.09	9.84			0	seed	12	blind seed 12 - 75 mm projectile	N	15-Nov
213	1285723.03	462841.13	13.31			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
214	1285716.41	462844.01	5.91		MkIV booster	4 S	scrap	4	steel scrap, 2 in x 2 in	N	15-Nov
215	1285710.20	462839.11	6.69			3 N	scrap	8	beer can	N	15-Nov
216	1285711.99	462836.81	4.53			6 NW	scrap	2	wire, 8 in long	N	15-Nov
217	1285708.96	462833.04	1.18		MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	15-Nov
218	1285715.69	462830.27	13.78			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
219	1285729.73	462830.22	14.09			-	no contact	-	dug to 12 in, nothing found	-	15-Nov
220	1285760.40	462926.64			MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	14-Nov
221	1285721.49	462926.81			75 mm	-	no contact	-	dug to 18 inches	-	16-Nov
222	1285709.19	462928.56			MkIV booster	4 SW	other	0	reinforcement in wall		16-Nov
223	1285757.41	462921.63			MkIV booster	0	seed	36	blind seed 16 - large ISO	N	15-Nov
224	1285690.22	462851.19			MkIV booster	-	no contact	-	dug to 12 in, nothing found	-	15-Nov
225	1285701.02	462953.60				4 NE	other	12	drain line	Y	15-Nov
226	1285727.43	462841.18				-	no contact	-	dug to 12 in, nothing found	-	15-Nov
227	1285728.18	462925.93				-	no contact	-	dug to 12 in, nothing found	-	16-Nov
228	1285685.71	462962.50				3 S	scrap	6	nail, 3 in long	N	15-Nov
229	1285698.05	462957.88				0	scrap	8	nail, 4 in long	N	15-Nov
230	1285717.85	462939.46				-	no contact	-	dug to 12 in, nothing found	-	16-Nov
231	1285674.40	462957.46				-	no contact	-	dug to 12 in, nothing found	-	16-Nov
232	1285684.80	462854.55				-	no contact	-	dug to 12 in, nothing found	-	15-Nov
233	1285725.38	462866.79				-	no contact	-	dug to 12 in, nothing found	-	15-Nov
234	1285747.58	462911.12				-	no contact	-	dug to 12 in, nothing found	-	15-Nov
235	1285760.79	462927.98				-	no contact	-	dug to 12 in, nothing found	-	14-Nov
236	1285708.66	462831.74				-	no contact	-	dug to 12 in, nothing found	-	15-Nov

4720 Quebec Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
237	1285691.34	462967.12				3 NE	scrap	2	nail, 4 in long	N	16-Nov
238	1285695.72	462923.27				-	no contact	-	dug to 12 in, nothing found	-	16-Nov
239	1285687.14	462859.91				3 E	scrap	2	nail, 4 in long	N	15-Nov
240	1285746.40	462893.11				-	no contact	-	dug to 12 in, nothing found	-	16-Nov
241	1285744.34	462877.48				8 W	scrap	12	steel plate under irrigation box	Y	15-Nov
242	1285672.41	462962.92				-	no contact	-	dug to 12 in, nothing found	-	15-Nov
243	1285707.64	462929.01				4 SW	other	0	reinforcement in wall	Y	16-Nov

Note: Yellow shading represents training digs requested by the demonstrators.

Munitions Related

4733 Woodway Lane Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
2001	1285604.27	462718.84	9.61		MkIV booster	0	scrap	12	bucket handle	N	6-Oct
2002	1285596.39	462723.19	34.65			6 W	other	36	power cable (utility)	Y	6-Oct
2003	1285587.04	462726.74	5.83		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2004	1285589.46	462728.21	5.85		MkIV booster	3 NE	scrap	5	nail, 5 in long	-	17-Nov
2005	1285590.46	462728.80	5.12			-	no contact	-	dug and nothing found	-	17-Nov
2006	1285594.63	462733.06	10.24			6 N	other	12	grounding rod (same as 2007)	Y	6-Oct
2007	1285594.47	462734.16	14.55		75 mm	6 S	other	12	grounding rod (same as 2006)	Y	6-Oct
2008	1285597.77	462739.34	7.87			0	scrap	6	nail, 3 in long	N	6-Oct
2009	1285611.74	462738.32	14.38		ISO M40	-	no contact	-	dug and nothing found	-	6-Oct
2010	1285606.91	462747.56	0.00		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2011	1285604.90	462748.53	0.00		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2012	1285606.57	462754.72	0.00		MkIV booster	-	no contact	-	dug and nothing found	N	6-Oct
2013	1285610.30	462758.63	1.74		ISO S80	2 E	scrap	6	tent stake, bent, 6 in long	N	6-Oct
2014	1285605.24	462760.53	1.22		MkIV booster	0	scrap	3	steel scrap, 1 in long	N	6-Oct
2015	1285604.84	462758.26	0.00		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2016	1285603.97	462758.72	0.78		MkIV booster	3 S	scrap	4	bolt, 3 in long	N	6-Oct
2017	1285602.68	462758.21	5.51			-	no contact	-	dug and nothing found	-	6-Oct
2018	1285603.19	462753.37	0.17		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2019	1285599.25	462747.51	7.59		MkIV booster	4 SE	scrap	8	wire, 8 in long (same as 2020)	N	6-Oct
2020	1285599.73	462746.36	0.00		MkIV booster	4 NW	scrap	8	wire, 8 in long (same as 2019)	N	6-Oct
2021	1285599.62	462745.01	1.97			-	no contact	-	dug and nothing found	-	6-Oct
2022	1285595.49	462744.59	3.47		MkIV booster	0	scrap	5	nail, 4 in long	N	6-Oct
2023	1285589.66	462742.36	7.02		MkIV booster	0	scrap	8	wire, 18 in long	N	6-Oct
2024	1285586.80	462736.81	2.71		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2025	1285586.25	462735.14	1.18			0	scrap	3	nail, 2 in long	N	6-Oct
2026	1285584.67	462739.76	5.51			-	no contact	-	dug and nothing found	-	6-Oct
2027	1285584.80	462741.03	1.78		MkIV booster	0	scrap	4	steel scrap, irregular	N	6-Oct
2028	1285582.44	462745.82	6.69			-	no contact	-	dug and nothing found	-	6-Oct
2029	1285582.67	462746.83	9.14		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2030	1285572.06	462741.29	0.26		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2031	1285571.72	462742.24	4.33			2 E	scrap		nail, 2 in long	N	6-Oct
2032	1285577.62	462753.65	6.40		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2033	1285578.17	462755.29	4.48		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2034	1285579.68	462754.95	4.33			-	no contact	-	dug and nothing found	-	6-Oct
2035	1285580.73	462756.69	8.27			0	scrap	6	pipe, 1 in long, 3 in diameter	N	6-Oct

4733 Woodway Lane Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
2036	1285579.41	462758.19	1.05		MkIV booster	2 NE	scrap	2	wire fragment	N	6-Oct
2037	1285574.03	462760.48	0.55		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2038	1285572.70	462757.58	2.41		MkIV booster	4 W	scrap	3	steel scrap, irregular	N	6-Oct
2039	1285571.86	462758.32	5.91			4 E	scrap	4	nail, 2 in long	N	6-Oct
2040	1285559.75	462759.30	2.23		MkIV booster	0	other	4	rebar in driveway	Y	6-Oct
2041	1285557.99	462759.62	1.97			-	no contact	-	dug and nothing found	N	6-Oct
2042	1285555.95	462758.57	5.40		MkIV booster	3 E	scrap	4	spoon	N	6-Oct
2043	1285554.67	462758.33	8.27			6 NE	scrap	6	nail, soda can pull tab	N	6-Oct
2044	1285553.60	462759.73	1.44		MkIV booster	6 W	scrap	2	nail, 1 in long	N	6-Oct
2045	1285552.72	462760.19	7.48			0	scrap	5	steel scrap	N	6-Oct
2046	1285554.51	462752.50	5.89		MkIV booster	7 E	scrap	6	pipe fitting, 4 in long, 3 in diameter	N	6-Oct
2047	1285547.45	462752.37	9.84			0	scrap	12	pipe, 6 in long, 3 in diameter	N	6-Oct
2048	1285545.60	462750.83	1.97			0	scrap	4	wire, 6 in long	N	6-Oct
2049	1285543.97	462750.95	35.04			4 NW	scrap	24	concrete	Y	6-Oct
2050	1285547.37	462748.56	31.10			4 N	scrap	8	wire, 4 in long x2	N	6-Oct
2051	1285547.92	462747.66	8.22		MkIV booster	0	scrap	6	wire, 4 in long	N	6-Oct
2052	1285549.51	462748.21	4.33			6 NE	scrap	8	bolt, bent, 6 in long	N	6-Oct
2053	1285549.26	462747.17	12.27		75 mm	4 E	scrap	4	wire, 4 in long	N	7-Oct
2054	1285544.62	462742.77	1.19		MkIV booster	-	no contact	-	dug and nothing found	-	17-Nov
2055	1285544.77	462739.90	2.54		MkIV booster	4 N	scrap	5	bolt, bent, 6 in long	N	6-Oct
2056	1285549.37	462739.55	12.99			-	no contact	-	dug and nothing found	-	17-Nov
2057	1285550.73	462737.31	6.84		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2058	1285548.00	462736.08	2.36			0	scrap	4	steel scrap, 3.5 in long	N	6-Oct
2059	1285546.90	462734.14	0.79			1 S	other	0	curb	Y	6-Oct
2060	1285546.77	462735.39	5.28		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2061	1285543.99	462737.25	2.00		MkIV booster	3 SE	scrap	6	steel rod, 5.5 in long	N	6-Oct
2062	1285536.50	462737.00				1 S	other	0	curb	Y	6-Oct
2063	1285537.59	462740.38	0.00		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2064	1285537.74	462741.52	2.82		MkIV booster	-	other	-	survey nail	Y	7-Oct
2065	1285538.83	462750.19	0.86		MkIV booster	4 SE	scrap	3	nail, 3 in long	N	6-Oct
2066	1285541.53	462752.09	0.00		MkIV booster	2 S	scrap	3	wire, 4 in long	N	6-Oct
2067	1285539.00	462753.50				16 S	scrap	4	battery, AA	N	6-Oct
2068	1285541.00	462757.00				3 E	scrap	6	steel scrap, 3 in wide, irregular	N	6-Oct
2069	1285543.85	462758.60	6.85		MkIV booster	6 NE	scrap	4	plumbing flange, 6 in diameter	N	6-Oct
2070	1285542.54	462761.34	2.53		MkIV booster	4 S	scrap	6	speaker frame fragment	N	6-Oct

4733 Woodway Lane Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
2071	1285541.50	462762.00				8 SE	scrap	2	aluminum foil	N	6-Oct
2072	1285543.65	462766.82	1.97			4 W	scrap	2	small bracket, 1 in long	N	6-Oct
2073	1285543.19	462767.77	1.58		MkIV booster	4 NW	scrap	2	nail, 2.5 in long	N	6-Oct
2074	1285551.37	462764.35	17.96		Stokes mortar	0	seed	16	blind seed 8 - Stokes Mortar	N	6-Oct
2075	1285558.54	462766.25	3.18		MkIV booster	0	scrap	5	screw, 3 in long	N	6-Oct
2076	1285560.84	462769.42	1.83		MkIV booster	3 S	scrap	1	nail, 1 in long	N	6-Oct
2077	1285564.05	462772.02	8.08		75 mm	0	other	6	rebar in driveway	N	6-Oct
2078	1285562.42	462773.07	1.57			-	no contact	-	dug and nothing found	-	6-Oct
2079	1285560.87	462774.60	5.91			0	scrap	10	pipe, 4 in diameter	N	6-Oct
2080	1285556.73	462776.36	0.98		MkIV booster	4 SW	scrap	4	nail x2, each 2 in long	N	6-Oct
2081	1285558.66	462778.13	27.46		Livens Vertical	-	no contact	-	dug and nothing found	-	6-Oct
2082	1285559.00	462779.75	2.20		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2083	1285560.63	462778.77	3.38		MkIV booster	6 SE	scrap	2	nail	N	6-Oct
2084	1285561.64	462781.58	3.22		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2085	1285564.45	462781.13	3.42		MkIV booster	3 N	scrap	4	nail, 2 in long	N	6-Oct
2086	1285564.78	462782.15	0.79			-	no contact	-	dug and nothing found	-	6-Oct
2087	1285566.04	462784.65	0.00		MkIV booster	0	scrap	2	steel banding, 3.5 in long	N	6-Oct
2088	1285567.59	462785.66	20.08			0	scrap	18	conduit (fragmented)	N	6-Oct
2089	1285560.73	462784.88	3.54			-	no contact	-	dug and nothing found	-	6-Oct
2090	1285561.46	462783.99	0.00		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2091	1285560.69	462783.09	8.12		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2092	1285553.37	462783.18	1.97			4 N	scrap	1	nail	N	6-Oct
2093	1285547.96	462783.41	0.01		MkIV booster	4 S	scrap	2	steel scrap, irregular, 2 in long	N	6-Oct
2094	1285549.68	462784.10	6.69			0	scrap	1	staple	N	6-Oct
2095	1285551.13	462784.40	0.00		MkIV booster	-	no contact	-	dug and nothing found		6-Oct
2096	1285557.39	462786.52	5.51			4 SE	scrap	3	wire, 12 in long x2	N	6-Oct
2097	1285558.14	462788.10	6.07		MkIV booster	6 W	scrap	2	wire, 12 in long x2	N	6-Oct
2098	1285558.86	462792.06	3.47		MkIV booster	4 E	scrap	3	wire, 12 in long x2	N	6-Oct
2099	1285555.00	462792.50				3 E	scrap	2	wire, 12 in long	N	7-Oct
2100	1285556.00	462795.50				0	scrap	2	wire, 12 in long	N	7-Oct
2101	1285554.00	462799.27	3.15			-	no contact	-	dug and nothing found	-	7-Oct
2102	1285554.78	462800.18	3.84		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2103	1285556.00	462800.50				6 NE	scrap		wire, 12 in long	N	7-Oct
2104	1285559.21	462803.29	5.25		MkIV booster	0	scrap	3	wire, 6 in long	N	6-Oct
2105	1285556.00	462807.00				2 N	scrap	0	nail x2 in stake	Y	7-Oct

4733 Woodway Lane Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
2106	1285561.60	462813.19	5.91			4 S	scrap	8	steel spike	N	7-Oct
2107	1285565.77	462807.88	10.71		MkIV booster	0	scrap	3	nail, 2 in long	N	7-Oct
2108	1285566.78	462808.99	0.30		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2109	1285568.63	462806.75	5.91			-	no contact	-	dug and nothing found	-	7-Oct
2110	1285566.61	462803.73	11.32		75 mm	2 W	scrap	4	nail, 2.5 in long	N	7-Oct
2111	1285566.78	462802.74	2.36			0	scrap	4	nail x2, each 2.5 in long	N	7-Oct
2112	1285560.50	462799.50				4 E	scrap	2	wire, 12 in long	N	6-Oct
2113	1285561.78	462795.31	7.42		MkIV booster	4 W	scrap	2	spray nozzle	N	7-Oct
2114	1285594.20	462765.55	7.13		MkIV booster	8 SW	scrap	10	steel scrap, 3.5 in long	N	6-Oct
2115	1285594.89	462769.23	4.51		MkIV booster	2 N	scrap	6	steel scrap, irregular, 2 in wide	N	6-Oct
2116	1285594.36	462777.00	1.02		MkIV booster		other		rebar within wall	Y	7-Oct
2117	1285593.73	462780.62	2.36			-	no contact	-	dug and nothing found	-	6-Oct
2118	1285597.34	462779.83	7.04		MkIV booster	0	scrap	6	nail, 3 in long	N	6-Oct
2119	1285599.51	462780.19	15.81		75 mm	0	seed	8	blind seed 10 - small ISO (stainless steel)	N	6-Oct
2120	1285602.28	462780.74	10.24			2 E	scrap	6	nail, 1 in long	N	6-Oct
2121	1285604.03	462776.40	0.94		MkIV booster	0	scrap	4	nail, 3 in long	N	6-Oct
2122	1285610.45	462776.23	10.63			4 W	scrap	2	screw, 2 in long	N	6-Oct
2123	1285618.56	462766.19	0.83		MkIV booster	6 E	scrap	6	steel scrap, 4 in long, corroded	N	6-Oct
2124	1285618.86	462767.73	0.03		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2125	1285618.66	462770.33	0.60		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2126	1285620.63	462773.76	6.69			4 SW	scrap	6	steel scrap, <1 inch size	N	6-Oct
2127	1285619.75	462778.25	5.87		MkIV booster	0	scrap	8	handle, 6 in wide	N	6-Oct
2128	1285621.53	462779.91	7.09			3 N	other	-	contact in root of tree - incomplete excavation	Y	7-Oct
2129	1285617.75	462779.19	0.18		MkIV booster	-	no contact	-	dug and nothing found	-	6-Oct
2130	1285613.68	462782.63	7.87			4 W	scrap	8	wire in tree root	Y	6-Oct
2131	1285612.18	462783.19	4.78		MkIV booster	4 E	scrap	8	wire in tree root	Y	6-Oct
2132	1285618.93	462784.75	19.29			4 W	scrap	24	pipe, 4 in long	N	7-Oct
2133	1285625.25	462787.69	14.42		75 mm	0	seed	11	blind seed 7 - vertical 75 mm	N	6-Oct
2134	1285625.14	462789.29	2.18		MkIV booster	3 N	scrap	2	nail	N	7-Oct
2135	1285623.69	462790.09	0.00		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2136	1285625.40	462793.40	0.00		MkIV booster	0	scrap	2	nail, 2 in long	N	7-Oct
2137	1285626.95	462793.01	5.55		MkIV booster	6 E	scrap	4	nail x4, 1 to 3 inches long	N	7-Oct
2138	1285628.57	462796.73	0.97		MkIV booster	0	scrap	2	nail	N	7-Oct
2139	1285626.35	462797.94	7.48			-	no contact	-	dug and nothing found	-	7-Oct
2140	1285625.87	462796.61	0.01		MkIV booster	4 SE	scrap	1	ear ring hook	N	7-Oct

4733 Woodway Lane Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
2141	1285623.40	462798.22	0.00		MkIV booster	3 SE	scrap	2	nail	N	7-Oct
2142	1285620.67	462796.60	6.30			-	no contact	-	dug and nothing found	-	7-Oct
2143	1285619.48	462796.96	0.36		MkIV booster	0	scrap	2	nail	N	7-Oct
2144	1285621.34	462800.28	1.56		MkIV booster	2 N	scrap	2	nail	N	7-Oct
2145	1285621.35	462801.44	4.33			-	no contact	-	dug and nothing found	-	7-Oct
2146	1285622.36	462803.34	0.91		MkIV booster	0	scrap	3	nail	N	7-Oct
2147	1285627.37	462800.67	0.00		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2148	1285627.48	462801.77	5.12			-	no contact	-	dug and nothing found	-	7-Oct
2149	1285627.02	462804.71	11.02			5 N	scrap	4	nail	N	7-Oct
2150	1285625.36	462805.17	9.49		MkIV booster	0	scrap	4	nail	N	7-Oct
2151	1285626.18	462808.34	39.37		Livens Horiz	-	no contact	-	dug to 46 inches and nothing found, close to gas line	-	7-Oct
2152	1285629.50	462807.00				-	no contact	-	dug and nothing found	-	7-Oct
2153	1285632.20	462807.40	0.00		MkIV booster	0	scrap	2	screw	N	7-Oct
2154	1285630.85	462809.36	0.06		MkIV booster	3 SE	scrap	2	screw	N	7-Oct
2155	1285631.11	462818.18	1.22		MkIV booster	-	no contact	-	dug and nothing found	-	16-Nov
2156	1285629.62	462818.15	0.00		MkIV booster	-	no contact	-	dug and nothing found	-	16-Nov
2157	1285623.36	462825.44	0.00		ISO M40	-	no contact	-	dug and nothing found, near gas line	-	16-Nov
2158	1285622.57	462824.22	5.12			4 NE	scrap	4	gutter downspout in concrete	N	16-Nov
2159	1285621.78	462825.17	2.36			-	no contact	-	dug and nothing found, near gas line	-	16-Nov
2160	1285619.88	462830.57	5.12			0	scrap	6	bracket	N	7-Oct
2161	1285620.53	462831.63	0.00		MkIV booster	4 SW	scrap	2	nail	N	7-Oct
2162	1285622.35	462833.68	4.33			-	no contact	-	dug and nothing found	-	7-Oct
2163	1285620.83	462834.01	0.79			-	no contact	-	dug and nothing found	-	7-Oct
2164	1285616.74	462833.48	0.39			2 N	scrap	2	nail, 3 in long	N	7-Oct
2165	1285617.35	462834.43	1.57			4 SE	scrap	2	nail, 3 in long	N	7-Oct
2166	1285616.91	462836.94	5.47		MkIV booster	0	scrap	3	nail, 3 in long	N	7-Oct
2167	1285613.16	462836.63	3.54			-	no contact	-	dug and nothing found	-	7-Oct
2168	1285613.30	462834.56	10.82		MkIV booster	0	scrap	4	nail, 3 in long	N	7-Oct
2169	1285612.72	462832.24	2.70		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2170	1285610.19	462833.95	3.15			-	no contact	-	dug and nothing found	-	7-Oct
2171	1285609.20	462835.61	31.89			6 N	scrap	2	nail, 1 in long	N	7-Oct
2172	1285607.24	462839.27	8.27			3 E	scrap	4	nail, 3 in long	N	7-Oct
2173	1285611.60	462837.87	2.26		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2174	1285613.28	462842.13	3.15			6 N	scrap	2	nail	N	7-Oct

4733 Woodway Lane Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
2175	1285609.10	462845.74	4.56		MkIV booster	0	scrap	3	nail, 2 in long	N	7-Oct
2176	1285606.67	462845.47	0.00			2 N	scrap	2	nail, 1.5 in long	N	7-Oct
2177	1285607.97	462848.14	3.61		MkIV booster	0	scrap	3	screw, 1.5 in long	N	7-Oct
2178	1285610.47	462854.26	3.09		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2179	1285613.23	462854.98	0.00		MkIV booster	6 N	other	-	rebar within wall	Y	7-Oct
2180	1285613.11	462857.17	14.17			-	other	-	rebar within wall	Y	7-Oct
2181	1285604.00	462858.00				8 N	other	-	rebar within wall	Y	7-Oct
2182	1285601.42	462851.50	11.89		MkIV booster	0	seed	8	blind seed 9 - small ISO (welded steel)	N	7-Oct
2183	1285599.05	462847.39	13.08		MkIV booster	6 N	scrap	10	house wire, nail x2, each 3 in long	N	7-Oct
2184	1285601.86	462845.44	5.73		MkIV booster	-	no contact	-	dug and nothing found	-	7-Oct
2185	1285601.70	462843.01	0.00			0	scrap	2	nail, 3 in long	N	7-Oct
2186	1285598.52	462843.22	13.78		MkIV booster	3 SW	scrap	6	screw, 3 in long	N	7-Oct
2187	1285595.98	462844.87	6.69			2 E	scrap	3	nail, 3 in long	N	7-Oct
2188	1285595.20	462840.06	2.53		MkIV booster	0	scrap	8	nail x30	N	7-Oct
2189	1285592.53	462842.75	6.15		MkIV booster	0	scrap	10	steel scrap, 4 in long, corroded	N	7-Oct
2190	1285590.68	462842.32	3.94			4 N	scrap	2	screw x2, 3 in long	N	7-Oct
2191	1285592.21	462844.75	0.79			0	scrap	4	screw, 1.5 in long	N	7-Oct
2192	1285591.52	462847.30	5.51			6 NW	scrap	8	nail x7, each 4 in long	N	7-Oct
2193	1285592.81	462848.48	7.45		MkIV booster	6 S	scrap	4	screw x2, each 3 in long	N	7-Oct
2194	1285592.00	462850.00				8 E	scrap	2	screw x2, each 3 in long	N	7-Oct
2195	1285593.05	462850.92	12.20			6 S	scrap	6	screw x2, each 3 in long	N	7-Oct
2196	1285594.74	462851.51	5.95		MkIV booster	3 E	scrap	2	screw x2, each 3 in long	N	7-Oct
2197	1285595.20	462849.61	12.84		MkIV booster	0	scrap	6	screw x2, each 3 in long	N	7-Oct
2198	1285596.62	462849.65	6.30			0	scrap		steel scrap, curved, 4 in long	N	7-Oct
2199	1285597.74	462852.12	7.43		MkIV booster	6 NE	scrap	10	steel spike, 7 in long	N	7-Oct
2200	1285593.33	462856.34	5.12			3 NW	scrap	3	screw, 2 in long	N	7-Oct
2201	1285591.31	462854.68	4.33			-	no contact	-	dug and nothing found	-	7-Oct
2202	1285591.07	462856.25	6.89		MkIV booster	2 SE	scrap	1	nail, 1 in long	N	7-Oct
2203	1285587.73	462859.04	4.76		MkIV booster	4 SE	scrap	3	nail, 3 in long	N	7-Oct
2204	1285586.43	462859.82	6.10		MkIV booster	0	scrap	2	screw, 3 in long	N	7-Oct
2205	1285584.95	462855.33	5.12			2 E	scrap	2	screw, 3 in long	N	7-Oct
2206	1285580.95	462857.80	7.09			4 W	scrap	4	screw, 3 in long	N	7-Oct
2207	1285579.00	462852.82	18.90			0	scrap	24	fence post	Y	7-Oct
2208	1285583.74	462852.14	9.45			4 E	scrap	2	nail, 2 in long	N	7-Oct
2209	1285585.00	462851.00				0	scrap	14	rebar, ~36 in long (same as 2210)	N	7-Oct

4733 Woodway Lane Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
2210	1285584.69	462849.76	17.32			0	scrap	16	rebar, ~36 in long (same as 2209)	N	7-Oct
2211	1285587.40	462850.54	9.54		MkIV booster	6 NE	scrap	6	screw, 3 in long	N	7-Oct
2212	1285588.23	462851.42	9.84			2 E	scrap	5	razor blade, nail, 3 in long	N	7-Oct
2213	1285588.92	462852.34	8.04		MkIV booster	0	scrap	4	screw	N	7-Oct
2214	1285588.56	462848.04	15.75			6 SE	scrap	3	nail, 3 in long	N	7-Oct
2215	1285586.40	462845.65	7.09			4 NE	scrap	2	nail, 1 in long	N	7-Oct
2216	1285586.64	462844.32	1.97			0	scrap	2	screw x2, 1 to 3 in long	N	7-Oct
2217	1285585.03	462843.56	16.84		75 mm	3 SE	scrap	6	screw, 3.5 in long	N	7-Oct
2218	1285584.31	462847.17	22.44			8 N	scrap	17	large bolt	N	7-Oct
2219	1285581.28	462848.14	22.44			2 E	scrap	8	steel rod, 3.5 in long	N	7-Oct
2220	1285579.58	462845.85	5.40		ISO M40	6 SE	scrap	3	nail, 3.5 in long	N	7-Oct
2221	1285581.45	462844.70	4.33			4 E	scrap	2	nail, 3 in long	N	7-Oct
2222	1285562.47	462826.55	3.15			0	scrap	2	screw, 3 in long	N	7-Oct
2223	1285565.99	462837.28	10.33		MkIV booster	3 S	scrap	4	screw, 3 in long	N	7-Oct
2224	1285568.50	462849.00							rebar in wood block - not dug	Y	7-Oct
2225	1285573.85	462850.25	2.76						survey nail	Y	7-Oct
2226	1285573.15	462853.35	13.19		75 mm	4 W	other	12	fiber optic cable	Y	7-Oct
2227	1285573.00	462855.00				4 W	other	12	fiber optic cable	Y	7-Oct
2228	1285573.00	462862.00				0	scrap	6	fence post, 18 in long	N	7-Oct
2229	1285581.56	462864.02	16.54			0	scrap	10	bolt, wire x6	N	7-Oct
2230	1285581.05	462865.65	15.21		75 mm	4 W	scrap	12	steel scrap, nail x2	N	7-Oct

Note: Yellow shading represents training digs requested by the demonstrators.

4740 Quebec Street Dig Sheet

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1001	1285519.97	463024.81	13.76			1 E	scrap	5	battery	N	5-Oct
1002	1285521.04	463023.09	4.43		MkIV booster	0	scrap	4	steel scrap x3	N	5-Oct
1003	1285522.26	463021.03	7.07			3 SE	scrap	6	steel scrap	N	5-Oct
1004	1285524.00	463018.68	10.89		MkIV booster		scrap		metal within concrete	N	16-Nov
1005	1285524.38	463019.82	12.97			0	other	12	asphalt	N	5-Oct
1006	1285526.95	463022.93	8.57		MkIV booster	0	scrap	4	nail	N	5-Oct
1007	1285526.40	463019.67	18.37		ISO M40	4 SE	scrap	10	nail x3	N	5-Oct
1008	1285526.34	463018.69	14.93				scrap		metal within concrete	N	16-Nov
1009	1285526.61	463014.59	8.47		ISO S80	2 E	scrap	4	staple, 1 in long	N	16-Nov
1010	1285529.04	463011.83			MkIV booster	0	scrap	6	wire, 12 in long	N	6-Oct
1011	1285531.04	463012.53	6.68			2 S	scrap	2	wire, 12 in long	N	6-Oct
1012	1285536.23	463010.49	12.58			3 N	scrap	4	wire, 12 in long	N	6-Oct
1013	1285540.32	463003.28			MkIV booster	4 NE	scrap	2	wire, 12 in long	N	6-Oct
1014	1285541.24	463005.33	8.25			2 N	scrap	3	wire, 12 in long	N	6-Oct
1015	1285542.11	463008.62	6.77		MkIV booster	0	scrap	2	wire, 12 in long	N	6-Oct
1016	1285543.90	463008.64	14.93			3 NW	scrap	4	wire, 12 in long	N	6-Oct
1017	1285545.14	463012.46	18.83		MkIV booster	4 SE	scrap	10	nail, 4 in long		16-Nov
1018	1285554.48	463015.00	0.39			3 N	scrap	3	steel scrap	N	5-Oct
1019	1285554.78	463015.95	0.09		MkIV booster	-	no contact	-	dug and nothing found		5-Oct
1020	1285556.03	463010.82	4.76		MkIV booster	4 S	scrap	3	nail	N	5-Oct
1021	1285559.25	463008.64	3.93			12 N	other	0	Sewer/Water Meter	Y	5-Oct
1022	1285560.29	463008.88	1.41		MkIV booster		other	0	Sewer/Water Meter	Y	5-Oct
1023	1285561.63	463007.55	7.47			3 N	other	12	conrete rubble	Y	5-Oct
1024	1285562.28	463008.38	12.69		MkIV booster	3 S	other	12	conrete rubble	Y	5-Oct
1025	1285565.69	463007.96	5.90			2 SE	scrap	8	pipe 2 inch diameter	N	5-Oct
1026	1285565.87	463006.65	7.29		MkIV booster	0	scrap	8	steel banding	N	5-Oct
1027	1285563.11	463002.75	11.79			0	scrap	3	wire, 12 in long	N	6-Oct
1028	1285561.87	463002.88	4.32			3 E	scrap	2	wire, 12 in long	N	6-Oct
1029	1285559.66	463003.50	8.65			0	scrap	4	wire, 12 in long	N	6-Oct
1030	1285557.70	463003.79	4.77		MkIV booster	2 SE	scrap	3	wire, 12 in long	N	6-Oct
1031	1285554.22	463006.04	6.29			-	other	-	on gas line (not dug)	-	16-Nov
1032	1285554.88	463004.45	5.78		MkIV booster	0	scrap	3	wire, 12 in long	N	6-Oct
1033	1285555.18	462999.63	1.18			4 NE	scrap	4	wire, 12 in long	N	6-Oct

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1034	1285553.65	462999.00			MkIV booster	0	scrap	2	wire, 12 in long	N	6-Oct
1035	1285562.48	462994.25	1.75		MkIV booster	4 N	scrap	3	wire, 12 in long	N	6-Oct
1036	1285562.06	462992.50	5.11			6 S	other	-	contact under walkway	Y	6-Oct
1037	1285564.84	462991.57	5.11			0	scrap	2	wire, 12 in long	N	6-Oct
1038	1285565.77	462992.24	1.02		MkIV booster	6 NE	scrap	2	wire, 12 in long x2	N	6-Oct
1039	1285567.71	463000.10	4.68		MkIV booster	4 N	scrap	3	wire, 12 in long	N	6-Oct
1040	1285569.03	463000.92	8.65			0	scrap	2	wire, 12 in long	N	6-Oct
1041	1285580.00	462998.50		462.3		12 SW	other	0	dug to 12 in below concrete, source is likely hand rail on surface	Y	16-Nov
1042	1285582.31	463004.32	0.43		MkIV booster	6 SW	scrap	2	nail	N	5-Oct
1043	1285583.58	463003.44	14.15			-	no contact	-	dug and nothing found	-	5-Oct
1044	1285585.55	462997.84	6.29			3 N	other	3	reinforced concrete	Y	16-Nov
1045	1285597.57	463004.94							survey nail in asphalt - not dug	Y	
1046	1285593.98	462996.74				0	scrap	8	nail, 4 in long	N	16-Nov
1047	1285593.50	462995.00		61.23		2 S	scrap	6	nail, 3 in long	N	16-Nov
1048	1285590.24	462989.76				0	scrap	10	steel banding	N	5-Oct
1049	1285588.32	462977.31				0	scrap	6	nail	N	5-Oct
1050	1285585.31	462974.76		17.05		0	scrap	8	steel scrap	N	5-Oct
1051	1285583.45	462971.25		19.81		0	scrap	4	steel scrap in concrete	Y	5-Oct
1052	1285581.75	462971.91	7.55		MkIV booster	3 W	scrap	8	nail x2	N	5-Oct
1053	1285580.51	462971.47	13.36			0	scrap	8	steel scrap	N	5-Oct
1054	1285577.60	462972.07	4.72			0	scrap	4	steel scrap	N	5-Oct
1055	1285576.22	462970.69	4.72						wall - not dug	Y	
1056	1285575.23	462971.14	2.09		MkIV booster				wire on wall - not dug	Y	
1057	1285575.62	462972.91	9.02		MkIV booster				wall - not dug	Y	
1058	1285571.97	462983.15	4.56		MkIV booster	0	scrap	5	steel scrap	N	5-Oct
1059	1285570.70	462980.12	1.97			1 N	scrap	2	wire, 12 in long	N	5-Oct
1060	1285569.53	462980.32	3.75		MkIV booster	0	scrap	1	wire, 12 in long	N	5-Oct
1061	1285568.33	462980.55	2.74		MkIV booster	0	scrap	1	wire, 12 in long	N	5-Oct
1062	1285568.13	462978.99	0.79			0	scrap	1	wire, 12 in long	N	5-Oct
1063	1285566.60	462978.71	9.43			6 S	scrap	1	wire, 12 in long x2	N	5-Oct
1064	1285563.79	462980.32	8.25			0	scrap	2	wire, 12 in long x3, steel scrap	N	5-Oct
1065	1285561.46	462980.65	11.40			4 S	scrap	2	wire, 12 in long x2	N	5-Oct

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1066	1285558.28	462981.78	6.68			3 SW	scrap	1	wire, 12 in long	N	5-Oct
1067	1285552.95	462981.37	1.57			0	scrap	2	wire, 12 in long	N	5-Oct
1068	1285552.69	462982.69	1.51		MkIV booster	3 N	scrap	1	wire, 12 in long x2	N	5-Oct
1069	1285548.20	462985.00	4.56		MkIV booster	0	scrap	2	wire, 12 in long	N	5-Oct
1070	1285546.68	462985.04	19.26			0	scrap	2	wire, 12 in long	N	5-Oct
1071	1285545.36	462983.63	18.08			0	other	16	contact under irrigation pipe	Y	5-Oct
1072	1285529.37	462987.08	9.10		MkIV booster	4 SE	other	-	contact in roots - could not resolve completely	Y	6-Oct
1073	1285532.09	462990.26	10.50		MkIV booster	2 E	scrap	3	wire, 6 in long	N	5-Oct
1074	1285530.99	462990.90	7.47			4 SE	scrap	3	wire, 4 in long	N	5-Oct
1075	1285527.43	462997.49	7.48		MkIV booster	3 N	scrap	4	steel scrap x2	N	5-Oct
1076	1285523.51	462997.44	2.95		MkIV booster	0	scrap	3	steel scrap	N	5-Oct
1077	1285526.59	463002.22	3.54			0	scrap	1	wire, 12 in long	N	5-Oct
1078	1285527.30	463005.94	2.75			4 S	scrap	2	wire, 12 in long	N	6-Oct
1079	1285523.94	463005.12	7.56		MkIV booster				near sensitive plants - not excavated		
1080	1285523.86	463006.13	1.97			8 N	other		within roots of large tree	Y	6-Oct
1081	1285518.37	463011.26	5.50						near sensitive plants - not excavated		
1082	1285517.75	463009.99	6.46		MkIV booster				near sensitive plants - not excavated		
1083	1285517.59	463003.01	1.75		MkIV booster	6 SW	scrap		steel scrap	N	6-Oct
1084	1285514.79	462990.38	6.25		MkIV booster				near sensitive plants - not excavated		
1085	1285511.23	462990.71	7.87		MkIV booster				near sensitive plants - not excavated		
1086	1285508.28	462989.23	7.62		MkIV booster				near sensitive plants - not excavated		
1087	1285510.96	462985.37	8.48		MkIV booster				near sensitive plants - not excavated		
1088	1285512.45	462979.68	10.55		MkIV booster				near sensitive plants - not excavated		
1089	1285506.48	462978.68	20.28		Stokes mortar	0	scrap	16	flat band of steel, 6 in long, 1 in wide	N	5-Oct
1090	1285499.50	462968.50		36.3		-	no contact	-	dug and nothing found		6-Oct
1091	1285501.20	462967.10	5.11			0	scrap	7	steel scrap	N	6-Oct
1092	1285499.00	462964.00		28.0		3 N	scrap	6	nail	N	6-Oct
1093	1285501.41	462964.75	1.97			0	scrap	4	nail	N	6-Oct
1094	1285502.59	462963.67			MkIV booster	4 NE	scrap	6	nail	N	6-Oct
1095	1285507.42	462973.02	6.69		MkIV booster				near sensitive plants - not excavated		
1096	1285509.51	462972.07	3.93			0	scrap	4	steel scrap	N	5-Oct
1097	1285511.65	462974.39	11.66		MkIV booster				near sensitive plants - not excavated		
1098	1285516.50	462976.28	9.25		MkIV booster				near sensitive plants - not excavated		

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1099	1285519.49	462973.89	4.15		MkIV booster	2 NW	scrap	2	nail	N	5-Oct
1100	1285524.56	462974.36	5.19		MkIV booster	6 E	scrap	3	nail	N	5-Oct
1101	1285529.78	462977.12	5.90						near sensitive plants - not excavated		
1102	1285531.32	462977.10			MkIV booster				near sensitive plants - not excavated		
1103	1285540.48	462971.16	9.35		MkIV booster				near sensitive plants - not excavated		
1104	1285545.68	462973.88	3.17		MkIV booster				near sensitive plants - not excavated		
1105	1285547.80	462970.94	4.34		MkIV booster				near sensitive plants - not excavated		
1106	1285552.31	462966.31	13.76		Stokes mortar	8 W	scrap		wire mesh of root basket	Y	6-Oct
1107	1285560.01	462963.32			75 mm	0	scrap		wire mesh of root basket	Y	6-Oct
1108	1285565.44	462968.20	3.94		MkIV booster	4 SE	scrap	8	nail x2, braided cable	N	5-Oct
1109	1285573.26	462960.06	8.16		MkIV booster				wall - not excavated	Y	
1110	1285574.47	462964.92			MkIV booster	0	scrap	10	steel scrap	N	5-Oct
1111	1285576.25	462965.14	3.93			0	scrap	6	steel scrap	N	5-Oct
1112	1285578.80	462968.01	10.22			0	scrap	10	steel scrap	N	5-Oct
1113	1285578.88	462968.95	6.29			0	scrap	6	steel scrap	N	5-Oct
1114	1285580.05	462969.33	11.72		MkIV booster	2 N	scrap	8	steel scrap	N	5-Oct
1115	1285581.35	462969.02				6 SE	scrap	6	nail	N	5-Oct
1116	1285586.26	462968.66							wall - not excavated	Y	
1117	1285584.82	462965.63							wall - not excavated	Y	
1118	1285582.62	462964.85		18.37		0	scrap	8	steel scrap	N	5-Oct
1119	1285583.30	462959.01							wall - not excavated	Y	
1120	1285579.38	462956.99		13.35		2 N	scrap		steel scrap	N	5-Oct
1121	1285575.77	462949.73				0	scrap	10	steel scrap	N	5-Oct
1122	1285577.78	462949.14		23.33		0	scrap	6	steel scrap	N	5-Oct
1123	1285580.05	462949.02							wall - not excavated	Y	
1124	1285577.73	462942.68							wall - not excavated	Y	
1125	1285574.67	462931.82				-	no contact	-	dug and nothing found		5-Oct
1126	1285566.00	462948.00		67.44		0	scrap	6	steel scrap	N	5-Oct
1127	1285560.50	462939.00		128.8		3W	scrap	10	steel scrap	N	5-Oct
1128	1285562.26	462928.94	12.28		MkIV booster	6 E	scrap	4	nail	N	5-Oct
1129	1285558.50	462928.50		543.1		0	scrap	6	steel scrap	N	5-Oct
1130	1285558.11	462923.81	9.07		MkIV booster	0	scrap	12	nail x3	N	4-Oct
1131	1285555.83	462919.36	13.47		ISO M40	2 SE	scrap	6	nail x2	N	5-Oct

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1132	1285544.86	462913.11	8.15		MkIV booster	9 E	scrap	5	bolt	N	4-Oct
1133	1285545.19	462911.80	11.79			12 W	scrap	6	nail	N	4-Oct
1134	1285546.80	462909.77	9.35		MkIV booster	3 E	other	3	wiring to house	Y	4-Oct
1135	1285552.02	462905.74	25.55			-	no contact	-	dug and nothing found		4-Oct
1136	1285551.08	462906.07	6.56		MkIV booster	4 S	scrap	6	nail	N	4-Oct
1137	1285548.35	462893.94	6.02		MkIV booster	2 NW	scrap	8	steel hook	N	4-Oct
1138	1285549.92	462896.18	3.48		ISO S80	7 SE	scrap	3	large spike, 8 in long	N	4-Oct
1139	1285549.09	462897.15	7.86			-	no contact	-	dug and nothing found		4-Oct
1140	1285548.24	462898.68	4.98		MkIV booster	0	scrap	2	wire, 24 in long	N	4-Oct
1141	1285546.89	462898.97	1.57			0	scrap	3	steel scrap	N	
1142	1285541.71	462903.37				4 NW	scrap	6	nail, copper scrap	N	4-Oct
1143	1285535.64	462905.19	2.13		MkIV booster	-	no contact	-	dug and nothing found		4-Oct
1144	1285536.76	462909.43	2.40		MkIV booster	0	scrap	7	nail	N	4-Oct
1145	1285536.07	462914.34	0.39			2 S	scrap	4	steel scrap	N	4-Oct
1146	1285534.12	462916.70	2.60		MkIV booster	-	other	-	foundation	Y	4-Oct
1147	1285520.37	462911.94	5.11			0	scrap	3	saw blade	N	4-Oct
1148	1285521.10	462917.22	8.13		MkIV booster	2 N	scrap	5	nail x3	N	4-Oct
1149	1285520.48	462916.37	3.54			-	no contact	-	dug and nothing found		4-Oct
1150	1285518.97	462914.51	2.75			0	scrap	5	pipe fragment	N	4-Oct
1151	1285517.89	462916.88	7.10		MkIV booster	0	scrap	4	nail x2	N	4-Oct
1152	1285515.63	462917.58	0.39			2 E	scrap	3	nail x2	N	4-Oct
1153	1285515.17	462918.36	8.65			0	scrap	7	nail	N	4-Oct
1154	1285514.33	462920.37	4.42		MkIV booster	2 NW	seed	6	blind seed 19 - small ISO	N	4-Oct
1155	1285520.56	462925.22	6.83		MkIV booster	-	other	-	foundation	Y	4-Oct
1156	1285519.71	462926.74	3.39		MkIV booster	3	scrap	2	wire	N	4-Oct
1157	1285513.42	462925.06	1.97			-	no contact	-	dug and nothing found		4-Oct
1158	1285510.33	462921.70	7.47			3 N	scrap	3	nail	N	4-Oct
1159	1285510.49	462920.33	2.13		MkIV booster	1 W	scrap	1	steel scrap	N	4-Oct
1160	1285509.37	462912.61	0.39			0	scrap	2	steel scrap	N	4-Oct
1161	1285503.49	462914.33				3 S	scrap	3	wire, 4 in long	N	4-Oct
1162	1285505.53	462916.48	11.00			0	seed	7	blind seed 20, medium ISO	N	4-Oct
1163	1285503.74	462918.99	12.18		MkIV booster	0	scrap	1	steel scrap	N	4-Oct
1164	1285502.72	462924.07	8.28		MkIV booster	2 SW	scrap	5	wire, 8 in long	N	4-Oct

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1165	1285507.04	462928.09	1.85		MkIV booster	0	scrap	2	large nail x2, 8 in long	N	4-Oct
1166	1285505.72	462930.80	8.07		MkIV booster	0	scrap	5	nail x2	N	4-Oct
1167	1285505.29	462934.13	6.32		MkIV booster	-	no contact	-	dug and nothing found		4-Oct
1168	1285500.63	462932.90	4.72						survey nail	Y	
1169	1285499.17	462929.51	4.75		MkIV booster	12	scrap	2	steel scrap	N	4-Oct
1170	1285497.98	462920.65	5.50			4 S	scrap	5	U-bolt	N	4-Oct
1171	1285497.51	462918.94	5.56		MkIV booster	-	no contact	-	dug and nothing found	N	4-Oct
1172	1285485.50	462908.00		552.3					chain link fence	Y	
1173	1285485.50	462905.00		441.2					chain link fence	Y	
1174	1285488.08	462903.59	4.72						chain link fence	Y	
1175	1285488.97	462904.18	6.01		MkIV booster				chain link fence	Y	
1176	1285492.50	462906.50		321.3		2 NE	scrap	3	wire	N	4-Oct
1177	1285496.00	462902.00		681.6		3 S	scrap	2	wire	N	4-Oct
1178	1285500.00	462899.00		78.32		-	no contact	-	dug and nothing found		4-Oct
1179	1285501.23	462903.00	8.25			0	seed	3	blind seed 18, 75 mm	N	4-Oct
1180	1285507.00	462904.50		28.62		4 W	scrap	8	nail	N	4-Oct
1181	1285510.57	462904.64	3.93			6 E	other	3	concrete (near wall)	Y	4-Oct
1182	1285511.91	462903.40	3.67		MkIV booster	-	no contact	-	dug and nothing found		4-Oct
1183	1285512.35	462902.48	3.18		MkIV booster	5 N	scrap	3	nail x2	N	4-Oct
1184	1285512.04	462899.58	4.29		MkIV booster	8 W	scrap	5	nail	N	4-Oct
1185	1285512.50	462895.00		732.2		4 NE	scrap	2	wire, 36 in long	N	4-Oct
1186	1285513.64	462895.80	0.39			4 SW	scrap	2	wire, 36 in long	N	4-Oct
1187	1285517.33	462898.24	4.32			12 N	scrap	1	nail	N	4-Oct
1188	1285522.36	462896.51	0.18		MkIV booster	7 E	scrap	1	wire, 8 inch long	N	4-Oct
1189	1285520.56	462898.62	17.69			0	seed	26	blind seed 17, inert 75 mm round	N	4-Oct
1190	1285520.35	462899.80	6.11		MkIV booster	-	no contact	-	dug and nothing found		4-Oct
1191	1285520.63	462901.84			MkIV booster	10 E	scrap	3	nail	N	4-Oct
1192	1285519.52	462902.11	2.75			-	no contact	-	dug and nothing found		4-Oct
1193	1285521.60	462905.70	2.75			4 W	scrap	3	nail	N	4-Oct
1194	1285527.66	462904.17	4.39		ISO S80	2 S	scrap	1	large spike, 8 in long	N	4-Oct
1195	1285530.59	462902.01	5.50		MkIV booster	6 E	scrap	5	nail	N	4-Oct
1196	1285530.79	462900.53	23.19			-	no contact	-	dug and nothing found		4-Oct
1197	1285530.80	462899.40	0.39			4 NE	scrap	3	nail	N	4-Oct

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1198	1285531.60	462896.21	5.36		MkIV booster	-	no contact	-	dug and nothing found		4-Oct
1199	1285526.24	462894.99			MkIV booster	-	no contact	-	dug and nothing found		4-Oct
1200	1285525.41	462893.64	1.57			-	no contact	-	dug and nothing found		4-Oct
1201	1285526.00	462890.50		260.8		6 S	other	12	contact in roots - could not resolve completely	Y	4-Oct
1202	1285532.67	462892.65	1.04		ISO S80	6 W	scrap	4	magnet	N	4-Oct
1203	1285533.74	462894.91	4.84		MkIV booster	0	scrap	2	nail	N	4-Oct
1204	1285537.46	462894.62	2.75		MkIV booster	0	scrap	8	nail, steel scrap	N	4-Oct
1205	1285543.13	462889.04	3.93			0	scrap	5	steel scrap	N	4-Oct
1206	1285542.67	462887.78	0.64		MkIV booster	0	scrap	3	steel scrap	N	4-Oct
1207	1285546.19	462888.18	9.53		MkIV booster	0	scrap	1	steel bracket	N	4-Oct
1208	1285550.16	462884.60	4.36		MkIV booster	3 SW	scrap	6	nail	N	4-Oct
1209	1285549.23	462883.34	14.54			-	no contact	-	dug and nothing found		4-Oct
1210	1285509.71	462995.20							MPV extra - not dug		
1211	1285510.84	462997.11							MPV extra - not dug		
1212	1285515.64	462995.61							MPV extra - not dug		
1213	1285518.01	462995.96							MPV extra - not dug		
1214	1285511.74	463000.10							MPV extra - not dug		
1215	1285512.21	463002.13							MPV extra - not dug		
1216	1285518.23	463015.49							MPV extra - not dug		
1217	1285523.91	463022.55				2 east	scrap	8	steel scrap	N	4-Oct
1218	1285524.59	463024.14				0	scrap	4	wire x8	N	4-Oct
1219	1285530.45	463019.72							MPV extra - not dug		
1220	1285559.77	463015.04							MPV extra - not dug		
1221	1285562.10	463011.34							MPV extra - not dug		
1222	1285562.80	463009.98							MPV extra - not dug		
1223	1285580.92	462988.55							MPV extra - not dug		
1224	1285554.61	462976.57							MPV extra - not dug		
1225	1285549.99	462975.62							MPV extra - not dug		
1226	1285546.97	462977.23							MPV extra - not dug		
1227	1285547.46	462973.99							MPV extra - not dug		

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1228	1285550.48	462972.86							MPV extra - not dug		
1229	1285550.01	462970.37							MPV extra - not dug		
1230	1285559.05	462970.34							MPV extra - not dug		
1231	1285562.61	462970.78							MPV extra - not dug		
1232	1285562.59	462968.48							MPV extra - not dug		
1233	1285563.94	462965.67							MPV extra - not dug		
1234	1285567.42	462966.55							MPV extra - not dug		
1235	1285568.53	462964.29							MPV extra - not dug		
1236	1285570.47	462955.81							wall - not dug	Y	
1237	1285572.50	462939.75							MPV extra - not dug		
1238	1285541.24	462916.66							MPV extra - not dug		
1239	1285538.05	462914.73							MPV extra - not dug		
1240	1285536.30	462912.24							MPV extra - not dug		
1241	1285540.12	462910.81							MPV extra - not dug		
1242	1285548.01	462908.74							MPV extra - not dug		
1243	1285545.09	462900.74				2 S	scrap	2	nail x2	N	4-Oct
1244	1285533.40	462896.53							MPV extra - not dug		
1245	1285515.53	462896.81							MPV extra - not dug		
1246	1285517.24	462911.24				-	no contact	-	dug and nothing found		5-Oct
1247	1285522.72	462912.44				-	no contact	-	dug and nothing found		5-Oct
1248	1285527.97	462908.95							MPV extra - not dug		
1249	1285533.52	462912.14							wall - not dug	Y	
1250	1285530.94	462913.97				2 E	scrap	2	steel scrap	N	5-Oct
1251	1285524.82	462915.25				-	no contact	-	dug and nothing found		5-Oct
1252	1285516.81	462918.90				-	no contact	-	dug and nothing found		5-Oct
1253	1285516.32	462922.93				6 E	scrap	6	nail x2, steel scrap	N	5-Oct
1254	1285516.20	462928.19				0	scrap	4	nail	N	5-Oct
1255	1285514.96	462928.84				-	no contact	-	dug and nothing found		5-Oct
1256	1285511.42	462924.07				3 NE	scrap	3	nail x2	N	5-Oct
1257	1285507.43	462919.42				12 W	scrap	12	nail x2	N	4-Oct

Target ID	X	Y	Estimated Depth (in)	mV	Fit Item	Offset distance (inches) & direction	Contact type (MPPEH, MD, seed, scrap, hot rock, no contact, other)	Actual depth (in)	Description (75 mm, nail, utility, frag, etc.)	Left in place? (Y/N)	Excavation date (2016)
1258	1285502.80	462910.32							MPV extra - not dug		
1259	1285494.68	462902.56							MPV extra - not dug		
1260	1285492.89	462903.43				10 SE	scrap	8	wire in tree root	Y	5-Oct
1261	1285493.97	462908.57				4 S	scrap	2	wire	Y	4-Oct
1262	1285497.79	462932.66				-	no contact	-	dug and nothing found		5-Oct
1263	1285499.79	462936.39				2 SE	scrap	2	nail x2	N	5-Oct
1264	1285497.23	462955.23							MPV extra - not dug		
1265	1285507.83	462968.89							MPV extra - not dug		
1266	1285505.82	462971.43							MPV extra - not dug		
1267	1285503.50	462972.50							MPV extra - not dug		
1268	1285504.69	462973.07							MPV extra - not dug		
1269	1285506.63	462976.51							MPV extra - not dug		
1270	1285508.38	462976.80							MPV extra - not dug		
1271	1285509.64	462978.72							MPV extra - not dug		
1272	1285515.34	462973.24							MPV extra - not dug		
1273	1285516.75	462971.57							MPV extra - not dug		
1274	1285525.73	462980.85							MPV extra - not dug		
1275	1285527.13	462982.20							MPV extra - not dug		
1276	1285520.21	462980.45							MPV extra - not dug		
1277	1285507.73	462985.55							MPV extra - not dug		
1278	1285509.90	462991.22							MPV extra - not dug		

Note: Yellow shading represents training digs requested by the demonstrators.

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Appendix F: Final Target Lists

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Appendix F-1:

Final CUED Target Lists

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
1	318531.1	4311968.1	1285665.578	462975.1779	33	TT	in driveway apron
2	318533.6	4311967.3	1285673.835	462972.734	67	TT	
3	318534.3815	4311967.116	1285676.411	462972.1867	TT 21, MPV 67	TWO	
4	318533.3	4311965.9	1285672.952	462968.1206	4	TT	sidewalk
5	318538.6	4311965.4	1285690.371	462966.8622	60	TT	
6	318533.955	4311964.429	1285675.206	462963.3423	25	TT	
7	318537.205	4311964.156	1285685.885	462962.6816	88	MPV	sidewalk
8	318532.959	4311964.009	1285671.969	462961.8938	48	MPV	
9	318545.2	4311962.7	1285712.213	462958.4817	2	TT	next to light pole
10	318540.961	4311962.654	1285698.313	462958.0256	84	MPV	sidewalk
11	318533.6335	4311962.646	1285674.28	462957.4706	QE-36	EM61	
12	318548.2	4311961.9	1285722.11	462956.0738	1	TT	DC Water manhole (not flagged)
13	318533.894	4311961.711	1285675.202	462954.424	112	MPV	
14	318546.4	4311961.7	1285716.22	462955.2882	42	TT	DC SL/TS box (not flagged)
15	318545.162	4311961.286	1285712.19	462953.8412	90	MPV	sidewalk
16	318532.343	4311961.2	1285670.151	462952.6363	76	MPV	
17	318551.4	4311961.2	1285732.656	462954.0082	9	TT	
18	318543.709	4311961.197	1285707.43	462953.4447	46	MPV	sidewalk
19	318541.835	4311961.181	1285701.285	462953.2573	107	MPV	
20	318541.2545	4311960.735	1285699.413	462951.7511	TT 62, MPV 42	TWO	
21	318550.5	4311960.7	1285729.74	462952.3035	3	TT	flag went into void
22	318540.3865	4311960.633	1285696.574	462951.3557	TT 69, MPV 99	TWO	
23	318532.54	4311960.601	1285670.841	462950.6859	TT 18, MPV 41	TWO	
24	318552.6045	4311960.492	1285736.657	462951.7728	TT 10, MPV 59	TWO	
25	318537.6505	4311960.276	1285687.626	462949.9862	TT 19, MPV 22	TWO	
26	318532.041	4311960.265	1285669.228	462949.5479	75	MPV	
27	318554.6	4311960.1	1285743.23	462950.6307	55	TT	curb
28	318541.257	4311960.055	1285699.47	462949.5226	82	MPV	
29	318556.1	4311959.4	1285748.201	462948.4428	27	TT	curb/utility
30	318541.755	4311959.354	1285701.154	462947.2593	122	MPV	
31	318532.194	4311959.242	1285669.804	462946.2036	111	MPV	
32	318535.2932	4311958.807	1285680	462945.0006	QE-28	EM61	
33	318557.5	4311958.7	1285752.843	462946.2477	40	TT	stone walkway
34	318534.0535	4311958.584	1285675.95	462944.1806	QE-66	Mag	
35	318555.2445	4311958.575	1285745.454	462945.6754	TT 13, MPV 43	TWO	

Target # [1]	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
36	318558.5	4311958.4	1285756.144	462945.3357	31	TT	curb
37	318554.475	4311958.218	1285742.956	462944.449	68	MPV	
38	318555	4311958.1	1285744.686	462944.0998	16	TT	
39	318547.1585	4311957.824	1285718.987	462942.6301	TT 71, MPV 120	TWO	
40	318554.83	4311957.816	1285744.149	462943.1561	8	MPV	
41	318546.3	4311957.6	1285716.188	462941.8336	80	TT	
42	318556.006	4311957.404	1285748.036	462941.8895	24	MPV	stone walkway
43	318547	4311957.4	1285718.498	462941.228	73	TT	
44	318531.403	4311957.264	1285667.352	462939.6591	72	MPV	
45	318544.201	4311957.223	1285709.33	462940.446	108	MPV	
46	318546.925	4311956.945	1285718.285	462939.7303	21	MPV	
47	318539.9	4311956.8	1285695.254	462938.7489	49	TT	
48	318555.9	4311956.8	1285747.732	462939.9008	63	TT	sidewalk
49	318538.7	4311956.7	1285691.325	462938.3346	30	TT	
50	318533.3129	4311956.235	1285673.69	462936.4206	QE-63	Mag	
51	318531.2715	4311955.992	1285667.012	462935.476	TT 47, MPV 66	TWO	
52	318531.778	4311955.637	1285668.699	462934.3498	117	MPV	
53	318530.213	4311954.908	1285663.618	462931.8461	34	MPV	on wall
54	318533.3	4311954.8	1285673.751	462931.7141	68	TT	
55	318532.85	4311954.455	1285672.3	462930.5506	QE-61	Mag	
56	318535.942	4311954.301	1285682.452	462930.266	TT 52, MPV 94	TWO	
57	318531.6	4311954.3	1285668.211	462929.9518	46	TT	
58	318553.9	4311954.3	1285741.352	462931.5571	6	TT	
59	318530.856	4311954.274	1285665.773	462929.8129	93	MPV	
60	318535.1	4311953.9	1285679.719	462928.8918	74	TT	near irrigation valve
61	318554.8	4311953.8	1285744.34	462929.982	8	TT	
62	318531.402	4311953.787	1285667.599	462928.2549	TT 59, MPV 19	TWO	
63	318532.9	4311953.6	1285672.525	462927.7495	70	TT	
64	318543.6419	4311953.566	1285707.76	462928.4106	QE-59	Mag	may be under wall
65	318535.131	4311953.527	1285679.848	462927.6706	1	MPV	
66	318531.4	4311953.4	1285667.62	462926.9855	56	TT	
67	318547.2	4311953.1	1285719.463	462927.139	41	TT	
68	318559.68	4311952.849	1285760.414	462927.2142	45	MPV	
69	318553.238	4311952.806	1285739.288	462926.6077	TT 66, MPV 118	TWO	
70	318541.828	4311952.749	1285701.869	462925.601	40	MPV	
71	318547.232	4311952.637	1285719.602	462925.6227	18	MPV	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
72	318549.863	4311952.515	1285728.24	462925.4106	QE-57	Mag	
73	318534	4311952.5	1285676.212	462924.2208	15	TT	surface metal (from gutter?)
74	318546.916	4311952.229	1285718.595	462924.2618	25	MPV	
75	318549.071	4311952.212	1285725.664	462924.3612	71	MPV	
76	318539.53	4311951.913	1285694.392	462922.6936	35	MPV	water valve (not flagged)
77	318541.38	4311951.861	1285700.464	462922.6562	20	MPV	
78	318558.225	4311951.721	1285755.723	462923.4097	106	MPV	
79	318546.431	4311951.201	1285717.078	462920.8552	39	MPV	light (not flagged)
80	318558.9249	4311950.912	1285758.077	462920.8073	NA	NA	QC Pick
81	318558.691	4311950.374	1285757.349	462919.0253	74	MPV	
82	318542.242	4311950.285	1285703.404	462917.5492	47	MPV	
83	318548.041	4311949.902	1285722.452	462916.7105	TT 36, MPV 62	TWO	
84	318555.673	4311948.766	1285747.566	462913.534	61	MPV	
85	318548.9	4311948.5	1285725.37	462912.174	23	TT	
86	318555.4656	4311948.01	1285746.94	462911.0406	QE-53	Mag	
87	318550.066	4311947.608	1285729.259	462909.3323	109	MPV	
88	318558.849	4311947.603	1285758.066	462909.9482	5	MPV	
89	318556.3845	4311947.356	1285750.001	462908.9606	TT 38, MPV 52	TWO	
90	318553.6385	4311947.276	1285741	462908.5006	QE-16	EM61	
91	318558.672	4311947.167	1285757.517	462908.5054	4	MPV	
92	318553.1	4311947	1285739.254	462907.5566	34	TT	
93	318556	4311946.6	1285748.794	462906.4534	58	TT	
94	318555.114	4311945.491	1285745.968	462902.7522	26	MPV	
95	318555.096	4311944.922	1285745.95	462900.8847	TT 5, MPV 25	TWO	irrigation valve (not flagged)
96	318555.448	4311944.846	1285747.11	462900.6606	QE-51	Mag	0.4 from AGC target
97	318554.425	4311944.06	1285743.811	462898.0091	TT 37, MPV 53	TWO	
98	318552.85	4311943.973	1285738.652	462897.6104	15	MPV	
99	318522.14	4311943.878	1285637.934	462895.088	32	MPV	
100	318557.372	4311943.527	1285753.515	462896.4731	64	MPV	
101	318526.6	4311943.3	1285652.604	462893.5133	7	TT	
102	318554.023	4311943.223	1285742.553	462895.2343	TT 24, MPV 51	TWO	
103	318526.891	4311943.216	1285653.564	462893.2588	28	MPV	
104	318522.386	4311942.985	1285638.805	462892.1768	57	MPV	
105	318555.178	4311942.621	1285746.384	462893.3436	77	MPV	
106	318526	4311942.4	1285650.701	462890.5183	17	TT	
107	318527.3	4311941.6	1285655.022	462887.988	51	TT	

Target # [1]	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
108	318527.2	4311941.2	1285654.723	462886.6688	54	TT	
109	318521.935	4311940.694	1285637.491	462884.6302	29	MPV	
110	318556.371	4311939.762	1285750.503	462884.0524	27	MPV	
111	318526.018	4311939.63	1285650.959	462881.4343	73	MPV	
112	318543.217	4311939.424	1285707.384	462881.9952	TT 44, MPV 31	TWO	
113	318542.8365	4311939.066	1285706.162	462880.7953	TT 50, MPV 91	TWO	
114	318545.7	4311938.237	1285715.614	462878.2824	81	MPV	
115	318523.869	4311938.151	1285644.017	462876.4287	79	MPV	
116	318550.698	4311937.84	1285732.035	462877.3401	123	MPV	
117	318554.5016	4311937.721	1285744.519	462877.2249	NA	NA	QC Pick
118	318545.796	4311937.332	1285715.994	462875.321	54	MPV	
119	318550	4311936.8	1285729.82	462873.8788	MPV 37, TT 65	TWO	
120	318523.2045	4311936.764	1285641.937	462871.8301	TT 12, MPV 6	TWO	
121	318549.7957	4311936.408	1285729.179	462872.579	76	TT	
122	318528.061	4311936.127	1285657.912	462870.0921	23	MPV	
123	318531.412	4311935.756	1285668.929	462869.1165	60	MPV	
124	318527.9	4311935.7	1285657.415	462868.68	22	TT	
125	318529.5	4311935.7	1285662.662	462868.7951	61	TT	
126	318531.3	4311935.4	1285668.588	462867.9408	48	TT	
127	318529.8374	4311935.274	1285663.8	462867.4206	QE-47	Mag	
128	318544.621	4311935.004	1285712.307	462867.6009	50	MPV	
129	318544.2	4311934.8	1285710.941	462866.9015	43	TT	
130	318529.907	4311934.767	1285664.064	462865.7643	TT 53, MPV 55	TWO	
131	318544.252	4311934.5	1285711.133	462865.9213	7	MPV	
132	318548.747	4311934.255	1285725.894	462865.4413	63	MPV	
133	318547.559	4311934.155	1285722.005	462865.0278	124	MPV	
134	318525.6355	4311933.964	1285650.112	462862.8231	TT 26, MPV 56	TWO	
135	318540.615	4311933.958	1285699.244	462863.8801	TT 39, MPV 3	TWO	
136	318535.6	4311933.9	1285682.799	462863.3305	TT 57, MAG 44	TWO	QE-44
137	318543.3	4311933.8	1285708.061	462863.5569	75	TT	
138	318525.1	4311933.7	1285648.375	462861.9187	35	TT	
139	318553.1194	4311933.575	1285740.284	462863.5244	NA	NA	QC Pick
140	318549.603	4311933.515	1285728.755	462863.0759	TT 32, MPV 16	TWO	
141	318543.219	4311933.505	1285707.817	462862.5835	10	MPV	
142	318537.24	4311933.044	1285688.24	462860.6406	QE-42	Mag	
143	318535.502	4311932.848	1285682.553	462859.8731	96	MPV	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
144	318522.96	4311932.812	1285641.42	462858.8521	17	MPV	
145	318519.43	4311932.759	1285629.846	462858.4241	30	MPV	
146	318535.8	4311932.7	1285683.542	462859.4091	64	TT	
147	318541.7425	4311932.625	1285703.038	462859.5909	TT 14, MPV 11	TWO	
148	318519.861	4311932.536	1285631.276	462857.7237	9	MPV	
149	318525.8655	4311932.517	1285650.971	462858.0937	TT 20, MPV 12	TWO	
150	318532.192	4311932.402	1285671.729	462858.172	58	MPV	
151	318536.268	4311932.224	1285685.111	462857.8816	49	MPV	
152	318543.833	4311932.096	1285709.932	462858.0063	38	MPV	
153	318545.1417	4311931.916	1285714.237	462857.5097	NA	NA	QC Pick
154	318540.3815	4311931.914	1285698.625	462857.1593	TT 28, MPV 13, M	THREE	MAG QE-69
155	318521.343	4311931.795	1285636.19	462855.4001	44	MPV	
156	318540.5606	4311931.529	1285699.24	462855.9106	QE-08	EM61	0.4m from ACG target
157	318526.272	4311931.415	1285652.383	462854.5086	36	MPV	
158	318536.298	4311931.345	1285685.272	462855.0007	2	MPV	
159	318546.2	4311931.2	1285717.76	462855.238	77	TT	
160	318526.846	4311930.975	1285654.298	462853.1067	65	MPV	
161	318543.1478	4311930.356	1285707.81	462852.2506	QE-39	Mag	
162	318537.5629	4311930.25	1285689.5	462851.5006	QE-05	EM61	
163	318542.6	4311929.6	1285706.068	462849.731	72	TT	
164	318540.4	4311929.3	1285698.874	462848.5887	45	TT	
165	318539.6	4311929.1	1285696.264	462847.8751	78	TT	
166	318539.5	4311928.7	1285695.965	462846.556	79	TT	
167	318545.789	4311927.808	1285716.656	462844.0831	89	MPV	
168	318547.9858	4311927.772	1285723.864	462844.1241	TT 11, MPV 33	TWO	
169	318549.0034	4311927.103	1285727.25	462842.0006	QE-01	EM61	
170	318543.7	4311926.3	1285709.913	462838.9867	29	TT	
171	318543.394	4311924.316	1285709.052	462832.4574	80	MPV	

\1 - These target numbers change following cued data processing; the resulting new target numbering system in the subsequent tables and figures are the same from that point forward.

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
2000	318508.733	4311892.037	1285597.693	462724.0915	145	MPV	
2001	318507.734	4311891.18	1285594.478	462721.2087	2	MPV	
2002	318503.782	4311892.886	1285581.393	462726.5197	1	MPV	Removed - Water meter
2003	318505.4	4311893	1285586.692	462727.0101	2092	TT	
2004	318506.365	4311893.507	1285589.82	462728.7424	54	MPV	
2005	318507.724	4311895.048	1285594.167	462733.8945	254	MPV	
2006	318508.789	4311896.652	1285597.544	462739.2321	MPV 246, TT 2084	TWO	
2007	318509.4128	4311898.504	1285599.457	462745.3527	2105	TT	
2008	318509.4543	4311899.176	1285599.545	462747.5592	MPV 175, TT 2099	TWO	
2009	318508.2405	4311898.322	1285595.625	462744.6694	MPV 233, TT 2110	TWO	
2010	318506.447	4311897.749	1285589.784	462742.6599	MPV 155, TT 2020	TWO	
2011	318505.425	4311895.816	1285586.571	462736.248	45	MPV	
2012	318504.7125	4311897.266	1285584.13	462740.9525	MPV 81, TT 2087	TWO	
2013	318504.456	4311898.88	1285583.172	462746.2277	231	MPV	
2014	318501.1	4311897.5	1285572.264	462741.4599	2071	TT	
2015	318502.8165	4311901.203	1285577.628	462753.7272	MPV 137, TT 2100	TWO	
2016	318503.057	4311901.62	1285578.386	462755.1138	211	MPV	
2017	318503.73	4311902.02	1285580.565	462756.4742	MPV 82, TT 2073	TWO	
2018	318503.8	4311902.2	1285580.782	462757.0696	MPV 195, TT 2090	TWO	
2019	318503.3	4311902.5	1285579.12	462758.0176	2019	TT	
2020	318501.786	4311903.409	1285574.089	462760.89	245	MPV	
2021	318501.333	4311902.593	1285572.662	462758.181	198	MPV	
2022	318497	4311903	1285558.421	462759.204	2037	TT	
2023	318495.3	4311903.3	1285552.824	462760.0656	2007	TT	
2024	318495.7	4311902.8	1285554.172	462758.4544	2048	TT	
2025	318495.6505	4311900.936	1285554.143	462752.3372	MPV 94, TT 2002	TWO	
2026	318493.594	4311901.134	1285547.384	462752.8386	22	MPV	
2027	318493.6	4311900.8	1285547.428	462751.7435	MPV 31, TT 2015	TWO	
2028	318493.054	4311900.481	1285545.66	462750.6579	17	MPV	
2029	318493.674	4311899.592	1285547.757	462747.7868	21	MPV	
2030	318494.286	4311899.244	1285549.79	462746.6894	43	MPV	
2031	318494.3815	4311896.804	1285550.279	462738.692	MPV 138, TT 2115	TWO	
2032	318493.6475	4311896.021	1285547.928	462736.0725	MPV 88, TT 2028	TWO	
2033	318493.5	4311895.4	1285547.489	462734.0251	2023	TT	
2034	318492.397	4311896.375	1285543.801	462737.1419	MPV 50, TT 2006	TWO	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
2035	318492.6385	4311897.09	1285544.541	462739.5044	MPV 170, TT 2010	TWO	
2036	318492.557	4311897.859	1285544.219	462742.0224	187	MPV	
2037	318490.579	4311897.713	1285537.742	462741.4011	111	MPV	
2038	318490.3	4311897.6	1285536.835	462741.0104	2011	TT	
2039	318490.1	4311898.207	1285536.135	462742.9869	256	MPV	
2040	318490.9	4311900.1	1285538.623	462749.2532	2070	TT	
2041	318490.93	4311900.449	1285538.696	462750.4001	MPV 77, TT 2050	TWO	
2042	318492	4311900.5	1285542.202	462750.6444	2069	TT	
2043	318491.8145	4311900.906	1285541.564	462751.961	2060	TWO	
2044	318492.5331	4311902.809	1285543.784	462758.2574	MPV 30, TT 2017	TWO	
2045	318492.118	4311903.783	1285542.352	462761.4207	MPV 8, TT 2024	TWO	
2046	318492.393	4311905.661	1285543.119	462767.6	98	MPV	
2047	318494.7175	4311904.502	1285550.827	462763.966	MPV 253, TT 2014	TWO	
2048	318497.3	4311905.1	1285559.254	462766.1133	2088	TT	
2049	318497.8	4311906	1285560.829	462769.1012	2061	TT	
2050	318498.3	4311907.2	1285562.382	462773.073	2005	TT	
2051	318497.8995	4311907.681	1285561.034	462774.6201	MPV 252, TT 2001	TWO	
2052	318497.7865	4311908.949	1285560.572	462778.7709	MPV 100, TT 2091	TWO	
2053	318497.1838	4311909.288	1285558.571	462779.8412	MPV 90, TT 2108	TWO	
2054	318496.962	4311908.701	1285557.886	462777.8997	128	MPV	
2055	318496.418	4311908.094	1285556.145	462775.8711	2116	TT	
2056	318493.9	4311910.3	1285547.728	462782.9238	2094	TT	
2057	318494.473	4311910.563	1285549.588	462783.8277	167	MPV	
2058	318494.901	4311910.828	1285550.973	462784.7276	209	MPV	
2059	318497.5025	4311910.408	1285559.536	462783.538	2109	TT	
2060	318497.8585	4311910.181	1285560.72	462782.8168	MPV 125, TT 2040	TWO	
2061	318498.186	4311909.584	1285561.837	462780.884	153	MPV	
2062	318498.8	4311909.7	1285563.842	462781.3086	2096	TT	
2063	318499.2	4311910.7	1285565.082	462784.6173	2058	TT	
2064	318497.859	4311910.702	1285560.684	462784.5273	229	MPV	
2065	318497.3	4311911.4	1285558.8	462786.7764	2032	TT	
2066	318497.681	4311912.831	1285559.947	462791.4987			QC Pick
2067	318498.2	4311914	1285561.565	462795.3689	2051	TT	
2068	318496.0535	4311915.345	1285554.428	462799.6257	MPV 9, TT 2055	TWO	
2069	318496.5	4311917.583	1285555.731	462806.9982			Removed - wooden stake with nails

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
2070	318497.6	4311916.4	1285559.424	462803.1973	MPV 36, TT 2034	TWO	
2071	318499.7	4311916.3	1285566.319	462803.0205	2104	TT	
2072	318499.7	4311917.6	1285566.226	462807.2843	2066	TT	
2073	318499.664	4311918.011	1285566.078	462808.6281	MPV 247, TT 2082	TWO	
2074	318498.3667	4311919.468	1285561.718	462813.3166	MPV 15, TT 2114	TWO	
2075	318498.723	4311923.523	1285562.595	462826.639	MPV 117, TT 2008	TWO	
2076	318499.7	4311926.6	1285565.578	462836.8031	2026	TT	
2077	318502.424	4311930.731	1285574.215	462850.5483	MPV 159, TT 2004	TWO	
2078	318502.1	4311931.3	1285573.111	462852.3912	2016	TT	
2079	318502.1465	4311931.708	1285573.234	462853.7311	MPV 164, TT 2012	TWO	
2080	318504.019	4311931.433	1285579.395	462852.9656	MPV 71, TT 2027	TWO	
2081	318504.652	4311930.209	1285581.56	462848.9966	178	MPV	
2082	318504.7	4311929.9	1285581.739	462847.9866	2083	TT	
2083	318504.619	4311928.929	1285581.544	462844.796	132	MPV	
2084	318506.06	4311928.575	1285586.295	462843.7387	205	MPV	
2085	318506.2	4311929	1285586.724	462845.1427	2038	TT	
2086	318506.026	4311929.31	1285586.131	462846.1469	MPV 23, TT 2045	TWO	
2087	318505.566	4311929.755	1285584.59	462847.5734	67	MPV	
2088	318505.6	4311930.4	1285584.655	462849.6913	2043	TT	
2089	318505.5595	4311930.994	1285584.48	462851.6366	MPV 65, TT 2039	TWO	
2090	318505.702	4311931.796	1285584.889	462854.2773	210	MPV	
2091	318504.421	4311932.847	1285580.612	462857.6323	48	MPV	
2092	318504.8	4311934.7	1285581.722	462863.7371	2065	TT	
2093	318504.742	4311935.285	1285581.489	462865.6517	11	MPV	
2094	318505.147	4311934.858	1285582.849	462864.2803	72	MPV	
2095	318506.141	4311933.178	1285586.23	462858.8417	168	MPV	
2096	318506.825	4311933.265	1285588.467	462859.1763	214	MPV	
2097	318508.5535	4311932.394	1285594.199	462856.444	MPV 124, TT 2098	TWO	
2098	318507.7	4311932.2	1285591.413	462855.7462	MPV 186, TT 2054	TWO	
2099	318507.7445	4311931.779	1285591.59	462854.3686	MPV 134, TT 2052	TWO	
2100	318506.998	4311931.263	1285589.178	462852.6225	MPV 42, TT 2030	TWO	
2101	318506.8	4311930.7	1285588.569	462850.7617	2042	TT	
2102	318506.483	4311930.717	1285587.529	462850.7946	66	MPV	
2103	318506.845	4311929.902	1285588.775	462848.1476	144	MPV	
2104	318507.959	4311929.857	1285592.432	462848.0802	201	MPV	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
2105	318507.703	4311929.504	1285591.617	462846.904	189	MPV	
2106	318507.839	4311928.733	1285592.119	462844.385	80	MPV	
2107	318507.354	4311928.085	1285590.575	462842.2247	40	MPV	
2108	318507.983	4311928.214	1285592.629	462842.6915	MPV 18, TT 2013	TWO	
2109	318508.8311	4311927.53	1285595.46	462840.51	2095	TT	
2110	318509.132	4311928.89	1285596.348	462844.993	249	MPV	
2111	318509.948	4311928.428	1285599.058	462843.5364	191	MPV	
2112	318510.789	4311928.672	1285601.799	462844.3973	181	MPV	
2113	318510.276	4311929.349	1285600.068	462846.5808	200	MPV	
2114	318509.829	4311929.607	1285598.583	462847.3948	154	MPV	
2115	318509.341	4311930.282	1285596.934	462849.5736	MPV 222, TT 2044	TWO	
2116	318508.815	4311930.135	1285595.219	462849.0536	185	MPV	
2117	318508.205	4311930.667	1285593.18	462850.7546	219	MPV	
2118	318508.681	4311930.871	1285594.727	462851.4579	240	MPV	
2119	318509.5465	4311931.099	1285597.549	462852.2664	MPV 63, TT 2053	TWO	
2120	318510.743	4311930.821	1285601.493	462851.4424	74	MPV	
2121	318513.8	4311931.9	1285611.442	462855.2014	MPV 139, TT 2069	TWO	
2122	318513.5	4311931.6	1285610.48	462854.1959	2075	TT	
2123	318512.8401	4311929.8	1285608.445	462848.2442	MPV 89, TT 2118	TWO	
2124	318512.4	4311928.9	1285607.066	462845.2611	2009	TT	
2125	318513.2651	4311928.947	1285609.9	462845.4789	MPV 108, TT 2107	TWO	
2126	318514.3	4311928	1285613.363	462842.446	2068	TT	
2127	318513.8	4311926.4	1285611.838	462837.1622	2102	TT	
2128	318512.6705	4311927.152	1285608.079	462839.5457	MPV 166, TT 2064	TWO	
2129	318512.9	4311926.1	1285608.908	462836.1134	2049	TT	
2130	318513.277	4311925.512	1285610.187	462834.212	225	MPV	
2131	318514.129	4311924.851	1285613.029	462832.1054	97	MPV	
2132	318514.2	4311925.2	1285613.236	462833.2551	2056	TT	
2133	318514.0433	4311925.564	1285612.696	462834.4387	MPV 69, TT 2111	TWO	
2134	318514.387	4311925.789	1285613.807	462835.2004	140	MPV	
2135	318515.2	4311926.3	1285616.437	462836.935	2093	TT	
2136	318515.5	4311926.7	1285617.392	462838.2685	2101	TT	
2137	318515.4	4311925.9	1285617.122	462835.6374	2062	TT	
2138	318515.5	4311925.4	1285617.486	462834.0047	2077	TT	
2139	318516.657	4311925.506	1285621.273	462834.434	MPV 86, TT 2089	TWO	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
2140	318517.0025	4311925.317	1285622.42	462833.8396	2106	TT	
2141	318516.6	4311924.7	1285621.144	462831.788	2057	TT	
2142	318516.15	4311924.439	1285619.687	462830.8979	MPV 262, TT 2033	TWO	
2143	318516.7	4311922.8	1285621.609	462825.5634	2022	TT	
2144	318517.087	4311922.515	1285622.899	462824.6565	221	MPV	
2145	318518.992	4311920.41	1285629.298	462817.8896	102	MPV	
2146	318519.638	4311920.504	1285631.41	462818.2444	4	MPV	
2147	318519.613	4311917.816	1285631.522	462809.4263	56	MPV	
2148	318519.843	4311917.224	1285632.319	462807.5012	165	MPV	
2149	318518	4311917.5	1285626.254	462808.2738	2076	TT	
2150	318518.185	4311916.379	1285626.942	462804.6104	226	MPV	
2151	318518.4	4311915.4	1285627.717	462801.4148	2072	TT	
2152	318516.756	4311916.046	1285622.279	462803.4153	MPV 79, TT 2031	TWO	
2153	318516.566	4311915.326	1285621.707	462801.0401	99	MPV	
2154	318516.1	4311914	1285620.274	462796.6575	2085	TT	
2155	318516.878	4311914.592	1285622.784	462798.6535	MPV 107, TT 2079	TWO	
2156	318518.076	4311914.314	1285626.733	462797.8296	207	MPV	
2157	318518.489	4311913.811	1285628.124	462796.2096	183	MPV	
2158	318517.7	4311913.1	1285625.587	462793.8208	2035	TT	
2159	318518.159	4311912.774	1285627.116	462792.7846	126	MPV	
2160	318517.5841	4311912.109	1285625.278	462790.5626	2029	TT	
2161	318516.8	4311912	1285622.714	462790.1481	2025	TT	
2162	318517.508	4311911.181	1285625.095	462787.5129	13	MPV	
2163	318515.551	4311910.394	1285618.733	462784.7891	MPV 24, TT 2021	TWO	
2164	318513.605	4311910.053	1285612.375	462783.5322	3	MPV	
2165	318514.087	4311909.566	1285613.991	462781.9696	5	MPV	
2166	318515.5	4311908.7	1285618.688	462779.231	2078	TT	
2167	318516.6	4311909.1	1285622.267	462780.6221	2003	TT	
2168	318516.185	4311908.761	1285620.93	462779.4804	251	MPV	
2169	318515.861	4311908.254	1285619.904	462777.7942	10	MPV	
2170	318516.117	4311907.091	1285620.828	462773.9981	120	MPV	
2171	318515.454	4311905.924	1285618.737	462770.1228	163	MPV	
2172	318515.6	4311905.2	1285619.268	462767.7587	2046	TT	
2173	318515.566	4311904.789	1285619.186	462766.4082	112	MPV	
2174	318513.2	4311907.9	1285611.202	462776.4415	2097	TT	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
2175	318512.9	4311908	1285610.211	462776.7479	2103	TT	
2176	318511.2	4311907.9	1285604.642	462776.2976	2081	TT	
2177	318509.801	4311909.085	1285599.968	462780.0831			QC Pick
2178	318509.1845	4311909.102	1285597.945	462780.0932	MPV 35, TT 2047	TWO	
2179	318508.8	4311909.3	1285596.67	462780.7166	MPV 122, TT 2067	TWO	
2180	318507.8702	4311909.359	1285593.616	462780.8444	MPV 223, TT 2117	TWO	
2181	318508.24	4311908.413	1285594.897	462777.767	96	MPV	
2182	318508.247	4311905.893	1285595.101	462769.5023	218	MPV	
2183	318508.0155	4311904.756	1285594.424	462765.7564	MPV 101, TT 2074	TWO	
2184	318510.6044	4311902.306	1285603.092	462757.9084	2112	TT	
2185	318511	4311902.6	1285604.368	462758.8999	2080	TT	
2186	318511.244	4311903.124	1285605.13	462760.6361	150	MPV	
2187	318512.804	4311902.651	1285610.281	462759.1954	MPV 127, TT 2018	TWO	
2188	318513.1	4311902.6	1285611.256	462759.0511	2036	TT	
2189	318512.7608	4311902.264	1285610.167	462757.924	2086	TT	
2190	318511.69	4311901.536	1285606.708	462755.4598	220	MPV	
2191	318510.4058	4311901.015	1285602.533	462753.6599	2113	TT	
2192	318511.015	4311899.519	1285604.639	462748.7957	156	MPV	
2193	318511.488	4311899.066	1285606.223	462747.344	196	MPV	
2194	318513.108	4311896.284	1285611.736	462738.336	57	MPV	
2195	318510.742	4311890.51	1285604.392	462719.2278	130	MPV	
2196	318510.7	4311890.2	1285604.277	462718.208	2063	TT	

\1 - These target numbers change following cued data processing; the resulting new target numbering system in the subsequent tables and figures are the same from that point forward.

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
1000	318487.3	4311983.8	1285520.79	463023.5185	1020	TT	
1001	318487.7	4311983.1	1285522.152	463021.2514	1013	TT	
1002	318488.458	4311982.635	1285524.671	463019.7809	168	MPV	
1003	318489.1	4311983.6	1285526.708	463022.9921	1069	TT	
1004	318489.1	4311982.6	1285526.78	463019.7123	1044	TT	
1005	318488.999	4311980.988	1285526.564	463014.4179	33	MPV	
1006	318489.9	4311980.4	1285529.562	463012.5542	1082	TT	
1007	318490.4	4311980.5	1285531.195	463012.9182	1030	TT	
1008	318492	4311980	1285536.478	463011.3934	1047	TT	
1009	318493.1	4311977.7	1285540.252	463003.9289	1080	TT	
1010	318493.5	4311979.1	1285541.463	463008.5495	1083	TT	
1011	318494	4311979.3	1285543.089	463009.2415	1073	TT	
1012	318494.828	4311980.173	1285545.741	463012.1644	374	MPV	
1013	318497.342	4311980.919	1285553.933	463014.7922	113	MPV	
1014	318498.183	4311979.786	1285556.773	463011.1366	1	MPV	
1015	318498.9307	4311978.91	1285559.289	463008.3181	1061	TT	
1016	318499.9	4311979	1285562.461	463008.6823	1039	TT	
1017	318500.8795	4311978.739	1285565.693	463007.8967	TT 1016, MPV 83	TWO	
1018	318501.1	4311978.2	1285566.455	463006.1448	1035	TT	
1019	318500.1	4311977.3	1285563.24	463003.1209	1070	TT	
1020	318499.6	4311977.3	1285561.6	463003.0849	1052	TT	
1021	318499.2	4311977.5	1285560.273	463003.7121	1040	TT	
1022	318498.8	4311977.6	1285558.954	463004.0113	1059	TT	
1023	318497.6	4311977.7	1285555.011	463004.2529	1004	TT	
1024	318497.3	4311976.2	1285554.135	462999.3115	1079	TT	
1025	318499.8	4311974.4	1285562.464	462993.5877	1002	TT	
1026	318500.7	4311974.1	1285565.438	462992.6685	1001	TT	
1027	318501.5	4311976.7	1285567.875	463001.2538	1081	TT	
1028	318506.2	4311977.5	1285583.232	463004.216	1036	TT	
1029	318506.896	4311975.529	1285585.657	462997.7999	TT 1037, MPV 23	TWO	
1030	318502.7	4311971	1285572.221	462982.645	1028	TT	
1031	318502.2	4311970.2	1285570.639	462979.9851	1021	TT	
1032	318501.8	4311970.3	1285569.319	462980.2843	1019	TT	
1033	318501.5	4311969.9	1285568.364	462978.9507	1015	TT	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
1034	318501.1	4311970	1285567.045	462979.2499	1012	TT	
1035	318500	4311970.2	1285563.423	462979.8267	1029	TT	
1036	318499.4	4311970.4	1285561.441	462980.4395	1055	TT	
1037	318498.4	4311970.9	1285558.125	462982.0074	1026	TT	
1038	318496.8	4311971	1285552.87	462982.2202	1022	TT	
1039	318495.2365	4311971.577	1285547.7	462984.0006	QE-24	EM61	
1040	318495	4311972	1285546.894	462985.3705	1025	TT	
1041	318494.637	4311968.473	1285545.957	462973.7763	29	MPV	
1042	318492.682	4311967.387	1285539.623	462970.0736	4	MPV	
1043	318495.094	4311967.164	1285547.55	462969.5158	143	MPV	
1044	318496.509	4311966.26	1285552.256	462966.6527	47	MPV	in center of bush did not flag
1045	318498.366	4311965.534	1285558.399	462964.4052	3	MPV	
1046	318500.408	4311966.723	1285565.011	462968.452	93	MPV	
1047	318503.747	4311967.499	1285575.907	462971.2375	278	MPV	
1048	318503.759	4311967.91	1285575.917	462972.5864	244	MPV	
1049	318505.4665	4311967.781	1285581.526	462972.2862	TT 1045, MPV 212	TWO	
1050	318504.807	4311966.908	1285579.426	462969.3754	402	MPV	
1051	318504.5	4311966.9	1285578.42	462969.3271	1060	TT	
1052	318504.717	4311966.394	1285579.168	462967.6831	383	MPV	
1053	318503.364	4311965.716	1285574.779	462965.362	327	MPV	
1054	318502.944	4311964.084	1285573.519	462959.979	229	MPV	
1055	318499.2687	4311954.988	1285562.119	462929.8813	1076	TT	
1056	318498.0391	4311953.239	1285558.212	462924.0567	TT 1041, MPV 64	TWO	
1057	318497.416	4311951.745	1285556.276	462919.1108	46	MPV	
1058	318495.141	4311949.162	1285549	462910.4752	45	MPV	Gate hinge
1059	318494.004	4311949.661	1285545.235	462912.0283	TT 1023, MPV 150	TWO	
1060	318494.523	4311948.719	1285547.005	462908.9777	206	MPV	
1061	318495.745	4311947.615	1285551.093	462905.4447	336	MPV	
1062	318492.8	4311947	1285541.478	462903.2156	1027	TT	
1063	318494.7429	4311945.896	1285547.93	462899.7333	1006	TT	
1064	318494.934	4311945.086	1285548.615	462897.0915	85	MPV	
1065	318495.3645	4311944.804	1285550.047	462896.1976	TT 1008, MPV 81	TWO	
1066	318494.8	4311944.1	1285548.246	462893.8479	1071	TT	
1067	318495.4	4311941.1	1285550.43	462884.0515	1024	TT	
1068	318494.2	4311942.4	1285546.401	462888.229	1007	TT	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
1069	318493.089	4311942.412	1285542.756	462888.187	1075	TT	
1070	318491.5	4311944.3	1285537.409	462894.2663	1072	TT	
1071	318490.1	4311943.8	1285532.853	462892.5256	1031	TT	
1072	318490.198	4311944.433	1285533.129	462894.6088	353	MPV	
1073	318489.8185	4311944.77	1285531.86	462895.6852	TT 1056, MPV 118	TWO	
1074	318487.792	4311944.228	1285525.252	462893.7633	314	MPV	
1075	318487.1	4311945.3	1285522.905	462897.2295	1054	TT	
1076	318486.75	4311945.452	1285521.746	462897.7028	238	MPV	
1077	318486.408	4311945.94	1285520.589	462899.2787	6	MPV	
1078	318486.398	4311946.952	1285520.484	462902.5972	122	MPV	
1079	318485.4	4311945.9	1285517.286	462899.075	1053	TT	
1080	318484	4311944.9	1285512.766	462895.6943	1000	TT	
1081	318483.818	4311946.093	1285512.084	462899.5925	TT 1064, MPV 266	TWO	
1082	318483.969	4311947.17	1285512.501	462903.1374	2	MPV	
1083	318483.655	4311947.459	1285511.451	462904.0627	140	MPV	
1084	318480.531	4311947.149	1285501.227	462902.821	TT 1003, MPV 55	TWO	
1085	318476.8915	4311947.698	1285489.25	462904.36	1003	TT	
1086	318479.6	4311952.3	1285497.802	462919.6486	1034	TT	
1087	318479.7175	4311952.704	1285498.159	462920.9821	TT 1049, MPV 13	TWO	
1088	318481.166	4311953.593	1285502.845	462924.0022	204	MPV	
1089	318481.3	4311952.1	1285503.392	462919.115	1050	TT	
1090	318481.9925	4311951.334	1285505.719	462916.6525	TT 1017,	TWO	
1091	318481.3	4311950.7	1285503.493	462914.5232	1045	TT	
1092	318483.2	4311950.1	1285509.768	462912.692	1032	TT	
1093	318483.5	4311952.5	1285510.579	462920.5853	1010	TT	
1094	318484.4	4311952.5	1285513.531	462920.6501	1018	TT	
1095	318484.801	4311951.829	1285514.895	462918.4782	172	MPV	
1096	318484.7	4311951.5	1285514.587	462917.3918	1038	TT	
1097	318485.6555	4311951.398	1285517.728	462917.1277	1058	TT	
1098	318486.4	4311951.4	1285520.17	462917.1862	1062	TT	
1099	318486	4311950.7	1285518.909	462914.8615	1009	TT	
1100	318486.4228	4311949.808	1285520.359	462911.9656	1042	TT	
1101	318486.971	4311947.654	1285522.313	462904.941	245	MPV	
1102	318488.6165	4311947.433	1285527.726	462904.3329	TT 1005, MPV159	TWO	
1103	318489.3	4311946.1	1285530.063	462900.0117	1043	TT	

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
1104	318489.5	4311946.6	1285530.683	462901.666	1063	TT	
1105	318491.0205	4311947.675	1285535.593	462905.2997	TT 1065, MPV 195	TWO	
1106	318490.457	4311948.85	1285533.66	462909.1146	12	MPV	Irrigation valve
1107	318491.557	4311948.927	1285537.262	462909.4464	324	MPV	
1108	318491.2	4311950.4	1285535.985	462914.2519	1033	TT	
1109	318490.76	4311951.147	1285534.489	462916.6703	32	MPV	
1110	318486.6	4311953.8	1285520.653	462925.0723	1011	TT	
1111	318486.317	4311954.394	1285519.682	462927.0001	190	MPV	
1112	318484.6	4311953.8	1285514.094	462924.9283	1048	TT	
1113	318482.6	4311954.8	1285507.462	462928.0642	1074	TT	
1114	318482.0095	4311955.598	1285505.468	462930.6374	TT 1067, MPV 119	TWO	
1115	318482.2	4311955.9	1285506.071	462931.6432	1068	TT	
1116	318481.778	4311956.58	1285504.638	462933.8432	157	MPV	
1117	318480.565	4311956.302	1285500.679	462932.844	TT 1014, MPV 132	TWO	Survey nail
1118	318480.055	4311955.407	1285499.071	462929.8718	105	MPV	
1119	318481.1	4311966.1	1285501.729	462965.0186	1057	TT	
1120	318481.047	4311966.521	1285501.524	462966.3956	167	MPV	
1121	318483.2107	4311968.412	1285508.485	462972.7544	1086	TT	
1122	318483.505	4311968.21	1285509.465	462972.1123	68	MPV	
1123	318484.006	4311968.841	1285511.063	462974.2179	110	MPV	
1124	318484.4	4311970.5	1285512.235	462979.6876	1087	TT	
1125	318482.959	4311970.872	1285507.482	462980.804	104	MPV	
1126	318484.065	4311972.193	1285511.015	462985.2163	222	MPV	
1127	318483.57	4311973.429	1285509.302	462989.2346	14	MPV	
1128	318484.366	4311973.832	1285511.884	462990.6137	179	MPV	
1129	318485.262	4311973.631	1285514.837	462990.0189	76	MPV	
1130	318486.072	4311972.064	1285517.607	462984.9377	127	MPV	Irrigation control valve not marked
1131	318485.712	4311969.596	1285516.604	462976.8171	177	MPV	
1132	318486.587	4311968.645	1285519.542	462973.7609	30	MPV	
1133	318488.225	4311968.741	1285524.907	462974.1937	377	MPV	
1134	318489.935	4311968.331	1285530.546	462972.972	90	MPV	Metal railing not marked
1135	318489.93	4311969.833	1285530.421	462977.898	34	MPV	
1136	318489.636	4311972.667	1285529.253	462987.172	84	MPV	
1137	318490.4	4311973.6	1285531.691	462990.2871	1066	TT	
1138	318487.895	4311974.636	1285523.401	462993.5047	128	MPV	Irrigation control valve

Target # \1	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Original Target ID	Sensor	Comments
1139	318488	4311975.9	1285523.654	462997.658	1051	TT	
1140	318489.416	4311976.069	1285528.286	462998.3143	326	MPV	
1141	318488.9	4311977.4	1285526.498	463002.6426	1085	TT	
1142	318489.1	4311977.8	1285527.125	463003.9689	1084	TT	Irrigation valve
1143	318489.3	4311978.6	1285527.724	463006.6072	1078	TT	
1144	318488.324	4311978.269	1285524.546	463005.4513	41	MPV	
1145	318485.992	4311977.568	1285516.948	463002.9843	16	TT	
1146	318486.383	4311979.892	1285518.063	463010.6348	165	MPV	

\1 - These target numbers change following cued data processing; the resulting new target numbering system in the subsequent tables and figures are the same from that point forward.

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Appendix F-2:

Final Dig Target Lists

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
1	318531.2521	4311968.125	1285666.075	462975.2708	8.2677		1	1		1			MPV1	318531.2743	4311968.099	0.21	MkIV booster		
2	318533.4464	4311967.297	1285673.331	462972.713	5.5118		2	2					MPV1	318533.4464	4311967.297	0.14	MkIV booster		
3	318533.79	4311967.38	1285674.452	462973.01	-1.5748		2			2			TT1	318533.79	4311967.38	-0.04			
4	318534.3867	4311967.161	1285676.425	462972.3347	4.3307		3	3		3			TT1	318534.36	4311967.18	0.11			
5	318535.085	4311967.359	1285678.701	462973.0343	17.75587							NCR02	MPVCA	318535.085	4311967.359	0.451			
6	318535.0401	4311968.112	1285678.5	462975.5009		233.03	75						EM61						
7	318539.1207	4311966.498	1285692	462970.5009		53.03	74						EM61						
8	318534.6919	4311966.138	1285677.5	462969.0013		17.24	72						EM61						
9	318533.3307	4311966.172	1285673.033	462969.0149	7.874		4	4					MPV1	318533.3307	4311966.172	0.2	ISO M40		
10	318533.24	4311965.82	1285672.761	462967.8538	7.4803		4			4			TT1	318533.24	4311965.82	0.19			
11	318533.8195	4311964.424	1285674.762	462963.3168	16.1417		6	6		6			TT1	318533.96	4311964.47	0.41			
12	318532.9963	4311964.015	1285672.091	462961.9161	13.3858		8	8					MPV1	318532.9963	4311964.015	0.34	MkIV booster		
13	318532.566	4311963.352	1285670.728	462959.7106	38.5826							NCR02	MPVCA	318532.566	4311963.352	0.98			
14	318533.9027	4311961.878	1285675.218	462954.9723	12.2047		13	13		13			MPV1	318533.9255	4311961.905	0.31	MkIV booster		
15	318535.455	4311960.612	1285680.401	462950.9318								NCR01	MPVCA						
16	318537.4666	4311960.589	1285687	462951.0011		17.97	65						EM61						
17	318537.7065	4311960.193	1285687.815	462949.7196	2.7559		25	25		25			TT1	318537.73	4311960.23	0.07			
18	318536.55	4311957.75	1285684.198	462941.6236								NCR01	MPVCA						
19	318535.4047	4311959.06	1285680.347	462945.8378	9.8425		32	32		32			MPV1	318535.4794	4311959.009	0.25	MkIV booster		
20	318534.1587	4311958.416	1285676.307	462943.6359	-3.5433		34	34		34			TT1	318534.16	4311958.48	-0.09			
21	318532.5868	4311960.614	1285670.993	462950.7318	3.1496		23	23					MPV1	318532.5868	4311960.614	0.08	MkIV booster		
22	318532.3	4311961.09	1285670.018	462952.2724	19.685		16			16			TT1	318532.3	4311961.09	0.5			
23	318532.2887	4311960.685	1285670.01	462950.9432	11.4173		23	16		23			MPV1	318532.3175	4311960.79	0.29	MkIV booster		
24	318532.0049	4311960.217	1285669.113	462949.3878	12.9921		26	26		26			MPV1	318531.9598	4311960.174	0.33	MkIV booster		
25	318532.41	4311959.59	1285670.487	462947.3605	22.8346		31			31			TT1	318532.41	4311959.59	0.58			
26	318532.3398	4311959.019	1285670.298	462945.4827	13.3858		31	31					MPV1	318532.3398	4311959.019	0.34	MkIV booster		
27	318531.49	4311957.46	1285667.623	462940.3082	21.2598		44			44			TT1	318531.49	4311957.46	0.54			
28	318531.5789	4311957.113	1285667.939	462939.1765	19.2913		44	44					MPV1	318531.5789	4311957.113	0.49	ISO M40		
29	318531.2327	4311956.148	1285666.873	462935.9865	9.4488		51	51		51			MPV1	318531.2855	4311956.265	0.24	MkIV booster		
30	318530.25	4311956.174	1285663.648	462936.001	8.74014							NCR02	MPVCA	318530.387	4311956.153	0.222			
31	318530.193	4311955.04	1285663.543	462932.2775	9.4488		53	53		53			MPV1	318530.126	4311955.099	0.24	MkIV booster		
32	318530.9345	4311954.525	1285666.012	462930.6418	11.811		59	59					MPV1	318530.9345	4311954.525	0.3	MkIV booster		
33	318531.2087	4311954.128	1285666.94	462929.3594	25.1968		59	57		59			TT1	318531.12	4311954.08	0.64			
34	318531.4149	4311953.502	1285667.661	462927.3211	27.9527		66	66					MPV1	318531.3998	4311953.493	0.71	Stokes mortar		
35	318531.5753	4311953.862	1285668.162	462928.5134	17.7165		62	62		62			TT1	318531.45	4311953.82	0.45			
36	318531.48	4311954.24	1285667.822	462929.7463	19.685		57			57			TT1	318531.48	4311954.24	0.5			
37	318531.8441	4311955.727	1285668.909	462934.6497	20.8661		52	52		52			MPV1	318531.7582	4311955.623	0.53	75 mm		
38	318533.4017	4311956.208	1285673.983	462936.3394	12.2047		50	50		50			MPV1	318533.3334	4311956.245	0.31	MkIV booster		
39	318533.4906	4311954.89	1285674.37	462932.023	8.6614		54	54					MPV1	318533.5912	4311954.95	0.22	MkIV booster		
40	318533.0791	4311954.25	1285673.066	462929.8942	19.685		55	55		55			MPV1	318533.1383	4311954.149	0.5	75 mm		
41	318532.8238	4311953.821	1285672.259	462928.4688	5.5118		63	63		63			TT1	318532.81	4311953.86	0.14			
42	318533.7606	4311952.503	1285675.427	462924.2134	0.7874		73	73		73			MPV1	318533.7613	4311952.455	0.02	MkIV booster		
43	318535.14	4311953.57	1285679.874	462927.8123	2.3622		65	60	65	60	65		MPV2	318535.1296	4311953.513	0.06	ISO S80		
44	318535.9445	4311954.233	1285682.465	462930.0447	7.4803		56	56					MPV1	318535.9445	4311954.233	0.19	MkIV booster		
45	318536.01	4311954.67	1285682.649	462931.4828	-0.7874		56			56			TT1	318536.01	4311954.67	-0.02			
46	318537.2072	4311955.716	1285686.5	462934.9997		34.69	45						EM61						
47	318538.5287	4311956.432	1285690.783	462937.4432	6.2992		49	49					MPV1	318538.5287	4311956.432	0.16	MkIV booster		
48	318538.64	4311956.78	1285691.123	462938.5926	-1.9685		49			49			TT1	318538.64	4311956.78	-0.05			
49	318538.632	4311957.087	1285691.074	462939.5989	9.4488							NCR02	MPVCA	318538.598	4311957.278	0.24			
50	318539.8283	4311956.848	1285695.015	462938.9012	-0.7874		47	47		47			TT1	318539.83	4311956.85	-0.02			
51	318541	4311957.85	1285698.786	462942.272								NCR01	MPVCA						
52	318541.8057	4311959.216	1285701.331	462946.8103	14.9606		30	30		30			MPV1	318541.8614	4311959.321	0.38	MkIV booster		
53	318541.26	4311960.265	1285699.465	462950.2115	18.5039		28	28		28			MPV1	318541.2901	4311960.24	0.47	75 mm		
54	318541.1363	4311960.593	1285699.036	462951.2784	7.874		20	20		20			TT1	318541.12	4311960.65	0.2			
55	318540.6106	4311960.714	1285697.303	462951.6374	23.622		22	22		22			TT1	318540.67	4311960.77	0.6			
56	318540.438	4311961.646	1285696.67	462954.6819	8.89762							NCR02	MPVCA	318540.398	4311961.608	0.226			

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
57	318541.173	4311962.151	1285699.044	462956.3911								NCR01	MPVCA						
58	318543.6618	4311961.159	1285707.278	462953.3166	12.9921		18	18		18			TT1	318543.66	4311961.17	0.33			
59	318544.8756	4311961.023	1285711.269	462952.958	10.2362		15	15					MPV1	318544.8756	4311961.023	0.26	MkIV booster		
60	318545.15	4311961.23	1285712.154	462953.6567	1.1811		15			15			TT1	318545.15	4311961.23	0.03			
61	318545.1636	4311962.918	1285712.077	462959.194	1.9685		9	9					MPV1	318545.1636	4311962.918	0.05	MkIV booster		
62	318545.53	4311962.68	1285713.296	462958.4398	-1.9685		9			9			TT1	318545.53	4311962.68	-0.05		lightpost	
63	318547.414	4311960.452	1285719.636	462951.2679	15.90548							NCR02	MPVCA	318547.199	4311959.977	0.404			
64	318549.7819	4311959.099	1285727.5	462947.0007		24.26	62						EM61					bad decay	
65	318550.2792	4311960.917	1285729	462952.9993		1457.3	67						EM61						
66	318550.5425	4311960.741	1285729.876	462952.441	3.937		21	21		21			MPV1	318550.585	4311960.691	0.1	ISO M40		
67	318551.3452	4311961.171	1285732.478	462953.9091	3.937		17	17		17			TT1	318551.36	4311961.17	0.1			
68	318552.5282	4311960.432	1285736.411	462951.5705	5.1181		24	24		24			TT1	318552.49	4311960.43	0.13			
69	318552.2433	4311960.112	1285735.5	462950.5004		37.26	64						EM61						
70	318552.281	4311959.498	1285735.668	462948.4893	0							NCR02	MPVCA	318552.281	4311959.498	0			
71	318554.5767	4311960.046	1285743.158	462950.4519	20.8661		27	27		27			TT1	318554.57	4311959.95	0.53			
72	318554.5962	4311958.322	1285743.346	462944.7988	6.6929		37	37		37			MPV1	318554.5925	4311958.323	0.17	MkIV booster		
73	318554.9617	4311958.112	1285744.56	462944.1364	8.2677		38	40		38	40		TT1	318554.87	4311958.13	0.21			
74	318555.2785	4311958.374	1285745.58	462945.0185	10.2362		35	38	35	35			MPV1	318555.26	4311958.355	0.26	75 mm		
75	318555.973	4311959.295	1285747.792	462948.0893	5.1181		29	29					MPV1	318555.976	4311959.339	0.13	MkIV booster		
76	318556.4863	4311958.952	1285749.5	462947.0012		24.77	63						EM61					bad decay	
77	318557.4722	4311958.668	1285752.754	462946.1407	7.0866		33	33		33			TT1	318557.43	4311958.65	0.18			
78	318558.1272	4311958.546	1285754.911	462945.7877	15.3543		36	36		36			TT1	318558.17	4311958.53	0.39			
79	318560.4145	4311957.341	1285762.5	462942.0002		57.61	54						EM61					light pole?	
80	318555.9326	4311957.631	1285747.779	462942.6287	9.0551		42	42		42			MPV1	318555.9952	4311957.642	0.23	MkIV booster		
81	318555.8289	4311956.993	1285747.485	462940.5286	1.1811		48	48					MPV1	318555.8289	4311956.993	0.03	MkIV booster		
82	318555.98	4311956.72	1285748	462939.6441	2.3622		48			48			TT1	318555.98	4311956.72	0.06			
83	318555.6709	4311956.531	1285747	462939.002		300.44	51						EM61						
84	318554.9786	4311954.169	1285744.899	462931.2051	23.2283		61	61					MPV1	318554.9786	4311954.169	0.59	Livens Horiz		
85	318554.83	4311953.77	1285744.44	462929.8857	1.1811		61			61			TT1	318554.83	4311953.77	0.03		near banister (metal)	
86	318554.124	4311954.261	1285742.09	462931.4453	10.6299		58	58		58			MPV1	318554.168	4311954.291	0.27	ISO M40		
87	318553.51	4311952.95	1285740.17	462927.1012	1.9685		69			69			TT1	318553.51	4311952.95	0.05		data noisy	
88	318553.1023	4311953.077	1285738.824	462927.4884	9.0551		69	69					MPV1	318553.1023	4311953.077	0.23	MkIV booster		
89	318549.3249	4311952.272	1285726.492	462924.5762	7.874		75	75		75			MPV1	318549.2099	4311952.243	0.2	MkIV booster		
90	318547.3717	4311952.123	1285720.097	462923.9469	2.7559		74	74					MPV1	318547.3717	4311952.123	0.07	MkIV booster		
91	318547.2111	4311952.961	1285719.51	462926.6838	2.3622		67	67		67	71		MPV1	318547.1633	4311952.982	0.06	MkIV booster		
92	318548.425	4311954.909	1285723.351	462933.1604	7.16534							NCR02	MPVCA	318548.422	4311954.951	0.182			
93	318546.243	4311955.959	1285716.119	462936.4472								NCR01	MPVCA						
94	318547.093	4311957.652	1285718.785	462942.0612	8.6614		39	39	43	39	43		MPV1	318547.0774	4311957.666	0.22	MkIV booster		
95	318547.4763	4311958.235	1285720	462944.0009		25.87	57						EM61					bad decay	
96	318546.2017	4311957.319	1285715.885	462940.9048	1.9685		41	41		41			MPV1	318546.2234	4311957.247	0.05	MkIV booster		
97	318545.316	4311957.329	1285712.98	462940.8739	9.21258							NCR02	MPVCA	318545.047	4311957.314	0.234			
98	318544.139	4311957.243	1285709.125	462940.5071	11.0236		45	45		45			MPV1	318544.1381	4311957.226	0.28	MkIV booster		
99	318541.8682	4311952.695	1285702.005	462925.4268	0		70	70		70			MPV1	318541.8665	4311952.71	0	ISO S80		
100	318541.6314	4311952.001	1285701.278	462923.1335	11.811		77	77		77			MPV1	318541.5228	4311951.932	0.3	MkIV booster		
101	318542.2912	4311950.135	1285703.577	462917.0608	-1.1811		82	82		82			TT1	318542.27	4311950.25	-0.03			
102	318546.35	4311951.03	1285716.825	462920.2884	24.8031		79			79			TT1	318546.35	4311951.03	0.63			
103	318546.7	4311951.63	1285717.929	462922.2816	-5.5118		74			74			TT1	318546.7	4311951.63	-0.14			
104	318548.1491	4311950.032	1285722.797	462917.1447	15.3543		83	83					MPV1	318548.1491	4311950.032	0.39	75 mm		
105	318548.16	4311949.73	1285722.855	462916.1549	19.685		83			83			TT1	318548.16	4311949.73	0.5			
106	318549.0306	4311948.479	1285725.8	462912.1145	7.874		85	85					MPV1	318549.0306	4311948.479	0.2	MkIV booster		
107	318548.83	4311947.91	1285725.183	462910.2338	10.2362		85			85			TT1	318548.83	4311947.91	0.26			
108	318550.1259	4311947.552	1285729.459	462909.1529	9.0551		87	87		87			MPV1	318550.0619	4311947.483	0.23	MkIV booster		
109	318552.256	4311946.584	1285736.515	462906.1313	17.95272							NCR02	MPVCA	318552.006	4311946.766	0.456			
110	318552.8842	4311946.815	1285738.559	462906.9342	-2.3622		92	92		92			TT1	318552.86	4311946.77	-0.06			
111	318553.6	4311947.55	1285740.854	462909.3964	-1.9685		90			90			TT1	318553.6	4311947.55	-0.05			
112	318553.9154	4311947.445	1285741.896	462909.0748	0.7874		90	90					MPV1	318553.9154	4311947.445	0.02	MkIV booster		

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
113	318555.2048	4311947.959	1285746.088	462910.8534	1.1811		86	86					MPV1	318555.2048	4311947.959	0.03	MkIV booster		
114	318555.52	4311948.77	1285747.064	462913.5361	3.5433		84			84			TT1	318555.52	4311948.77	0.09			
115	318555.9117	4311948.827	1285748.344	462913.7512	14.9606		84	84					MPV1	318555.9117	4311948.827	0.38	MkIV booster		
116	318558.2089	4311951.788	1285755.666	462923.6283	3.1496		78	78		78			MPV1	318558.1878	4311951.716	0.08	MkIV booster		
117	318558.46	4311952.333	1285756.45	462925.4339	6.02361							NCR02	MPVCA	318558.542	4311952.496	0.153			
118	318558.846	4311951.598	1285757.769	462923.051	35.74796							NCR02	MPVCA	318558.846	4311951.598	0.908			
119	318558.4423	4311950.829	1285756.5	462920.4997		17.92	39						EM61						
120	318558.6911	4311950.369	1285757.349	462919.0089	8.2677		81	81		80	81		TT2	318558.66	4311950.34	0.21			
121	318558.87	4311947.73	1285758.126	462910.3662	3.937		88			88			TT1	318558.87	4311947.73	0.1			
122	318558.9155	4311947.109	1285758.32	462908.3327	8.2677		91	88	91	91			TT1	318558.94	4311947.06	0.21			
123	318558.257	4311947.819	1285756.109	462910.614	4.17322							NCR02	MPVCA	318558.257	4311947.819	0.106			
124	318556.4891	4311947.461	1285750.336	462909.3125	1.5748		89	89		89			TT1	318556.44	4311947.39	0.04			
125	318556.0638	4311946.64	1285749	462906.5891	2.3622		93	93		93			TT1	318556.11	4311946.57	0.06			
126	318556.697	4311945.308	1285751.173	462902.2659	6.81101							NCR02	MPVCA	318556.697	4311945.308	0.173			
127	318555.784	4311945.181	1285748.188	462901.7837	10.74801							NCR02	MPVCA	318555.784	4311945.181	0.273			
128	318555.2375	4311945.201	1285746.394	462901.8099	5.1181		95	94					MPV1	318555.2375	4311945.201	0.13	ISO M40		
129	318554.9491	4311945.028	1285745.46	462901.2217	4.3307		95	96		94	96		TT2	318555.05	4311944.99	0.11			
130	318554.3574	4311944.213	1285743.578	462898.5061	5.1181		97	97		97			MPV1	318554.3148	4311944.265	0.13	MkIV booster		
131	318552.9529	4311944.144	1285738.977	462898.1786	3.937		98	98					MPV1	318552.9529	4311944.144	0.1	ISO S80		
132	318552.7	4311943.79	1285738.173	462896.9994	2.3622		98			98			TT1	318552.7	4311943.79	0.06			
133	318554.1751	4311943.513	1285743.031	462896.197	33.4645		102	102		102			TT1	318554.25	4311943.53	0.85			
134	318554.7866	4311942.244	1285745.128	462892.0789	0		105	105					MPV1	318554.7866	4311942.244	0	MkIV booster		
135	318557.34	4311943.57	1285753.407	462896.6118	-1.1811		100			100			TT1	318557.34	4311943.57	-0.03			
136	318557.4677	4311943.147	1285753.857	462895.2336	9.8425		100	100					MPV1	318557.4677	4311943.147	0.25	MkIV booster		
137	318556.3862	4311939.795	1285750.551	462884.1617	10.2362		110	110		110			TT1	318556.38	4311939.84	0.26			
138	318554.6097	4311937.494	1285744.89	462876.4868	18.8976		117	117					MPV1	318554.6097	4311937.494	0.48	Livens Vertical		
139	318550.7126	4311938.173	1285732.059	462878.4333	12.5984		116	116		116			MPV1	318550.5853	4311938.145	0.32	75 mm		
140	318550.0218	4311936.638	1285729.904	462873.349	10.2362		119	119	121	119	121		TT1	318550.01	4311936.65	0.26			
141	318552.63	4311933.891	1285738.656	462864.527	5.31495							NCR02	MPVCA	318552.63	4311933.891	0.135			
142	318553.0591	4311933.426	1285740.097	462863.0327	3.5433		139	139		139			TT1	318553.11	4311933.55	0.09			
143	318549.5745	4311933.573	1285728.657	462863.264	1.1811		140	140		140			TT1	318549.63	4311933.51	0.03			
144	318548.5439	4311934.31	1285725.224	462865.6071	0.3937		132	132					MPV1	318548.5439	4311934.31	0.01	MkIV booster		
145	318547.4228	4311934.06	1285721.565	462864.7064	1.5748		133	133		133			TT1	318547.43	4311934	0.04			
146	318546.0035	4311932.809	1285717	462860.5011		10278.84	10						EM61						
147	318545.489	4311933.963	1285715.229	462864.249	5.62991							NCR02	MPVCA	318545.403	4311934.202	0.143			
148	318544.3921	4311934.689	1285711.579	462866.5512	15.3543		129	129	131	128	129		TT1	318544.46	4311934.73	0.39			
149	318544.7851	4311935.029	1285712.844	462867.6947	6.6929		128	128					MPV1	318544.7851	4311935.029	0.17	MkIV booster		
150	318545.9518	4311937.472	1285716.495	462875.7914	4.3307		118	118		118			MPV1	318545.9337	4311937.333	0.11	MkIV booster		
151	318545.7195	4311938.328	1285715.671	462878.5822	7.4803		114	114		114			MPV1	318545.7291	4311938.355	0.19	MkIV booster		
152	318543.1842	4311939.445	1285707.275	462882.0633	18.5039		112	112	113	112			MPV2	318543.1344	4311939.433	0.47	Stokes mortar		
153	318542.55	4311939.19	1285705.213	462881.1813	2.7559		113			113			TT1	318542.55	4311939.19	0.07		same as 112	
154	318543.2007	4311933.516	1285707.756	462862.6182	4.7244		141	137	141	137			TT1	318543.24	4311933.47	0.12		same as 141	
155	318541.8895	4311932.899	1285703.5	462860.5001		43.06	9						EM61						
156	318541.6366	4311932.689	1285702.686	462859.7932	3.5433		147	147		147			MPV1	318541.6033	4311932.687	0.09	MkIV booster		
157	318540.526	4311933.952	1285698.952	462863.8557	18.5039		135	135		135			TT1	318540.51	4311933.95	0.47			
158	318540.3101	4311931.888	1285698.392	462857.0705	3.937		154	154		154			TT1	318540.31	4311931.89	0.1			
159	318537.6964	4311932.832	1285689.752	462859.9785	11.4173		142	142					MPV1	318537.6964	4311932.832	0.29	Livens Horiz		
160	318535.6019	4311933.977	1285682.8	462863.5832	12.9921		136	136					MPV1	318535.6338	4311934.024	0.33	MkIV booster		
161	318534.681	4311934.161	1285679.766	462864.1204	14.68501							NCR02	MPVCA	318534.754	4311934.224	0.373			
162	318534.6	4311935.34	1285679.416	462867.9815	33.8582							NCR02	MPVCA	318534.485	4311935.461	0.86			
163	318531.3761	4311935.633	1285668.821	462868.7104	4.7244		123	123	126	123	126		TT2	318531.35	4311935.66	0.12			
164	318529.9523	4311934.799	1285664.211	462865.8725	12.9921		130	130		130			MPV1	318530.0047	4311934.817	0.33	MkIV booster		
165	318529.4784	4311935.634	1285662.596	462868.5771	1.1811		125	125	127	125	127		TT1	318529.47	4311935.54	0.03			
166	318528.0222	4311936.017	1285657.793	462869.7284	3.5433		122	122	124	122	124		TT1	318527.98	4311936.11	0.09			
167	318525.9222	4311939.499	1285650.654	462880.9977	19.685		111	111					MPV1	318525.9222	4311939.499	0.5	75 mm		
168	318525.59	4311939.49	1285649.565	462880.9443	-1.5748		111			111			TT1	318525.59	4311939.49	-0.04			

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
169	318526.035	4311940.101	1285650.981	462882.9803	5.39369							NCR02	MPVCA	318526.315	4311939.96	0.137			
170	318526.887	4311939.96	1285653.785	462882.5792	11.92911							NCR02	MPVCA	318527.057	4311939.7	0.303			
171	318529.382	4311940.481	1285661.931	462884.4676	13.66139							NCR02	MPVCA	318529.382	4311940.481	0.347			
172	318527.28	4311941.37	1285654.973	462887.2321	16.5354		108	107	108	107	108		TT1	318527.16	4311941.42	0.42			
173	318526.6441	4311943.144	1285652.76	462893.0048	7.874		101	101	103	101	103		TT1	318526.6	4311943.14	0.2			
174	318525.8587	4311942.371	1285650.239	462890.4129	4.3307		106	106		106			TT1	318525.82	4311942.41	0.11			
175	318523.414	4311943.578	1285642.134	462894.1957	0.27559							NCR02	MPVCA	318523.189	4311943.612	0.007			
176	318522.48	4311943.99	1285639.041	462895.4798	-5.5118		99			99			TT1	318522.48	4311943.99	-0.14			
177	318521.8724	4311943.962	1285637.05	462895.3442	20.8661		99	99					MPV1	318521.8724	4311943.962	0.53	75 mm		
178	318522.5701	4311943.289	1285639.387	462893.1871	0.3937		104	104					MPV1	318522.5701	4311943.289	0.01	MkIV booster		
179	318523.24	4311943.03	1285641.603	462892.3858	-10.6299		104			104			TT1	318523.24	4311943.03	-0.27		Metal hand railing	
180	318522.38	4311940.68	1285638.951	462884.6163	1.9685		109			109			TT1	318522.38	4311940.68	0.05			
181	318522.7347	4311940.687	1285640.114	462884.6648	1.9685		109	109					MPV1	318522.7347	4311940.687	0.05	MkIV booster		
182	318523.738	4311938.171	1285643.586	462876.4848	4.7244		115	115		115			MPV1	318523.676	4311938.271	0.12	MkIV booster		
183	318523.1498	4311936.755	1285641.759	462871.7982	11.811		120	120		120			TT1	318523.16	4311936.75	0.3			
184	318522.293	4311935.566	1285639.034	462867.8368	14.05509							NCR02	MPVCA	318522.256	4311935.398	0.357			
185	318519.3394	4311932.758	1285629.549	462858.4143	17.3228		145	145		145			MPV1	318519.3689	4311932.716	0.44	Stokes mortar		
186	318519.8696	4311932.501	1285631.306	462857.6095	18.8976		148	148		148			MPV1	318519.8892	4311932.482	0.48	Livens Vertical		
187	318521.33	4311931.856	1285636.143	462855.5992	25.9842		155	155		155			MPV1	318521.3901	4311931.762	0.66	Livens Horiz		
188	318521.898	4311932.551	1285637.956	462857.9196	8.6614							NCR02	MPVCA	318521.898	4311932.551	0.22			
189	318522.9459	4311932.844	1285641.371	462858.956	5.1181		144	144		144			TT1	318522.92	4311932.86	0.13			
190	318525.1722	4311933.622	1285648.617	462861.668	7.874		138	138		138			MPV1	318525.1344	4311933.633	0.2	MkIV booster		
191	318525.6311	4311933.889	1285650.103	462862.5768	9.8425		134	134		134			TT1	318525.61	4311933.79	0.25			
192	318526.536	4311934.631	1285653.018	462865.0756	15.03934							NCR02	MPVCA	318526.549	4311934.494	0.382			
193	318525.925	4311932.482	1285651.169	462857.9832	2.7559		149	149		149			MPV1	318525.8901	4311932.483	0.07	MkIV booster		
194	318526.2805	4311931.453	1285652.409	462854.6338	6.2992		157	157		157			MPV1	318526.231	4311931.445	0.16	MkIV booster		
195	318525.724	4311930.715	1285650.637	462852.1732	5.66928							NCR02	MPVCA	318525.845	4311930.802	0.144			
196	318526.8957	4311930.951	1285654.463	462853.0316	2.7559		160	160		160			TT1	318526.94	4311930.96	0.07			
197	318528.793	4311931.866	1285660.62	462856.1692	4.25196							NCR02	MPVCA	318528.828	4311931.716	0.108			
198	318529.583	4311932.301	1285663.179	462857.6528	5.27558							NCR02	MPVCA	318529.589	4311932.251	0.134			
199	318532.2	4311932.4	1285671.756	462858.1659	5.1181		150			150			TT1	318532.2	4311932.4	0.13			
200	318532.5137	4311932.438	1285672.782	462858.3132	19.685		150	150					MPV1	318532.5137	4311932.438	0.5	75 mm		
201	318535.3704	4311932.742	1285682.129	462859.5159	11.811		143	143		143	146		TT1	318535.44	4311932.86	0.3			
202	318536.0716	4311932.545	1285684.443	462858.9202	15.748		146	146	151	151			MPV1	318536.1059	4311932.502	0.4	75 mm		
203	318536.3298	4311931.552	1285685.362	462855.6819	2.3622		158	158					MPV1	318536.3298	4311931.552	0.06	MkIV booster		
204	318536.642	4311930.985	1285686.427	462853.8447	7.36219							NCR02	MPVCA	318536.471	4311930.75	0.187			
205	318539.5888	4311928.976	1285696.236	462847.4676	2.3622		165	165	166	165	166		TT1	318539.59	4311929.03	0.06			
206	318540.2948	4311929.198	1285698.536	462848.2466	5.9055		164	164		164			TT1	318540.26	4311929.24	0.15			
207	318542.5546	4311929.728	1285705.91	462850.1476	0		163	163		163			TT1	318542.55	4311929.76	0			
208	318543.0313	4311930.5	1285707.418	462852.7139	5.1181		161	161		161			TT1	318542.95	4311930.51	0.13			
209	318543.7612	4311932.131	1285709.694	462858.1159	3.5433		152	152		152			TT1	318543.78	4311932.18	0.09			
210	318545.1617	4311931.843	1285714.308	462857.2722	3.1496		153	153		153			TT1	318545.17	4311931.79	0.08			
211	318546.2169	4311931.11	1285717.822	462854.944	4.7244		159	159		159			TT1	318546.24	4311931.12	0.12			
212	318547.9321	4311927.764	1285723.688	462844.093	9.8425		168	168		168			TT1	318547.97	4311927.77	0.25			
213	318547.711	4311926.866	1285723.028	462841.1318	13.30706							NCR02	MPVCA	318547.856	4311927.08	0.338			
214	318545.7125	4311927.788	1285716.407	462844.012	5.9055		167	167		167			MPV1	318545.7151	4311927.856	0.15	MkIV booster		
215	318543.7877	4311926.336	1285710.198	462839.111	6.6929		170	170		170			TT1	318543.85	4311926.35	0.17			
216	318544.318	4311925.622	1285711.989	462836.8074	4.52755							NCR02	MPVCA	318544.445	4311925.611	0.115			
217	318543.3687	4311924.493	1285708.957	462833.0361	1.1811		171	171					MPV1	318543.3687	4311924.493	0.03	MkIV booster		
218	318545.402	4311923.604	1285715.69	462830.2667	13.7795							NCR02	MPVCA	318545.307	4311923.702	0.35			
219	318549.681	4311923.495	1285729.732	462830.2172	14.09446							NCR02	MPVCA	318549.463	4311923.934	0.358			
220	318559.6723	4311952.673	1285760.402	462926.6363			68	68					MPV1	318559.6723	4311952.673	3.98986E-08	MkIV booster	empty	
221	318547.8144	4311952.987	1285721.487	462926.8126			67	71					MPV1	318547.8144	4311952.987	0.497084517	75 mm	Empty	
222	318544.0774	4311953.602	1285709.186	462928.5606			64	64					MPV1	318544.0774	4311953.602	0.181622621	MkIV booster	empty	
223	318558.7282	4311951.168	1285757.413	462921.6322			80	80					MPV1	318558.7282	4311951.168	3.01752E-08	MkIV booster	empty	
224	318537.7804	4311930.152	1285690.22	462851.1945			162	162					MPV1	318537.7804	4311930.152	0.011415032	MkIV booster	empty	

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
225	318541.7552	4311961.288	1285701.016	462953.6009			19	19		19			TT1	318541.72	4311961.29	-0.06		weak response	
226	318549.0516	4311926.852	1285727.426	462841.1808			169	169		169			TT1	318549.16	4311926.76	0.07		weak/no response	
227	318549.8494	4311952.674	1285728.184	462925.9308			72	72		72			TT1	318549.86	4311952.65	-0.44		weak/no response	
228	318537.1504	4311964.102	1285685.71	462962.4989			7	7		7			TT1	318537.22	4311964.08	-0.06		weak/no response	
229	318540.8795	4311962.612	1285698.048	462957.8804			10	10		10			TT1	318540.88	4311962.7	-0.11		weak response	
230	318546.7901	4311956.865	1285717.848	462939.4581			46	46		46			TT1	318546.66	4311956.86	0.09		weak/no response	
231	318533.6715	4311962.641	1285674.405	462957.4566			11	11		11			TT1	318533.63	4311962.65	0.04		weak/no response	
232	318536.15	4311931.21	1285684.797	462854.5473			158			158			TT1	318536.15	4311931.21	0.06		weak/no response	
233	318548.6	4311934.67	1285725.382	462866.7919			132			132			TT1	318548.6	4311934.67	0.1		weak/no response	
234	318555.66	4311948.03	1285747.576	462911.1191			86			86			TT1	318555.66	4311948.03	-0.37		weak/no response	
235	318559.8	4311953.08	1285760.791	462927.9804			68			68			TT1	318559.8	4311953.08	-0.35		weak response	
236	318543.27	4311924.1	1285708.661	462831.74			171			171			TT1	318543.27	4311924.1	-0.01		no source under array	
237	318538.8961	4311965.473	1285691.337	462967.1229			5	5		5			TT1	318538.86	4311965.51	-0.03		weak amplitude	
238	318539.94	4311952.08	1285695.725	462923.2708			76			76			TT1	318539.94	4311952.08	-0.25		water valve	
239	318536.9	4311932.83	1285687.14	462859.9146			142			142			TT1	318536.9	4311932.83	-0.1		no source under array	
240	318555.18	4311942.55	1285746.396	462893.1109			105			105			TT1	318555.18	4311942.55	0.05		no sources under array	
241	318554.45	4311937.8	1285744.344	462877.479			117			117			TT1	318554.45	4311937.8	-0.03		no sources under array	
242	318533.1	4311964.32	1285672.41	462962.9239			8			8			TT1	318533.1	4311964.32	-0.62		over sprinkler head	
243	318543.61	4311953.75	1285707.642	462929.0124			64			64			TT1	318543.61	4311953.75	0.06		weak/no response	

\1 - At this stage, this is the best initial library match, but may not be a high confidence fit; it was considered useful to the dig teams and was included on the dig sheets.

UTM X = Easting, UTM Zone 18N WGS 84 Meters
UTM Y = Northing, UTM Zone 18N WGS 84 Meters
SP_X = Easting, Maryland SP NAD83 US Survey Foot
SP_Y = Northing, Maryland SP NAD83 US Survey Foot
Est_Depth_in = Estimated depth of the item (inches)
EM61_Ch2 = Channel 2 mV response for EM61 targets only
Flag = Closest cued flag ID
MPV1 = ID of closest MPV pick (w/in 30cm)
MPV2 = ID of second MPV point (w/in 30cm)
TT1 = ID of closest TEMTADS pick (w/in 30cm)
TT2 = ID of second TEMTADS point (w/in 30cm)
Comments = QC Comments
List = Dataset target info is from
Fit_X = Estimated location of closest modeled item (UTM Easting)
Fit_Y = Estimated location of closest modeled item (UTM Northing)
Fit_Z = Estimated depth of modeled item (meters)
Fit_Item = Best initial Library match
Processor_Comments: Indicates targets with little to no response
Training_Request: MPV requests ground truth for these targets to inform their classification routine

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
2001	318510.70	4311890.39	1285604.27	462718.84	9.61		2195	2195	2196	2195	2196		MPV1	318510.62	4311890.39	0.24	MkIV booster		
2002	318508.33	4311891.77	1285596.39	462723.19	34.65		2000			2000			TT1	318508.33	4311891.77	-0.88			
2003	318505.50	4311892.92	1285587.04	462726.74	5.83		2003	2003		2003			MPV1	318505.63	4311892.94	0.15	MkIV booster		
2004	318506.25	4311893.35	1285589.46	462728.21	5.85		2004	2004					MPV1	318506.25	4311893.35	0.15	MkIV booster		
2005	318506.56	4311893.52	1285590.46	462728.80	5.12		2004			2004			TT1	318506.56	4311893.52	0.13			
2006	318507.86	4311894.79	1285594.63	462733.06	10.24		2005			2005			TT1	318507.86	4311894.79	-0.26			
2007	318507.82	4311895.13	1285594.47	462734.16	14.55		2005	2005					MPV1	318507.82	4311895.13	0.37	75 mm		
2008	318508.86	4311896.68	1285597.77	462739.34	7.87		2006	2006		2006			TT1	318508.85	4311896.60	-0.20			
2009	318513.11	4311896.28	1285611.74	462738.32	14.38		2194	2194		2194			MPV1	318513.09	4311896.28	0.37	ISO M40		
2010	318511.70	4311899.13	1285606.91	462747.56	0.00		2193	2193		2193			MPV1	318511.79	4311899.06	0.00	MkIV booster		
2011	318511.09	4311899.44	1285604.90	462748.53	0.00		2192	2192		2192			MPV1	318511.20	4311899.50	0.00	MkIV booster		
2012	318511.64	4311901.31	1285606.57	462754.72	0.00		2190	2190		2190			MPV1	318511.68	4311901.23	0.00	MkIV booster		
2013	318512.81	4311902.48	1285610.30	462758.63	1.74		2187	2187	2188	2187	2188		MPV1	318512.86	4311902.50	0.04	ISO S80		yes
2014	318511.28	4311903.09	1285605.24	462760.53	1.22		2186	2186		2186			MPV1	318511.22	4311903.11	0.03	MkIV booster		
2015	318511.14	4311902.40	1285604.84	462758.26	0.00		2185	2185					MPV1	318511.14	4311902.40	0.00	MkIV booster		
2016	318510.88	4311902.55	1285603.97	462758.72	0.78		2185	2184		2185			MPV1	318510.85	4311902.50	0.02	MkIV booster		
2017	318510.48	4311902.40	1285602.68	462758.21	5.51		2184			2184			TT1	318510.48	4311902.40	0.14			
2018	318510.60	4311900.92	1285603.19	462753.37	0.17		2191	2191		2191			MPV1	318510.50	4311900.88	0.00	MkIV booster		
2019	318509.36	4311899.16	1285599.25	462747.51	7.59		2008	2008					MPV1	318509.36	4311899.16	0.19	MkIV booster		
2020	318509.50	4311898.81	1285599.73	462746.36	0.00		2007	2007		2008			MPV1	318509.53	4311898.75	0.00	MkIV booster		
2021	318509.46	4311898.40	1285599.62	462745.01	1.97		2007			2007			TT1	318509.46	4311898.40	0.05			
2022	318508.20	4311898.30	1285595.49	462744.59	3.47		2009	2009		2009			MPV1	318508.22	4311898.38	0.09	MkIV booster		
2023	318506.41	4311897.66	1285589.66	462742.36	7.02		2010	2010		2010			MPV1	318506.39	4311897.74	0.18	MkIV booster		
2024	318505.50	4311895.99	1285586.80	462736.81	2.71		2011	2011					MPV1	318505.50	4311895.99	0.07	MkIV booster		
2025	318505.32	4311895.48	1285586.25	462735.14	1.18		2011			2011			TT1	318505.32	4311895.48	0.03			
2026	318504.87	4311896.90	1285584.67	462739.76	5.51		2012			2012			TT1	318504.87	4311896.90	0.14			
2027	318504.92	4311897.29	1285584.80	462741.03	1.78		2012	2012					MPV1	318504.92	4311897.29	0.05	MkIV booster		
2028	318504.23	4311898.76	1285582.44	462745.82	6.69		2013			2013			TT1	318504.23	4311898.76	0.17			
2029	318504.31	4311899.07	1285582.67	462746.83	9.14		2013	2013					MPV1	318504.31	4311899.07	0.23	MkIV booster		
2030	318501.04	4311897.45	1285572.06	462741.29	0.26		2014	2014					MPV1	318501.04	4311897.45	0.01	MkIV booster		
2031	318500.94	4311897.74	1285571.72	462742.24	4.33		2014			2014			TT1	318500.94	4311897.74	0.11			
2032	318502.81	4311901.18	1285577.62	462753.65	6.40		2015	2015		2015			MPV1	318502.92	4311901.25	0.16	MkIV booster		
2033	318502.99	4311901.68	1285578.17	462755.29	4.48		2016	2016					MPV1	318502.99	4311901.68	0.11	MkIV booster		
2034	318503.45	4311901.56	1285579.68	462754.95	4.33		2016			2016			TT1	318503.45	4311901.56	0.11			
2035	318503.78	4311902.09	1285580.73	462756.69	8.27		2017	2017	2018	2017	2018		TT1	318503.79	4311902.03	-0.21			
2036	318503.39	4311902.55	1285579.41	462758.19	1.05		2019	2019		2019			MPV1	318503.32	4311902.61	0.03	MkIV booster		
2037	318501.76	4311903.29	1285574.03	462760.48	0.55		2020	2020		2020			MPV1	318501.74	4311903.35	0.01	MkIV booster		
2038	318501.34	4311902.41	1285572.70	462757.58	2.41		2021	2021					MPV1	318501.34	4311902.41	0.06	MkIV booster		
2039	318501.09	4311902.64	1285571.86	462758.32	5.91		2021			2021			TT1	318501.09	4311902.64	0.15			
2040	318497.41	4311903.02	1285559.75	462759.30	2.23		2022	2022					MPV1	318497.41	4311903.02	0.06	MkIV booster		
2041	318496.87	4311903.13	1285557.99	462759.62	1.97		2022			2022			TT1	318496.87	4311903.13	0.05			
2042	318496.24	4311902.82	1285555.95	462758.57	5.40		2024	2024					MPV1	318496.24	4311902.82	0.14	MkIV booster		
2043	318495.85	4311902.76	1285554.67	462758.33	8.27		2024			2024			TT1	318495.85	4311902.76	-0.21			
2044	318495.54	4311903.19	1285553.60	462759.73	1.44		2023	2023					MPV1	318495.54	4311903.19	0.04	MkIV booster		
2045	318495.27	4311903.34	1285552.72	462760.19	7.48		2023			2023			TT1	318495.27	4311903.34	0.19			
2046	318495.76	4311900.98	1285554.51	462752.50	5.89		2025	2025		2025			MPV1	318495.78	4311901.03	0.15	MkIV booster		yes
2047	318493.61	4311900.99	1285547.45	462752.37	9.84		2026	2026	2027	2026	2027		TT2	318493.66	4311900.82	-0.25			
2048	318493.04	4311900.53	1285545.60	462750.83	1.97		2028	2028		2028			TT1	318493.05	4311900.51	0.05			
2049	318492.54	4311900.58	1285543.97	462750.95	35.04		2028			2042			TT1	318492.54	4311900.58	-0.89			
2050	318493.56	4311899.83	1285547.37	462748.56	31.10		2029			2029			TT1	318493.56	4311899.83	-0.79			
2051	318493.72	4311899.55	1285547.92	462747.66	8.22		2029	2029					MPV1	318493.72	4311899.55	0.21	MkIV booster		
2052	318494.21	4311899.71	1285549.51	462748.21	4.33		2030			2030			TT1	318494.21	4311899.71	0.11			
2053	318494.13	4311899.40	1285549.26	462747.17	12.27		2030	2030					MPV1	318494.13	4311899.40	0.31	75 mm		
2054	318492.68	4311898.08	1285544.62	462742.77	1.19		2036	2036		2036			MPV1	318492.59	4311898.02	0.03	MkIV booster		
2055	318492.71	4311897.21	1285544.77	462739.90	2.54		2035	2035		2035			MPV1	318492.71	4311897.23	0.06	MkIV booster		
2056	318494.11	4311897.07	1285549.37	462739.55	12.99		2031			2031			TT1	318494.11	4311897.07	-0.33			

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
2057	318494.51	4311896.38	1285550.73	462737.31	6.84		2031	2031					MPV1	318494.51	4311896.38	0.17	MkIV booster		
2058	318493.67	4311896.02	1285548.00	462736.08	2.36		2032	2032		2032			TT1	318493.64	4311896.00	-0.06			
2059	318493.32	4311895.44	1285546.90	462734.14	0.79		2033			2033			TT1	318493.32	4311895.44	-0.02			
2060	318493.29	4311895.82	1285546.77	462735.39	5.28		2032	2033					MPV1	318493.29	4311895.82	0.13	MkIV booster		
2061	318492.45	4311896.41	1285543.99	462737.25	2.00		2034	2034		2034			MPV1	318492.48	4311896.39	0.05	MkIV booster		
2062	318490.17	4311896.38	1285536.50	462737.00			1						EM61						
2063	318490.52	4311897.40	1285537.59	462740.38	0.00		2038	2038					MPV1	318490.52	4311897.40	0.00	MkIV booster		
2064	318490.58	4311897.75	1285537.74	462741.52	2.82		2037	2037		2037	2038		MPV1	318490.62	4311897.79	0.07	MkIV booster		
2065	318490.97	4311900.38	1285538.83	462750.19	0.86		2041	2040	2041	2040	2041		MPV1	318490.95	4311900.37	0.02	MkIV booster		
2066	318491.81	4311900.94	1285541.53	462752.09	0.00		2043	2042	2043	2043			MPV1	318491.78	4311900.94	0.00	MkIV booster		
2067	318491.04	4311901.39	1285539.00	462753.50			4						EM61					bad decay	
2068	318491.68	4311902.45	1285541.00	462757.00			5						EM61					bad decay	
2069	318492.56	4311902.91	1285543.85	462758.60	6.85		2044	2044		2044			MPV1	318492.58	4311902.93	0.17	MkIV booster		
2070	318492.17	4311903.76	1285542.54	462761.34	2.53		2045	2045		2045			MPV1	318492.23	4311903.77	0.06	MkIV booster		
2071	318491.86	4311903.97	1285541.50	462762.00			7						EM61					bad decay	
2072	318492.55	4311905.42	1285543.65	462766.82	1.97		2046			2046			TT1	318492.55	4311905.42	0.05			
2073	318492.42	4311905.71	1285543.19	462767.77	1.58		2046	2046					MPV1	318492.42	4311905.71	0.04	MkIV booster		
2074	318494.89	4311904.61	1285551.37	462764.35	17.96		2047	2047		2047			MPV1	318494.90	4311904.62	0.46	Stokes mortar		yes
2075	318497.08	4311905.15	1285558.54	462766.25	3.18		2048	2048		2048			MPV1	318497.17	4311905.05	0.08	MkIV booster		
2076	318497.81	4311906.10	1285560.84	462769.42	1.83		2049	2049		2049			MPV1	318497.89	4311906.08	0.05	MkIV booster		
2077	318498.80	4311906.87	1285564.05	462772.02	8.08		2050	2050					MPV1	318498.80	4311906.87	0.21	75 mm	utility?	
2078	318498.31	4311907.20	1285562.42	462773.07	1.57		2050			2050			TT1	318498.31	4311907.20	0.04			
2079	318497.85	4311907.67	1285560.87	462774.60	5.91		2051	2051		2051			TT1	318497.89	4311907.67	-0.15			
2080	318496.60	4311908.24	1285556.73	462776.36	0.98		2055	2055		2055			MPV1	318496.62	4311908.29	0.02	MkIV booster		
2081	318497.20	4311908.77	1285558.66	462778.13	27.46		2054	2054					MPV1	318497.20	4311908.77	0.70	Livens Vertical	Empty	
2082	318497.31	4311909.26	1285559.00	462779.75	2.20		2053	2053		2053			MPV1	318497.35	4311909.36	0.06	MkIV booster		
2083	318497.80	4311908.95	1285560.63	462778.77	3.38		2052	2052		2052			MPV1	318497.74	4311908.94	0.09	MkIV booster		
2084	318498.13	4311909.80	1285561.64	462781.58	3.22		2061	2061					MPV1	318498.13	4311909.80	0.08	MkIV booster		
2085	318498.98	4311909.64	1285564.45	462781.13	3.42		2062	2062		2062			MPV1	318498.93	4311909.64	0.09	MkIV booster		
2086	318499.09	4311909.95	1285564.78	462782.15	0.79		2062			2061			TT1	318499.09	4311909.95	-0.02			
2087	318499.49	4311910.70	1285566.04	462784.65	0.00		2063	2063					MPV1	318499.49	4311910.70	0.00	MkIV booster		
2088	318499.97	4311911.00	1285567.59	462785.66	20.08		2063			2063			TT1	318499.97	4311911.00	-0.51			
2089	318497.88	4311910.81	1285560.73	462784.88	3.54		2064			2059	2064		TT1	318497.76	4311910.84	0.09			
2090	318498.09	4311910.53	1285561.46	462783.99	0.00		2064	2064					MPV1	318498.09	4311910.53	0.00	MkIV booster		
2091	318497.85	4311910.26	1285560.69	462783.09	8.12		2060	2059	2060	2060			MPV2	318497.94	4311910.15	0.21	MkIV booster		
2092	318495.62	4311910.34	1285553.37	462783.18	1.97		2058			2058			TT1	318495.62	4311910.34	-0.05			
2093	318493.97	4311910.45	1285547.96	462783.41	0.01		2056	2056		2056			MPV1	318493.94	4311910.48	0.00	MkIV booster		
2094	318494.50	4311910.65	1285549.68	462784.10	6.69		2057	2057		2057			TT1	318494.57	4311910.57	0.17			
2095	318494.95	4311910.73	1285551.13	462784.40	0.00		2058	2058					MPV1	318494.95	4311910.73	0.00	MkIV booster		
2096	318496.87	4311911.33	1285557.39	462786.52	5.51		2065			2065			TT1	318496.87	4311911.33	-0.14			
2097	318497.11	4311911.81	1285558.14	462788.10	6.07		2065	2065					MPV1	318497.11	4311911.81	0.15	MkIV booster		
2098	318497.35	4311913.01	1285558.86	462792.06	3.47		2066	2066		2066			MPV1	318497.31	4311912.96	0.09	MkIV booster		
2099	318496.18	4311913.17	1285555.00	462792.50			26					likely utility	EM61					bad decay	
2100	318496.50	4311914.08	1285556.00	462795.50			28					likely utility	EM61					bad decay	
2101	318495.92	4311915.24	1285554.00	462799.27	3.15		2068			2068			TT1	318495.92	4311915.24	0.08			
2102	318496.16	4311915.51	1285554.78	462800.18	3.84		2068	2068					MPV1	318496.16	4311915.51	0.10	MkIV booster		
2103	318496.54	4311915.60	1285556.00	462800.50			32						EM61						
2104	318497.53	4311916.43	1285559.21	462803.29	5.25		2070	2070		2070			MPV1	318497.60	4311916.46	0.13	MkIV booster		
2105	318496.58	4311917.58	1285556.00	462807.00			35						EM61						
2106	318498.33	4311919.43	1285561.60	462813.19	5.91		2074	2074		2074			TT1	318498.41	4311919.43	-0.15			
2107	318499.57	4311917.79	1285565.77	462807.88	10.71		2072	2072		2073			MPV1	318499.54	4311917.78	0.27	MkIV booster		
2108	318499.88	4311918.12	1285566.78	462808.99	0.30		2073	2073					MPV1	318499.88	4311918.12	0.01	MkIV booster		
2109	318500.43	4311917.42	1285568.63	462806.75	5.91		2072			2072			TT1	318500.43	4311917.42	0.15			
2110	318499.79	4311916.51	1285566.61	462803.73	11.32		2071	2071					MPV1	318499.79	4311916.51	0.29	75 mm		
2111	318499.84	4311916.21	1285566.78	462802.74	2.36		2071			2071			TT1	318499.84	4311916.21	0.06			
2112	318497.90	4311915.27	1285560.50	462799.50			31					likely utility	EM61						

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
2113	318498.27	4311913.98	1285561.78	462795.31	7.42		2067	2067		2067			MPV1	318498.19	4311914.02	0.19	MkIV booster		
2114	318507.95	4311904.70	1285594.20	462765.55	7.13		2183	2183		2183			MPV1	318508.02	4311904.75	0.18	MkIV booster		
2115	318508.18	4311905.81	1285594.89	462769.23	4.51		2182	2182		2182			MPV1	318508.25	4311905.85	0.11	MkIV booster	Empty	
2116	318508.07	4311908.18	1285594.36	462777.00	1.02		2181	2181		2181			MPV1	318508.19	4311908.12	0.03	MkIV booster		
2117	318507.90	4311909.29	1285593.73	462780.62	2.36		2180	2180		2180			TT1	318507.77	4311909.30	0.06			
2118	318509.00	4311909.02	1285597.34	462779.83	7.04		2178	2178	2179	2178	2179		MPV1	318509.10	4311908.96	0.18	MkIV booster		
2119	318509.66	4311909.12	1285599.51	462780.19	15.81		2177	2177					MPV1	318509.66	4311909.12	0.40	75 mm	Empty	
2120	318510.51	4311909.27	1285602.28	462780.74	10.24		2177			2177			TT1	318510.51	4311909.27	-0.26			
2121	318511.01	4311907.94	1285604.03	462776.40	0.94		2176	2176		2176			MPV1	318510.95	4311907.92	0.02	MkIV booster		
2122	318512.97	4311907.84	1285610.45	462776.23	10.63		2175	2174	2175	2174	2175		TT2	318512.79	4311907.69	-0.27			
2123	318515.37	4311904.73	1285618.56	462766.19	0.83		2173	2173		2173			MPV1	318515.41	4311904.72	0.02	MkIV booster		
2124	318515.48	4311905.20	1285618.86	462767.73	0.03		2172	2172		2172			MPV1	318515.43	4311905.10	0.00	MkIV booster		
2125	318515.43	4311905.99	1285618.66	462770.33	0.60		2171	2171		2171			MPV1	318515.50	4311906.07	0.02	MkIV booster		
2126	318516.06	4311907.02	1285620.63	462773.76	6.69		2170	2170		2170			TT1	318516.04	4311906.91	0.17			
2127	318515.82	4311908.40	1285619.75	462778.25	5.87		2169	2169		2166	2169		MPV1	318515.84	4311908.33	0.15	MkIV booster		
2128	318516.37	4311908.89	1285621.53	462779.91	7.09		2168	2167	2168	2167	2168		TT2	318516.44	4311908.79	-0.18			
2129	318515.21	4311908.70	1285617.75	462779.19	0.18		2166	2166					MPV1	318515.21	4311908.70	0.00	MkIV booster		
2130	318514.00	4311909.77	1285613.68	462782.63	7.87		2165	2165		2164	2165		TT1	318513.91	4311909.98	-0.20			
2131	318513.54	4311909.95	1285612.18	462783.19	4.78		2164	2164					MPV1	318513.54	4311909.95	0.12	MkIV booster		
2132	318515.61	4311910.38	1285618.93	462784.75	19.29		2163	2163		2163			TT1	318515.64	4311910.37	-0.49		feature space addition	
2133	318517.56	4311911.23	1285625.25	462787.69	14.42		2162	2162		2162			MPV1	318517.53	4311911.24	0.37	75 mm		yes
2134	318517.53	4311911.72	1285625.14	462789.29	2.18		2160	2160		2160			MPV1	318517.60	4311911.74	0.06	MkIV booster		
2135	318517.10	4311911.98	1285623.69	462790.09	0.00		2161	2161		2161			MPV1	318517.05	4311911.91	0.00	MkIV booster		
2136	318517.64	4311912.97	1285625.40	462793.40	0.00		2158	2158		2158			MPV1	318517.56	4311913.02	0.00	MkIV booster		
2137	318518.11	4311912.84	1285626.95	462793.01	5.55		2159	2159		2159			MPV1	318518.12	4311912.80	0.14	MkIV booster		
2138	318518.63	4311913.97	1285628.57	462796.73	0.97		2157	2157		2157			MPV1	318518.67	4311914.02	0.02	MkIV booster		
2139	318517.96	4311914.35	1285626.35	462797.94	7.48		2156			2156			TT1	318517.96	4311914.35	0.19			
2140	318517.81	4311913.95	1285625.87	462796.61	0.01		2156	2156					MPV1	318517.81	4311913.95	0.00	MkIV booster		
2141	318517.06	4311914.46	1285623.40	462798.22	0.00		2155	2155		2155			MPV1	318517.04	4311914.39	0.00	MkIV booster		
2142	318516.22	4311913.98	1285620.67	462796.60	6.30		2154			2154			TT1	318516.22	4311913.98	0.16			
2143	318515.86	4311914.10	1285619.48	462796.96	0.36		2154	2154					MPV1	318515.86	4311914.10	0.01	MkIV booster		
2144	318516.45	4311915.10	1285621.34	462800.28	1.56		2153	2153					MPV1	318516.45	4311915.10	0.04	MkIV booster		
2145	318516.46	4311915.45	1285621.35	462801.44	4.33		2153			2153			TT1	318516.46	4311915.45	0.11			
2146	318516.78	4311916.02	1285622.36	462803.34	0.91		2152	2152		2152			MPV1	318516.69	4311916.00	0.02	MkIV booster		
2147	318518.29	4311915.17	1285627.37	462800.67	0.00		2151	2151					MPV1	318518.29	4311915.17	0.00	MkIV booster		
2148	318518.33	4311915.51	1285627.48	462801.77	5.12		2151			2151			TT1	318518.33	4311915.51	0.13			
2149	318518.21	4311916.41	1285627.02	462804.71	11.02		2150			2150			TT1	318518.21	4311916.41	0.28			
2150	318517.71	4311916.56	1285625.36	462805.17	9.49		2150	2150					MPV1	318517.71	4311916.56	0.24	MkIV booster		
2151	318517.98	4311917.52	1285626.18	462808.34	39.37		2149	2149		2149			MPV1	318517.95	4311917.51	1.00	Livens Horiz	Empty	
2152	318518.98	4311917.09	1285629.50	462807.00			36						EM61					bad decay	
2153	318519.81	4311917.20	1285632.20	462807.40	0.00		2148	2148		2148			MPV1	318519.89	4311917.15	0.00	MkIV booster		
2154	318519.41	4311917.80	1285630.85	462809.36	0.06		2147	2147		2147			MPV1	318519.39	4311917.76	0.00	MkIV booster		
2155	318519.55	4311920.49	1285631.11	462818.18	1.22		2146	2146		2146			MPV1	318519.51	4311920.53	0.03	MkIV booster		
2156	318519.09	4311920.49	1285629.62	462818.15	0.00		2145	2145		2145			MPV1	318519.03	4311920.40	0.00	MkIV booster		
2157	318517.23	4311922.75	1285623.36	462825.44	0.00		2144	2143					MPV1	318517.23	4311922.75	0.00	ISO M40		
2158	318516.98	4311922.38	1285622.57	462824.22	5.12		2144	2144		2144			TT1	318517.09	4311922.42	-0.13			
2159	318516.75	4311922.68	1285621.78	462825.17	2.36		2143			2143			TT1	318516.75	4311922.68	0.06			
2160	318516.21	4311924.34	1285619.88	462830.57	5.12		2142	2142		2141	2142		TT2	318516.21	4311924.33	-0.13			
2161	318516.41	4311924.66	1285620.53	462831.63	0.00		2141	2141					MPV1	318516.41	4311924.66	0.00	MkIV booster		
2162	318516.98	4311925.27	1285622.35	462833.68	4.33		2140			2140			TT1	318516.98	4311925.27	0.11			
2163	318516.52	4311925.38	1285620.83	462834.01	0.79		2139	2139	2140	2139			TT1	318516.69	4311925.32	0.02			
2164	318515.27	4311925.24	1285616.74	462833.48	0.39		2138	2138		2138			TT1	318515.33	4311925.31	0.01			
2165	318515.46	4311925.53	1285617.35	462834.43	1.57		2138			2137			TT1	318515.46	4311925.53	0.04			
2166	318515.34	4311926.30	1285616.91	462836.94	5.47		2135	2135	2136	2135	2136		MPV2	318515.42	4311926.30	0.14	MkIV booster		
2167	318514.20	4311926.23	1285613.16	462836.63	3.54		2127			2127			TT1	318514.20	4311926.23	0.09			
2168	318514.23	4311925.60	1285613.30	462834.56	10.82		2133	2132	2133	2133	2134		MPV1	318514.08	4311925.42	0.27	MkIV booster		

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
2169	318514.04	4311924.89	1285612.72	462832.24	2.70		2131	2131		2131	2132		MPV1	318513.99	4311924.91	0.07	MkIV booster		
2170	318513.28	4311925.43	1285610.19	462833.95	3.15		2130	2130		2130			TT1	318513.26	4311925.42	0.08			
2171	318512.99	4311925.95	1285609.20	462835.61	31.89		2129	2129		2129			TT1	318513.10	4311925.97	-0.81			
2172	318512.41	4311927.07	1285607.24	462839.27	8.27		2128	2128		2128			TT1	318512.54	4311927.02	-0.21			
2173	318513.73	4311926.62	1285611.60	462837.87	2.26		2127	2127					MPV1	318513.73	4311926.62	0.06	MkIV booster		
2174	318514.27	4311927.90	1285613.28	462842.13	3.15		2126	2126		2126			TT1	318514.40	4311927.89	0.08			
2175	318513.02	4311929.03	1285609.10	462845.74	4.56		2125	2125		2125			MPV1	318512.91	4311929.10	0.12	MkIV booster		
2176	318512.28	4311928.97	1285606.67	462845.47	0.00		2124	2124		2124			TT1	318512.34	4311928.90	0.00			
2177	318512.69	4311929.77	1285607.97	462848.14	3.61		2123	2123		2123			MPV1	318512.63	4311929.83	0.09	MkIV booster		
2178	318513.50	4311931.62	1285610.47	462854.26	3.09		2122	2122		2122			MPV1	318513.47	4311931.68	0.08	MkIV booster		
2179	318514.34	4311931.82	1285613.23	462854.98	0.00		2121	2121					MPV1	318514.34	4311931.82	0.00	MkIV booster		
2180	318514.32	4311932.49	1285613.11	462857.17	14.17		2121			2121			TT1	318514.32	4311932.49	-0.36			
2181	318511.55	4311932.80	1285604.00	462858.00			54						EM61						
2182	318510.72	4311930.84	1285601.42	462851.50	11.89		2120	2120		2120			MPV1	318510.68	4311930.88	0.30	MkIV booster		
2183	318509.97	4311929.60	1285599.05	462847.39	13.08		2114	2113	2114	2113	2114		MPV2	318509.82	4311929.60	0.33	MkIV booster		
2184	318510.81	4311928.99	1285601.86	462845.44	5.73		2112	2112					MPV1	318510.81	4311928.99	0.15	MkIV booster		
2185	318510.75	4311928.25	1285601.70	462843.01	0.00		2112			2112			TT1	318510.75	4311928.25	0.00			
2186	318509.78	4311928.34	1285598.52	462843.22	13.78		2111	2111		2111			MPV1	318509.78	4311928.39	0.35	MkIV booster		
2187	318509.02	4311928.85	1285595.98	462844.87	6.69		2110	2110		2110			TT1	318508.99	4311928.84	-0.17			
2188	318508.75	4311927.39	1285595.20	462840.06	2.53		2109	2109		2109			MPV1	318508.77	4311927.34	0.06	MkIV booster		
2189	318507.95	4311928.23	1285592.53	462842.75	6.15		2108	2108		2108			MPV1	318508.00	4311928.28	0.16	MkIV booster		
2190	318507.39	4311928.11	1285590.68	462842.32	3.94		2107	2107		2107			TT1	318507.38	4311928.04	0.10			
2191	318507.87	4311928.84	1285592.21	462844.75	0.79		2106	2106		2106			TT1	318507.84	4311928.82	-0.02			
2192	318507.68	4311929.63	1285591.52	462847.30	5.51		2105	2105		2104	2105		TT1	318507.66	4311929.64	-0.14			
2193	318508.08	4311929.98	1285592.81	462848.48	7.45		2104	2104					MPV1	318508.08	4311929.98	0.19	MkIV booster		
2194	318507.84	4311930.45	1285592.00	462850.00			49						EM61						
2195	318508.17	4311930.72	1285593.05	462850.92	12.20		2117	2117		2117	2118		TT1	318508.14	4311930.57	-0.31			
2196	318508.68	4311930.89	1285594.74	462851.51	5.95		2118	2118					MPV1	318508.68	4311930.89	0.15	MkIV booster		
2197	318508.81	4311930.31	1285595.20	462849.61	12.84		2116	2116		2116			MPV1	318508.91	4311930.41	0.33	MkIV booster		
2198	318509.25	4311930.31	1285596.62	462849.65	6.30		2115	2115		2115			TT1	318509.17	4311930.27	-0.16			
2199	318509.60	4311931.05	1285597.74	462852.12	7.43		2119	2119		2119			MPV1	318509.62	4311931.09	0.19	MkIV booster		
2200	318508.29	4311932.37	1285593.33	462856.34	5.12		2097	2097		2097			TT1	318508.38	4311932.32	-0.13			
2201	318507.66	4311931.88	1285591.31	462854.68	4.33		2099	2099		2098	2099		TT2	318507.71	4311931.85	-0.11			
2202	318507.60	4311932.36	1285591.07	462856.25	6.89		2098	2098					MPV1	318507.60	4311932.36	0.17	MkIV booster		
2203	318506.60	4311933.23	1285587.73	462859.04	4.76		2096	2096		2095	2096		MPV1	318506.68	4311933.32	0.12	MkIV booster		
2204	318506.21	4311933.48	1285586.43	462859.82	6.10		2095	2095					MPV1	318506.21	4311933.48	0.15	MkIV booster		
2205	318505.73	4311932.12	1285584.95	462855.33	5.12		2090	2090		2090			TT1	318505.73	4311932.12	-0.13			
2206	318504.53	4311932.90	1285580.95	462857.80	7.09		2091	2091		2091			TT1	318504.49	4311932.84	-0.18			
2207	318503.90	4311931.39	1285579.00	462852.82	18.90		2080	2080		2080			TT1	318503.93	4311931.34	-0.48			
2208	318505.34	4311931.15	1285583.74	462852.14	9.45		2089	2089		2089			TT1	318505.26	4311931.17	-0.24			
2209	318505.71	4311930.80	1285585.00	462851.00			50						EM61						
2210	318505.61	4311930.42	1285584.69	462849.76	17.32		2088	2088		2088			TT1	318505.62	4311930.36	-0.44			
2211	318506.44	4311930.64	1285587.40	462850.54	9.54		2102	2102					MPV1	318506.44	4311930.64	0.24	MkIV booster		
2212	318506.70	4311930.90	1285588.23	462851.42	9.84		2101	2101		2101	2102		TT1	318506.62	4311930.90	-0.25			
2213	318506.92	4311931.18	1285588.92	462852.34	8.04		2100	2100		2100			MPV1	318506.90	4311931.21	0.20	MkIV booster		
2214	318506.78	4311929.87	1285588.56	462848.04	15.75		2103	2103		2103			TT1	318506.78	4311929.83	-0.40			
2215	318506.10	4311929.16	1285586.40	462845.65	7.09		2086	2085	2086	2085	2086		TT2	318506.03	4311929.17	-0.18			
2216	318506.17	4311928.75	1285586.64	462844.32	1.97		2084			2084			TT1	318506.17	4311928.75	0.05			
2217	318505.67	4311928.53	1285585.03	462843.56	16.84		2084	2084					MPV1	318505.67	4311928.53	0.43	75 mm		
2218	318505.48	4311929.63	1285584.31	462847.17	22.44		2087	2087		2087			TT1	318505.50	4311929.64	-0.57			
2219	318504.56	4311929.95	1285581.28	462848.14	22.44		2082	2081	2082	2081	2082		TT2	318504.61	4311929.84	-0.57			
2220	318504.03	4311929.26	1285579.58	462845.85	5.40		2083	2083					MPV1	318504.03	4311929.26	0.14	ISO M40		

Target #	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
2221	318504.59	4311928.90	1285581.45	462844.70	4.33		2083			2083			TT1	318504.59	4311928.90	0.11			
2222	318498.68	4311923.50	1285562.47	462826.55	3.15		2075	2075		2075			TT1	318498.75	4311923.50	-0.08			
2223	318499.83	4311926.74	1285565.99	462837.28	10.33		2076	2076					MPV1	318499.83	4311926.74	0.26	MkIV booster		
2224	318500.67	4311930.30	1285568.50	462849.00			48						EM61						
2225	318502.31	4311930.64	1285573.85	462850.25	2.76		2077	2077		2077			TT1	318502.29	4311930.58	-0.07			
2226	318502.12	4311931.59	1285573.15	462853.35	13.19		2079	2078	2079	2078	2079		MPV2	318502.11	4311931.72	0.34	75 mm		yes
2227	318502.08	4311932.10	1285573.00	462855.00			53						EM61						
2228	318502.13	4311934.23	1285573.00	462862.00			55						EM61						
2229	318504.75	4311934.79	1285581.56	462864.02	16.54		2092	2092	2094	2093	2094		TT1	318504.77	4311934.82	-0.42			
2230	318504.61	4311935.29	1285581.05	462865.65	15.21		2093	2093		2092			MPV1	318504.59	4311935.30	0.39	75 mm		

\1 - At this stage, this is the best initial library match, but may not be a high confidence fit; it was considered useful to the dig teams and was included on the dig sheets.

UTM X = Easting, UTM Zone 18N WGS 84 Meters
UTM Y = Northing, UTM Zone 18N WGS 84 Meters
SP_X = Easting, Maryland SP NAD83 US Survey Foot
SP_Y = Northing, Maryland SP NAD83 US Survey Foot
Est_Depth_in = Estimated depth of the item (inches)
EM61_Ch2 = Channel 2 mV response for EM61 targets only
Flag = Closest cued flag ID
MPV1 = ID of closest MPV pick (w/in 30cm)
MPV2 = ID of second MPV point (w/in 30cm)
TT1 = ID of closest TEMTADS pick (w/in 30cm)
TT2 = ID of second TEMTADS point (w/in 30cm)
Comments = QC Comments
List = Dataset target info is from
Fit_X = Estimated location of closest modeled item (UTM Easting)
Fit_Y = Estimated location of closest modeled item (UTM Northing)
Fit_Z = Estimated depth of modeled item (meters)
Fit_Item = Best initial Library match
Processor_Comments: Indicates targets with little to no response
Training_Request: MPV requests ground truth for these targets to inform their classification routine

Target ID	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
1001	318487.06	4311984.2	1285519.974	463024.8132	13.8		1000			1000			TT1	318487.06	4311984.2	-0.35			
1002	318487.3747	4311983.669	1285521.044	463023.0942	-4.4		1000	1000					MPV1	318487.3747	4311983.669	0.112816662	MkIV booster		
1003	318487.7317	4311983.031	1285522.261	463021.0257	7.1		1001	1001		1001			TT1	318487.73	4311982.97	-0.18			
1004	318488.2456	4311982.303	1285523.999	463018.6766	-10.9		1002	1002					MPV1	318488.2456	4311982.303	0.277063465	MkIV booster		
1005	318488.37	4311982.65	1285524.382	463019.8237	13.0		1002			1002			TT1	318488.37	4311982.65	-0.33			
1006	318489.1735	4311983.578	1285526.95	463022.9252	-8.6		1003	1003		1003			MPV1	318489.1569	4311983.486	0.218185652	MkIV booster		
1007	318488.9833	4311982.591	1285526.398	463019.6743	-18.4		1004	1004					MPV1	318488.9833	4311982.591	0.467460807	ISO M40		
1008	318488.96	4311982.29	1285526.343	463018.6854	14.9		1004			1004			TT1	318488.96	4311982.29	-0.38			
1009	318489.0146	4311981.041	1285526.612	463014.5928	-8.5		1005	1005		1005			MPV1	318488.9792	4311980.992	0.215580445	ISO S80		yes
1010	318489.7372	4311980.184	1285529.044	463011.834	0.0		1006	1006					MPV1	318489.7372	4311980.184	2.35E-14	MkIV booster		
1011	318490.3491	4311980.382	1285531.036	463012.5263	6.7		1007	1007		1007			TT1	318490.45	4311980.37	-0.17			
1012	318491.9192	4311979.725	1285536.233	463010.4856	12.6		1008	1008		1008			TT1	318491.99	4311979.65	-0.32			
1013	318493.1167	4311977.502	1285540.321	463003.2807	0.0		1009	1009					MPV1	318493.1167	4311977.502	2.35E-14	MkIV booster		
1014	318493.41	4311978.12	1285541.238	463005.3288	8.3		1009			1009			TT1	318493.41	4311978.12	-0.21			
1015	318493.699	4311979.116	1285542.114	463008.6163	-6.8		1010	1010		1010			MPV1	318493.6279	4311979.052	0.172146363	MkIV booster		
1016	318494.244	4311979.111	1285543.902	463008.6391	14.9		1011	1011		1011			TT1	318494.38	4311979.08	-0.38			
1017	318494.6463	4311980.268	1285545.138	463012.4629	-18.8		1012	1012		1012			MPV1	318494.5525	4311980.256	0.479179467	MkIV booster		
1018	318497.51	4311980.98	1285554.48	463015.0043	-0.4		1013			1013			TT1	318497.51	4311980.98	0.01			
1019	318497.6063	4311981.267	1285554.775	463015.9526	-0.1		1013	1013					MPV1	318497.6063	4311981.267	0.002269588	MkIV booster		
1020	318497.9552	4311979.695	1285556.033	463010.8201	-4.8		1014	1014		1014			MPV1	318497.9704	4311979.699	0.121117836	MkIV booster		
1021	318498.92	4311979.01	1285559.246	463008.6445	-3.9		1015			1015			TT1	318498.92	4311979.01	0.1			
1022	318499.2386	4311979.076	1285560.287	463008.8839	-1.4		1015	1015					MPV1	318499.2386	4311979.076	0.035786476	MkIV booster		
1023	318499.64	4311978.66	1285561.633	463007.5484	7.5		1016			1016			TT1	318499.64	4311978.66	-0.19			
1024	318499.8425	4311978.909	1285562.279	463008.3796	-12.7		1016	1016					MPV1	318499.8425	4311978.909	0.322883699	MkIV booster		
1025	318500.8788	4311978.758	1285565.689	463007.9573	5.9		1017	1017		1017			TT1	318500.84	4311978.77	-0.15			
1026	318500.9248	4311978.358	1285565.869	463006.6487	-7.3		1018	1018		1018			MPV1	318500.9096	4311978.245	0.185451313	MkIV booster		
1027	318500.0575	4311977.187	1285563.108	463002.7472	11.8		1019	1019		1019			TT1	318500.05	4311977.31	-0.3			
1028	318499.6795	4311977.237	1285561.865	463002.8823	4.3		1020	1020		1020			TT1	318499.65	4311977.32	-0.11			
1029	318499.0121	4311977.441	1285559.661	463003.5039	8.6		1021	1021		1021	1022		TT1	318498.98	4311977.55	-0.22			
1030	318498.4163	4311977.54	1285557.7	463003.7868	-4.8		1022	1022					MPV1	318498.4163	4311977.54	0.121316314	MkIV booster		
1031	318497.37	4311978.25	1285554.217	463006.0402	6.3		1023			1023			TT1	318497.37	4311978.25	-0.16			
1032	318497.5628	4311977.762	1285554.885	463004.4535	-5.8		1023	1023					MPV1	318497.5628	4311977.762	0.146953318	MkIV booster		
1033	318497.62	4311976.29	1285555.178	462999.6297	-1.2		1024			1024			TT1	318497.62	4311976.29	0.03			
1034	318497.1515	4311976.109	1285553.655	462999.0023	0.0		1024	1024					MPV1	318497.1515	4311976.109	2.33E-14	MkIV booster		
1035	318499.8077	4311974.601	1285562.475	462994.2475	-1.7		1025	1025					MPV1	318499.8077	4311974.601	0.044514595	MkIV booster		
1036	318499.67	4311974.07	1285562.062	462992.496	5.1		1025			1025			TT1	318499.67	4311974.07	-0.13			
1037	318500.51	4311973.77	1285564.839	462991.5725	5.1		1026			1026			TT1	318500.51	4311973.77	-0.13			
1038	318500.7984	4311973.967	1285565.77	462992.2394	-1.0		1026	1026					MPV1	318500.7984	4311973.967	0.02587045	MkIV booster		
1039	318501.4419	4311976.349	1285567.709	463000.0983	-4.7		1027	1027					MPV1	318501.4419	4311976.349	0.119003595	MkIV booster		
1040	318501.85	4311976.59	1285569.031	463000.9182	8.6		1027			1027			TT1	318501.85	4311976.59	-0.22			
1041	318505.1767	4311975.78	1285580	462998.5006		462.26	38					ERT EM61 Target	EM61						
1042	318505.9204	4311977.537	1285582.313	463004.3172	-0.4		1028	1028					MPV1	318505.9204	4311977.537	0.010867866	MkIV booster		
1043	318506.3	4311977.26	1285583.578	463003.436	14.1		1028			1028			TT1	318506.3	4311977.26	-0.36			
1044	318506.8636	4311975.541	1285585.55	462997.8385	6.3		1029	1029		1029			TT1	318506.84	4311975.58	-0.16			
1045	318510.5731	4311977.625	1285597.567	463004.9416								Driveway TT target	DW					not cued	
1046	318509.4239	4311975.15	1285593.975	462996.74								Driveway TT target	DW					not cued	
1047	318509.2673	4311974.623	1285593.5	462995.0006		61.23	37					ERT EM61 Target	EM61						
1048	318508.239	4311973.047	1285590.241	462989.759								Driveway TT target	DW					not cued	
1049	318507.5705	4311969.266	1285588.32	462977.3069								Driveway TT target	DW					not cued	
1050	318506.6361	4311968.509	1285585.31	462974.7586		17.05	44					ERT EM61 Target	EM61						
1051	318506.0454	4311967.451	1285583.449	462971.2456		19.81	45					ERT EM61 Target	EM61						

Target ID	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
1052	318505.5335	4311967.665	1285581.754	462971.9106	-7.5		1049	1049					MPV1	318505.5335	4311967.665	0.191987778	MkIV booster		
1053	318505.15	4311967.54	1285580.506	462971.473	13.4		1049			1049			TT1	318505.15	4311967.54	-0.34			
1054	318504.27	4311967.74	1285577.605	462972.0656	-4.7		1048			1048			TT1	318504.27	4311967.74	0.12		weak/no response	
1055	318503.84	4311967.33	1285576.224	462970.6899	-4.7		1047			1047			TT1	318503.84	4311967.33	0.12		weak/no response	
1056	318503.5396	4311967.473	1285575.229	462971.1373	-2.1		1047	1047					MPV1	318503.5396	4311967.473	0.053183472	MkIV booster		
1057	318503.6697	4311968.012	1285575.616	462972.9145	-9.0		1048	1048					MPV1	318503.6697	4311968.012	0.229592522	MkIV booster		
1058	318502.6257	4311971.156	1285571.966	462983.1496	-4.6		1030	1030		1030			MPV1	318502.6414	4311971.141	0.115999193	MkIV booster		
1059	318502.22	4311970.24	1285570.701	462980.1177	2.0		1031			1031			TT1	318502.22	4311970.24	-0.05			
1060	318501.8658	4311970.31	1285569.534	462980.3218	-3.7		1032	1031					MPV1	318501.8658	4311970.31	0.095366981	MkIV booster		
1061	318501.4996	4311970.388	1285568.328	462980.5496	-2.7		1032	1032	1032				MPV1	318501.5218	4311970.44	0.069788438	MkIV booster		
1062	318501.43	4311969.915	1285568.134	462978.9948	0.8		1033			1033	1032		TT2	318501.42	4311969.97	-0.02			
1063	318500.9617	4311969.838	1285566.603	462978.7069	9.4		1034	1034		1034			TT1	318500.94	4311969.74	-0.24			
1064	318500.1161	4311970.347	1285563.793	462980.3155	8.3		1035	1035		1035			TT1	318500.05	4311970.27	-0.21			
1065	318499.4082	4311970.465	1285561.463	462980.6516	11.4		1036	1036		1036			TT1	318499.41	4311970.42	-0.29			
1066	318498.4473	4311970.829	1285558.285	462981.7763	6.7		1037	1037		1037			TT1	318498.35	4311970.87	-0.17			
1067	318496.82	4311970.74	1285552.954	462981.3689	1.6		1038			1038			TT1	318496.82	4311970.74	-0.04			
1068	318496.747	4311971.145	1285552.685	462982.6919	-1.5		1038	1038					MPV1	318496.747	4311971.145	0.03847312	MkIV booster		
1069	318495.3957	4311971.879	1285548.2	462985.0021	-4.6		1039	1039					MPV1	318495.3957	4311971.879	0.115950237	MkIV booster		
1070	318494.9335	4311971.902	1285546.683	462985.0426	19.3		1040	1040		1040			TT1	318494.81	4311971.84	-0.49			
1071	318494.52	4311971.48	1285545.357	462983.6304	18.1		1039			1039			TT1	318494.52	4311971.48	-0.46			
1072	318489.6709	4311972.639	1285529.369	462987.0826	-9.1		1136	1136					MPV1	318489.6709	4311972.639	0.231482071	MkIV booster		
1073	318490.5218	4311973.59	1285532.092	462990.2631	-10.5		1137	1137					MPV1	318490.5218	4311973.59	0.26729654	MkIV booster		
1074	318490.19	4311973.79	1285530.989	462990.8951	7.5		1137			1137			TT1	318490.19	4311973.79	-0.19			
1075	318489.15	4311975.823	1285527.432	462997.4866	-7.5		1140	1140		1140			MPV1	318489.24	4311975.905	0.190235044	MkIV booster		
1076	318487.9536	4311975.835	1285523.506	462997.4415	-3.0		1139	1139		1139			MPV1	318487.9671	4311975.84	0.075141016	MkIV booster		
1077	318488.9245	4311977.27	1285526.588	463002.2163	3.5		1141	1141		1141			TT1	318488.9	4311977.29	-0.09			
1078	318489.1666	4311978.401	1285527.3	463005.9449	-2.8		1143	1143		1143			TT1	318489.11	4311978.44	0.07			
1079	318488.1373	4311978.173	1285523.941	463005.123	-7.6		1144	1144					MPV1	318488.1373	4311978.173	0.192263943	MkIV booster		
1080	318488.12	4311978.48	1285523.862	463006.1287	-2.0		1144			1144			TT1	318488.12	4311978.48	0.05			
1081	318486.48	4311980.08	1285518.368	463011.2584	-5.5		1146			1146			TT1	318486.48	4311980.08	0.14			
1082	318486.284	4311979.698	1285517.752	463009.9914	-6.5		1146	1146					MPV1	318486.284	4311979.698	0.164341555	MkIV booster		
1083	318486.1888	4311977.571	1285517.593	463003.0082	-1.8		1145	1145					MPV1	318486.1888	4311977.571	0.044562566	MkIV booster		
1084	318485.2512	4311973.741	1285514.794	462990.3789	-6.3		1129	1129					MPV1	318485.2512	4311973.741	0.15911617	MkIV booster		
1085	318484.167	4311973.865	1285511.229	462990.7075	-7.9		1128	1128					MPV1	318484.167	4311973.865	0.200165032	MkIV booster		
1086	318483.2584	4311973.434	1285508.28	462989.2285	-7.6		1127	1127					MPV1	318483.2584	4311973.434	0.193794446	MkIV booster		yes
1087	318484.0495	4311972.239	1285510.961	462985.366	-8.5		1126	1126					MPV1	318484.0495	4311972.239	0.215659495	MkIV booster		
1088	318484.4664	4311970.498	1285512.453	462979.6841	-10.6		1124	1124					MPV1	318484.4728	4311970.485	0.268458632	MkIV booster		
1089	318482.638	4311970.233	1285506.475	462978.685	-20.3		1125	1125					MPV1	318482.638	4311970.233	0.516070262	Stokes mortar		
1090	318480.4441	4311967.176	1285499.5	462968.5006		36.3	36					ERT EM61 Target	EM61						
1091	318480.954	4311966.738	1285501.204	462967.1006	5.1		1120	1120		1120			TT1	318480.97	4311966.62	-0.13			
1092	318480.2616	4311965.808	1285499	462964.0006		28.03	35					ERT EM61 Target	EM61						
1093	318481	4311966.02	1285501.406	462964.749	-2.0		1119			1119			TT1	318481	4311966.02	0.05			
1094	318481.3544	4311965.682	1285502.593	462963.6659	0.0		1119	1119					MPV1	318481.3544	4311965.682	3.68E-12	MkIV booster		
1095	318482.8873	4311968.501	1285507.418	462973.0222	-6.7		1121	1121					MPV1	318482.8873	4311968.501	0.170105119	MkIV booster		yes
1096	318483.5173	4311968.197	1285509.506	462972.0689	3.9		1122	1122		1121			TT1	318483.41	4311968.17	-0.1			
1097	318484.1876	4311968.89	1285511.655	462974.3917	-11.7		1123	1123					MPV1	318484.1876	4311968.89	0.296762677	MkIV booster		
1098	318485.6757	4311969.434	1285516.496	462976.2831	-9.2		1131	1131					MPV1	318485.6757	4311969.434	0.235241775	MkIV booster	empty	
1099	318486.5723	4311968.685	1285519.491	462973.891	-4.1		1132	1132					MPV1	318486.5723	4311968.685	0.105586721	MkIV booster		
1100	318488.119	4311968.795	1285524.556	462974.3631	-5.2		1133	1133					MPV1	318488.119	4311968.795	0.13198017	MkIV booster		
1101	318489.73	4311969.6	1285529.782	462977.1194	-5.9		1135			1135			TT1	318489.73	4311969.6	0.15			
1102	318490.1989	4311969.583	1285531.321	462977.0974	0.0		1135	1135					MPV1	318490.1989	4311969.583	2.86063E-07	MkIV booster		
1103	318492.9495	4311967.713	1285540.477	462971.1621	-9.4		1042	1042					MPV1	318492.9495	4311967.713	0.237936468	MkIV booster		
1104	318494.5521	4311968.507	1285545.676	462973.8817	-3.2		1041	1041					MPV1	318494.5521	4311968.507	0.080672615	MkIV booster		
1105	318495.1796	4311967.597	1285547.8	462970.9422	-4.3		1043	1043					MPV1	318495.1796	4311967.597	0.110528677	MkIV booster		

Target ID	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
1106	318496.5215	4311966.155	1285552.305	462966.3092	-13.8		1044	1044					MPV1	318496.5215	4311966.155	0.350218811	Stokes mortar		yes
1107	318498.8492	4311965.192	1285560.009	462963.3183	0.0		1045	1045					MPV1	318498.8492	4311965.192	2.23E-14	75 mm		
1108	318500.5359	4311966.644	1285565.436	462968.202	-3.9		1046	1046					MPV1	318500.5359	4311966.644	0.100308645	MkIV booster		
1109	318502.867	4311964.109	1285573.265	462960.0554	-8.2		1054	1054		1054			MPV1	318502.8339	4311964.068	0.207588993	MkIV booster		
1110	318503.268	4311965.584	1285574.474	462964.9221	0.0		1053	1053					MPV1	318503.268	4311965.584	2.38E-14	MkIV booster		
1111	318503.81	4311965.64	1285576.247	462965.1448	3.9		1053			1053			TT1	318503.81	4311965.64	-0.1		weak/no response	
1112	318504.6066	4311966.496	1285578.798	462968.008	10.2		1052	1052		1052			TT1	318504.57	4311966.36	-0.26			
1113	318504.6381	4311966.783	1285578.881	462968.9522	6.3		1051	1051		1051	1050		TT2	318504.64	4311966.8	-0.16			
1114	318504.997	4311966.89	1285580.051	462969.33	-11.7		1050	1050					MPV1	318504.997	4311966.89	0.298182076	MkIV booster		
1115	318505.3894	4311966.785	1285581.345	462969.0152								Driveway TT target	DW					not cued	
1116	318506.8845	4311966.645	1285586.259	462968.6613								Driveway TT target	DW					not cued	
1117	318506.4272	4311965.73	1285584.825	462965.6283								Driveway TT target	DW					not cued	
1118	318505.7512	4311965.507	1285582.624	462964.8476		18.37	43					ERT EM61 Target	EM61						
1119	318505.9171	4311963.725	1285583.296	462959.0146								Driveway TT target	DW					not cued	
1120	318504.7113	4311963.135	1285579.384	462956.9926		13.35	41					ERT EM61 Target	EM61						
1121	318503.56	4311960.945	1285575.765	462949.7294								Driveway TT target	DW					not cued	
1122	318504.1712	4311960.751	1285577.784	462949.1366		23.33	42					ERT EM61 Target	EM61						
1123	318504.8617	4311960.699	1285580.052	462949.0154								Driveway TT target	DW					not cued	
1124	318504.1117	4311958.784	1285577.731	462942.6801								Driveway TT target	DW					not cued	
1125	318503.1062	4311955.495	1285574.669	462931.8206								Driveway TT target	DW					not cued	
1126	318500.5725	4311960.484	1285566	462948.0006		67.44	32					ERT EM61 Target	EM61						
1127	318498.8362	4311957.778	1285560.5	462939.0006		128.79	30					ERT EM61 Target	EM61						
1128	318499.3058	4311954.702	1285562.262	462928.9437	-12.3		1055	1055		1055			MPV1	318499.3915	4311954.793	0.312456072	MkIV booster		
1129	318498.1565	4311954.592	1285558.5	462928.5006		543.12	26					ERT EM61 Target	EM61						
1130	318498.0051	4311953.166	1285558.106	462923.8139	-9.1		1056	1056		1056			MPV1	318498.0601	4311953.142	0.230837562	MkIV booster		
1131	318497.2807	4311951.824	1285555.827	462919.3585	-13.5		1057	1057		1057			MPV1	318497.3413	4311951.707	0.342622369	ISO M40		
1132	318493.8969	4311949.992	1285544.86	462913.1078	-8.1		1059	1059					MPV1	318493.8969	4311949.992	0.20726253	MkIV booster		
1133	318493.99	4311949.59	1285545.195	462911.796	11.8		1059			1059			TT1	318493.99	4311949.59	-0.3			
1134	318494.4644	4311948.962	1285546.796	462909.7704	-9.4		1060	1060		1060			MPV1	318494.5388	4311949.084	0.237918039	MkIV booster		
1135	318496.03	4311947.7	1285552.022	462905.744	25.5		1061			1061			TT1	318496.03	4311947.7	-0.65		weak/no response	
1136	318495.7452	4311947.805	1285551.08	462906.0678	-6.6		1061	1061					MPV1	318495.7452	4311947.805	0.167042263	MkIV booster		
1137	318494.8314	4311944.128	1285548.347	462893.9404	-6.0		1066	1066		1066			MPV1	318494.8127	4311944.015	0.153103349	MkIV booster		
1138	318495.3253	4311944.799	1285549.919	462896.1784	-3.5		1065	1065	1064	1065			MPV1	318495.3403	4311944.761	0.088667851	ISO S80		
1139	318495.08	4311945.1	1285549.093	462897.1479	7.9		1064			1064			TT1	318495.08	4311945.1	-0.2			
1140	318494.8307	4311945.573	1285548.241	462898.6814	-5.0		1063	1063					MPV1	318494.8307	4311945.573	0.126608156	MkIV booster		
1141	318494.42	4311945.67	1285546.887	462898.9699	1.6		1063			1063			TT1	318494.42	4311945.67	-0.04			
1142	318492.8725	4311947.047	1285541.712	462903.3733	0.0		1062	1062		1062			TT1	318492.91	4311947.04	0			
1143	318491.0351	4311947.642	1285535.643	462905.1941	-2.1		1105	1105		1105			MPV1	318491.0501	4311947.664	0.054201339	MkIV booster		
1144	318491.4045	4311948.925	1285536.762	462909.4288	-2.4		1107	1107		1107			MPV1	318491.2789	4311949	0.061076214	MkIV booster		
1145	318491.2257	4311950.427	1285536.068	462914.3423	0.4		1108	1108		1108			TT1	318491.24	4311950.41	-0.01			
1146	318490.6484	4311951.159	1285534.121	462916.7016	-2.6		1109	1109		1109			MPV1	318490.6167	4311951.088	0.066219793	MkIV booster		
1147	318486.4261	4311949.799	1285520.371	462911.9354	5.1		1100	1100		1100			TT1	318486.44	4311949.75	-0.13			
1148	318486.6848	4311951.403	1285521.104	462917.2165	-8.1		1098	1098					MPV1	318486.6848	4311951.403	0.206855125	MkIV booster		
1149	318486.49	4311951.15	1285520.483	462916.3727	3.5		1098			1098			TT1	318486.49	4311951.15	-0.09			
1150	318486.0156	4311950.591	1285518.968	462914.5051	2.8		1099	1099		1099			TT1	318486	4311950.55	-0.07			
1151	318485.7024	4311951.322	1285517.888	462916.8785	-7.1		1097	1097		1097			MPV1	318485.7148	4311951.423	0.180722033	MkIV booster		
1152	318485.02	4311951.55	1285515.633	462917.5788	-0.4		1096			1096			TT1	318485.02	4311951.55	0.01			
1153	318484.8832	4311951.79	1285515.167	462918.3561	8.6		1095	1095	1095	1095			TT1	318484.97	4311951.91	-0.22			
1154	318484.6405	4311952.409	1285514.326	462920.3689	-4.4		1094	1094		1094			MPV1	318484.6609	4311952.468	0.112381972	MkIV booster		yes
1155	318486.5731	4311953.847	1285520.562	462925.2228	-6.8		1110	1110		1110			MPV1	318486.5561	4311953.843	0.173839743	MkIV booster		yes
1156	318486.3245	4311954.314	1285519.713	462926.7383	-3.4		1111	1111		1111			MPV1	318486.4189	4311954.298	0.086144318	MkIV booster		
1157	318484.3947	4311953.845	1285513.417	462925.0611	2.0		1112	1112		1112			TT1	318484.36	4311953.86	-0.05			
1158	318483.43	4311952.84	1285510.325	462921.6954	7.5		1093			1093			TT1	318483.43	4311952.84	-0.19			
1159	318483.47	4311952.424	1285510.486	462920.3338	-2.1		1093	1093					MPV1	318483.47	4311952.424	0.054125608	MkIV booster		
1160	318483.0796	4311950.079	1285509.375	462912.6144	0.4		1092	1092		1092			TT1	318483.1	4311950.06	-0.01			

Target ID	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
1161	318481.2971	4311950.641	1285503.488	462914.3278			1091						TT1						
1162	318481.9338	4311951.282	1285505.53	462916.476	11.0		1090	1090		1090			TT1	318481.93	4311951.27	-0.28			
1163	318481.4038	4311952.061	1285503.736	462918.9945	-12.2		1089	1089		1089			MPV1	318481.4675	4311952.052	0.309876099	MkIV booster		
1164	318481.1276	4311953.616	1285502.718	462924.0732	-8.3		1088	1088		1088			MPV1	318481.0451	4311953.731	0.210662809	MkIV booster		
1165	318482.4707	4311954.811	1285507.037	462928.0909	-1.8		1113	1113		1113			MPV1	318482.4513	4311954.772	0.047064583	MkIV booster		
1166	318482.0879	4311955.647	1285505.721	462930.8045	-8.1		1114	1114	1115	1114	1115		MPV2	318482.1374	4311955.652	0.205331462	MkIV booster		
1167	318481.9796	4311956.662	1285505.293	462934.1266	-6.3		1116	1116		1116			MPV1	318482.1192	4311956.684	0.160917169	MkIV booster		
1168	318480.55	4311956.32	1285500.629	462932.902	4.7		1117			1117			TT1	318480.55	4311956.32	-0.12			
1169	318480.0831	4311955.295	1285499.171	462929.5065	-4.7		1118	1118		1118			MPV1	318480.0461	4311955.31	0.120790179	MkIV booster		
1170	318479.6605	4311952.603	1285497.979	462920.6467	5.5		1087	1087		1087	1086		TT1	318479.68	4311952.57	-0.14			
1171	318479.5053	4311952.086	1285497.507	462918.9398	-5.6		1086	1086					MPV1	318479.5053	4311952.086	0.141466009	MkIV booster		
1172	318475.773	4311948.833	1285485.5	462908.0006		552.31	15					ERT EM61 Target	EM61						
1173	318475.753	4311947.918	1285485.5	462905.0006		441.22	12					ERT EM61 Target	EM61						
1174	318476.53	4311947.47	1285488.081	462903.5858	-4.7		1085			1085			TT1	318476.53	4311947.47	0.12			
1175	318476.805	4311947.645	1285488.97	462904.1796	-6.0		1085	1085					MPV1	318476.805	4311947.645	0.152842839	MkIV booster		
1176	318477.8962	4311948.329	1285492.5	462906.5006		321.3	13					ERT EM61 Target	EM61						
1177	318478.9327	4311946.934	1285496	462902.0006		681.55	7					ERT EM61 Target	EM61						
1178	318480.1316	4311945.993	1285500	462899.0006		78.32	4					ERT EM61 Target	EM61						
1179	318480.5337	4311947.204	1285501.232	462903.0016	8.3		1084	1084		1084			TT1	318480.52	4311947.21	-0.21			
1180	318482.3016	4311947.622	1285507	462904.5006		28.62	10					ERT EM61 Target	EM61						
1181	318483.39	4311947.64	1285510.568	462904.6372	-3.9		1083			1083			TT1	318483.39	4311947.64	0.1			
1182	318483.7912	4311947.253	1285511.912	462903.3968	-3.7		1083	1083					MPV1	318483.7912	4311947.253	0.093434894	MkIV booster		
1183	318483.92	4311946.97	1285512.355	462902.4779	-3.2		1082	1082		1082			MPV1	318483.9119	4311947.045	0.080894963	MkIV booster		
1184	318483.8062	4311946.089	1285512.045	462899.5801	-4.3		1081	1081		1081			MPV1	318483.8123	4311946.048	0.109070896	MkIV booster		
1185	318483.9142	4311944.69	1285512.5	462895.0006		732.15	2					ERT EM61 Target	EM61						
1186	318484.268	4311944.928	1285513.643	462895.8038	0.4		1080	1080		1080			TT1	318484.31	4311944.79	-0.01			
1187	318485.4076	4311945.647	1285517.329	462898.2441	-4.3		1079	1079		1079			TT1	318485.29	4311945.59	0.11			
1188	318486.9279	4311945.083	1285522.356	462896.5053	-0.2		1075	1075		1075			MPV1	318486.9157	4311945.036	0.00452299	MkIV booster		
1189	318486.3943	4311945.739	1285520.559	462898.6185	17.7		1077	1076		1076	1077		TT1	318486.48	4311945.63	-0.45			
1190	318486.3381	4311946.1	1285520.349	462899.7985	-6.1		1077	1077					MPV1	318486.3381	4311946.1	0.155485124	MkIV booster		
1191	318486.438	4311946.721	1285520.632	462901.8424	0.0		1078	1078					MPV1	318486.438	4311946.721	3.28E-14	MkIV booster		
1192	318486.1	4311946.81	1285519.517	462902.11	-2.8		1078			1078			TT1	318486.1	4311946.81	0.07			
1193	318486.7582	4311947.891	1285521.598	462905.7029	-2.8		1101	1101		1101			TT1	318486.7	4311947.86	0.07		weak/no response	
1194	318488.5948	4311947.384	1285527.658	462904.1723	-4.4		1102	1102		1102			MPV1	318488.6395	4311947.418	0.111815138	ISO S80		
1195	318489.4749	4311946.706	1285530.593	462902.0119	-5.5		1104	1104					MPV1	318489.4749	4311946.706	0.139893529	MkIV booster		
1196	318489.5257	4311946.252	1285530.793	462900.5265	23.2		1103	1103		1104			TT1	318489.44	4311946.28	-0.59			
1197	318489.52	4311945.91	1285530.799	462899.4044	0.4		1103			1103			TT1	318489.52	4311945.91	-0.01			
1198	318489.7429	4311944.933	1285531.6	462896.2143	-5.4		1073	1073		1073			MPV1	318489.6857	4311945.065	0.13643399	MkIV booster		
1199	318488.1024	4311944.596	1285526.244	462894.9926	0.0		1074	1074					MPV1	318488.1024	4311944.596	2.45899E-08	MkIV booster		
1200	318487.84	4311944.19	1285525.412	462893.642	-1.6		1074			1074			TT1	318487.84	4311944.19	0.04			
1201	318487.9981	4311943.229	1285526	462890.5006		260.78	1					ERT EM61 Target	EM61						
1202	318490.044	4311943.839	1285532.666	462892.6478	-1.0		1071	1071		1071			MPV1	318490.008	4311943.887	0.026431344	ISO S80		
1203	318490.3871	4311944.521	1285533.743	462894.9094	-4.8		1072	1072		1072			MPV1	318490.3742	4311944.601	0.123102038	MkIV booster		
1204	318491.5175	4311944.408	1285537.458	462894.6218	-2.8		1070	1070		1070			MPV1	318491.5549	4311944.506	0.070038757	MkIV booster		
1205	318493.21	4311942.67	1285543.134	462889.0432	-3.9		1069			1069			TT1	318493.21	4311942.67	0.1			
1206	318493.0588	4311942.288	1285542.666	462887.7794	-0.6		1069	1069					MPV1	318493.0588	4311942.288	0.016303489	MkIV booster		
1207	318494.1346	4311942.387	1285546.187	462888.1816	-9.5		1068	1068		1068			MPV1	318494.0292	4311942.454	0.242459324	MkIV booster		
1208	318495.3211	4311941.27	1285550.159	462884.6034	-4.4		1067	1067					MPV1	318495.3211	4311941.27	0.110839058	MkIV booster		
1209	318495.03	4311940.89	1285549.232	462883.3361	14.5		1067			1067			TT1	318495.03	4311940.89	-0.37		response due to fence	
1210	318483.733	4311975.243	1285509.706	462995.1959								MPV Corr. Action Target							
1211	318484.09	4311975.82	1285510.836	462997.1141								MPV Corr. Action Target							
1212	318485.543	4311975.33	1285515.637	462995.6116								MPV Corr. Action Target							
1213	318486.267	4311975.42	1285518.005	462995.9589								MPV Corr. Action Target							
1214	318484.386	4311976.724	1285511.741	463000.1004								MPV Corr. Action Target							
1215	318484.542	4311977.34	1285512.209	463002.132								MPV Corr. Action Target							
1216	318486.467	4311981.371	1285518.232	463015.4918								MPV Corr. Action Target							

Target ID	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
1217	318488.245	4311983.484	1285523.912	463022.5501								MPV Corr. Action Target							
1218	318488.462	4311983.963	1285524.589	463024.1368								MPV Corr. Action Target							
1219	318490.219	4311982.578	1285530.451	463019.7207								MPV Corr. Action Target							
1220	318499.123	4311980.955	1285559.772	463015.0384								MPV Corr. Action Target							
1221	318499.809	4311979.811	1285562.104	463011.3357								MPV Corr. Action Target							
1222	318500.013	4311979.394	1285562.804	463009.9826								MPV Corr. Action Target							
1223	318505.391	4311972.742	1285580.922	462988.5522								MPV Corr. Action Target							
1224	318497.293	4311969.266	1285554.611	462976.5684								MPV Corr. Action Target							
1225	318495.879	4311969.007	1285549.992	462975.6171								MPV Corr. Action Target							
1226	318494.968	4311969.52	1285546.968	462977.2341								MPV Corr. Action Target							
1227	318495.097	4311968.527	1285547.462	462973.9865								MPV Corr. Action Target							
1228	318496.009	4311968.165	1285550.479	462972.8648								MPV Corr. Action Target							
1229	318495.848	4311967.408	1285550.006	462970.3704								MPV Corr. Action Target							
1230	318498.605	4311967.337	1285559.054	462970.336								MPV Corr. Action Target							
1231	318499.692	4311967.447	1285562.611	462970.775								MPV Corr. Action Target							
1232	318499.67	4311966.747	1285562.589	462968.4775								MPV Corr. Action Target							
1233	318500.063	4311965.881	1285563.94	462965.6655								MPV Corr. Action Target							
1234	318501.129	4311966.128	1285567.419	462966.5523								MPV Corr. Action Target							
1235	318501.452	4311965.432	1285568.528	462964.2928								MPV Corr. Action Target							
1236	318501.986	4311962.835	1285570.467	462955.8134								MPV Corr. Action Target							
1237	318502.498	4311957.926	1285572.5	462939.7495								MPV Corr. Action Target							
1238	318492.818	4311951.099	1285541.242	462916.661								MPV Corr. Action Target							
1239	318491.833	4311950.531	1285538.052	462914.7271								MPV Corr. Action Target							
1240	318491.283	4311949.786	1285536.302	462912.244								MPV Corr. Action Target							
1241	318492.436	4311949.324	1285540.117	462910.8117								MPV Corr. Action Target							
1242	318494.827	4311948.64	1285548.008	462908.7404								MPV Corr. Action Target							
1243	318493.885	4311946.222	1285545.093	462900.7419								MPV Corr. Action Target							
1244	318490.293	4311945.018	1285533.398	462896.5344								MPV Corr. Action Target							
1245	318484.85	4311945.222	1285515.531	462896.8116								MPV Corr. Action Target							
1246	318485.466	4311949.607	1285517.236	462911.2382								MPV Corr. Action Target							
1247	318487.146	4311949.938	1285522.722	462912.4447								MPV Corr. Action Target							
1248	318488.721	4311948.839	1285527.967	462908.9535								MPV Corr. Action Target							
1249	318490.433	4311949.774	1285533.515	462912.1435								MPV Corr. Action Target							
1250	318489.659	4311950.347	1285530.935	462913.9671								MPV Corr. Action Target							
1251	318487.803	4311950.779	1285524.816	462915.2504								MPV Corr. Action Target							
1252	318485.388	4311951.944	1285516.812	462918.8976								MPV Corr. Action Target							
1253	318485.265	4311953.177	1285516.32	462922.9328								MPV Corr. Action Target							
1254	318485.264	4311954.78	1285516.201	462928.1903								MPV Corr. Action Target							
1255	318484.89	4311954.985	1285514.959	462928.8358								MPV Corr. Action Target							
1256	318483.778	4311953.556	1285511.415	462924.0688								MPV Corr. Action Target							
1257	318482.531	4311952.166	1285507.425	462919.42								MPV Corr. Action Target							
1258	318481.062	4311949.425	1285502.804	462910.3242								MPV Corr. Action Target							
1259	318478.533	4311947.114	1285494.676	462902.5624								MPV Corr. Action Target							
1260	318477.993	4311947.389	1285492.885	462903.4254								MPV Corr. Action Target							
1261	318478.359	4311948.948	1285493.973	462908.5651								MPV Corr. Action Target							
1262	318479.682	4311956.265	1285497.786	462932.6591								MPV Corr. Action Target							
1263	318480.318	4311957.39	1285499.791	462936.3947								MPV Corr. Action Target							
1264	318479.664	4311963.146	1285497.231	462955.2265								MPV Corr. Action Target							
1265	318482.984	4311967.239	1285507.826	462968.89								MPV Corr. Action Target							
1266	318482.389	4311968.027	1285505.818	462971.4317								MPV Corr. Action Target							
1267	318481.69	4311968.369	1285503.5	462972.5031								MPV Corr. Action Target							
1268	318482.056	4311968.534	1285504.689	462973.0706								MPV Corr. Action Target							
1269	318482.67	4311969.568	1285506.628	462976.5062								MPV Corr. Action Target							
1270	318483.205	4311969.647	1285508.377	462976.8038								MPV Corr. Action Target							

Target ID	UTM Easting	UTM Northing	State Plane Easting	State Plane Northing	Estimated Depth (in)	EM61 (mV)	Flag	MPV 1	MPV2	TT 1	TT 2	QC Comments	List	Fit X	Fit Y	Fit Z	Fit Item \1	Processor Comments	Training
1271	318483.601	4311970.221	1285509.635	462978.715								MPV Corr. Action Target							
1272	318485.303	4311968.513	1285515.34	462973.2355								MPV Corr. Action Target							
1273	318485.72	4311967.997	1285516.745	462971.5731								MPV Corr. Action Target							
1274	318488.519	4311970.764	1285525.726	462980.85								MPV Corr. Action Target							
1275	318488.955	4311971.165	1285527.127	462982.1966								MPV Corr. Action Target							
1276	318486.834	4311970.679	1285520.206	462980.4499								MPV Corr. Action Target							
1277	318483.067	4311972.317	1285507.733	462985.5511								MPV Corr. Action Target							
1278	318483.766	4311974.029	1285509.902	462991.2166								MPV Corr. Action Target							

\1 - At this stage, this is the best initial library match, but may not be a high confidence fit; it was considered useful to the dig teams and was included on the dig sheets.

UTM X = Easting, UTM Zone 18N WGS 84 Meters
UTM Y = Northing, UTM Zone 18N WGS 84 Meters
SP_X = Easting, Maryland SP NAD83 US Survey Foot
SP_Y = Northing, Maryland SP NAD83 US Survey Foot
Est_Depth_in = Estimated depth of the item (inches)
EM61_Ch2 = Channel 2 mV response for EM61 targets only
Flag = Closest cued flag ID
MPV1 = ID of closest MPV pick (w/in 30cm)
MPV2 = ID of second MPV point (w/in 30cm)
TT1 = ID of closest TEMTADS pick (w/in 30cm)
TT2 = ID of second TEMTADS point (w/in 30cm)
Comments = QC Comments
List = Dataset target info is from
Fit_X = Estimated location of closest modeled item (UTM Easting)
Fit_Y = Estimated location of closest modeled item (UTM Northing)
Fit_Z = Estimated depth of modeled item (meters)
Fit_Item = Best initial Library match
Processor_Comments: Indicates targets with little to no response
Training_Request: MPV requests ground truth for these targets to inform their classification routine

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Appendix F-3:

Final Target Classification Lists

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
1	1285666.075	462975.2708	SV-1	318531.2673	4311968.074	0.268191877	2.36-in M6**	0.63528339	1.5741	Dig	25	1	20	Dig, Low Confidence	0.8758		Small ISO_BE305s	0.9955	318531.2	4311968	-0.27
3	1285674.452	462973.01	SV-2	318533.7618	4311967.295	0.068782477	37mm Trenchart;Hotchkiss*****	3.10050736	0.32253	Don't Dig	318	2	98	Don't Dig	0		37mm_BE365s	0.0179	318533.8	4311967	0.04
4	1285676.425	462972.3347	SV-3	318534.4135	4311967.142	0.106806415	37mm Trenchart;Hotchkiss*****	2.6160262	0.38226	Don't Dig	260	3	81	Don't Dig	0.5536		37mm_2011LSBP840m	0.881	318534.4	4311967	-0.11
10	1285672.761	462967.8538										4	55	Don't Dig	0.7746		5in proj_BP110826_TP77s	0.6772	318533.2	4311966	-0.19
11	1285674.762	462963.3168	SV-6	318533.6668	4311964.42	0.467015677	60mm TAM 1.8 British**	1.42687664	0.70083	Don't Dig	144	6	57	Don't Dig	0.759		60mm_29P_TP51s	0.8934	318534	4311964	-0.41
14	1285675.218	462954.9723	SV-11	318533.713	4311962.631	0.387390528	37mm HE**	2.20253098	0	Don't Dig	479	13	99	Don't Dig	0	weak/no response			318533.9	4311962	-0.01
14	1285675.218	462954.9723	SV-13	318533.9255	4311961.905	0.313771717	37mm HE**	1.43585373	0.69645	Don't Dig	146	13	99	Don't Dig	0	weak/no response			318533.9	4311962	-0.01
17	1285687.815	462949.7196	SV-25	318537.6831	4311960.156	0.087175204	ISO S80	0.22122965	4.52019	Dig	15	25	1	Dig, High Confidence	0.9944		small ISO80_FR_IVS2	0.9998	318537.7	4311960	-0.07
19	1285680.347	462945.8378	SV-32	318535.4794	4311959.009	0.246032183	37mm HE**	1.92852394	0.51853	Don't Dig	208	32	99	Don't Dig	0	weak/no response			318535.3	4311959	-0.08
20	1285676.307	462943.6359	SV-34	318534.1574	4311958.351	0.028109173	37mm Trenchart;Hotchkiss*****	4.83929472	0.20664	Don't Dig	456	34	0	Can't Analyze	*				318534.2	4311958	0.09
22	1285670.018	462952.2724										16	40	Dig, Low Confidence	0.7875		60mm_29P_TP51s	0.959	318532.3	4311961	-0.5
23	1285670.01	462950.9432	SV-16	318532.2843	4311960.798	0.305960395	37mm M55A1****	0.60159994	1.66223	Dig	21	23	66	Don't Dig	0.6749		105mm heat_BP110826_TP59s	0.8716	318532.3	4311961	-0.63
24	1285669.113	462949.3878	SV-26	318531.9511	4311960.288	0.284913795	MkIV booster	1.07735499	0.9282	Don't Dig	67	26	0	Can't Analyze	*				318532.1	4311960	-0.14
25	1285670.487	462947.3605										31	0	Can't Analyze	*				318532.4	4311960	-0.58
27	1285667.623	462940.3082										44	46	Dig, Low Confidence	0.6066		60mm_29P_TP53s	0.9265	318531.5	4311957	-0.54
29	1285666.873	462935.9865	SV-51	318531.2855	4311956.265	0.240547209	MkIV booster	1.23030517	0.81281	Don't Dig	89	51	63	Don't Dig	0.7171		60mm_29P_TP53s	0.7565	318531.2	4311956	-0.38
31	1285663.543	462932.2775	SV-53	318530.3565	4311955.078	0.128353924	MkIV booster	1.37655612	0.72645	Don't Dig	133	53	64	Don't Dig	0.7015		37mm_BE365s	0.6621	318530.3	4311955	-0.07
33	1285666.94	462929.3594										59	24	Dig, Low Confidence	0.8515		5in proj_BP110826_TP77s	0.8304	318531.1	4311954	-0.64
34	1285667.661	462927.3211	SV-66	318531.3998	4311953.493	0.711277501	6-in 6-in READ-Parrot**	1.39114527	0.71883	Don't Dig	136	66	65	Don't Dig	0.6824		Livens Projector_SV_TP4	0.576	318531.4	4311954	-0.84
35	1285668.162	462928.5134	SV-62	318531.7006	4311953.904	0.282080741	37mm M55A1****	1.52395017	0.65619	Don't Dig	164	62	58	Don't Dig	0.757		81mm_BE2m	0.752	318531.5	4311954	-0.45
36	1285667.822	462929.7463	SV-57	318531.8422	4311954.386	0.55404376	57mm M1&6 PR***	1.18206395	0.84598	Don't Dig	79	57	54	Don't Dig	0.7857		81mm_BE2m	0.7875	318531.5	4311954	-0.5
37	1285668.909	462934.6497	SV-52	318531.7582	4311955.623	0.534460466	57mm M1&6 PR***	1.22623641	0.8155	Don't Dig	88	52	73	Don't Dig	0.6404		60mm_29P_TP53s	0.8116	318531.9	4311956	-0.34
38	1285673.983	462936.3394	SV-50	318533.3334	4311956.245	0.313456784	37mm HE**	3.55501509	0.28129	Don't Dig	347	50	0	Can't Analyze	*				318533.5	4311956	0.17
39	1285674.37	462932.023	SV-54	318533.381	4311954.818	0.197932736	MkIV booster	2.78591209	0.35895	Don't Dig	282	54	89	Don't Dig	0.388		37mm_BE365s	0.0953	318533.4	4311955	-0.14
40	1285673.066	462929.8942	SV-55	318533.1383	4311954.149	0.503869808	57mm M1&6 PR***	1.07196016	0.93287	Don't Dig	66	55	82	Don't Dig	0.5407		37mm_2011LSBP840m	0.3428	318533	4311954	-0.28
41	1285672.259	462928.4688	SV-63	318532.8377	4311953.782	0.103899372	37mm Trenchart;Hotchkiss*****	2.16463595	0.46197	Don't Dig	223	63	49	Dig, Low Confidence	0.3877		37mm_BE365s	0.9327	318532.8	4311954	-0.14
42	1285675.427	462924.2134	SV-73	318533.7613	4311952.455	0.020427667	37mm Trenchart;Hotchkiss*****	4.24684502	0.23547	Don't Dig	415	73	100	Don't Dig	0.0715	surface metal			318533.8	4311953	0
43	1285679.874	462927.8123	SV-60	318535.1318	4311953.554	0.011710646	37mm Trenchart;Hotchkiss*****	1.72999154	0.57804	Don't Dig	188	60	0	Can't Analyze	*	data noisy			318535.2	4311954	-0.09
43	1285679.874	462927.8123	SV-60	318535.1318	4311953.554	0.011710646	37mm Trenchart;Hotchkiss*****	1.72999154	0.57804	Don't Dig	188	65	0	Can't Analyze	*	data noisy			318535.1	4311954	-0.02
43	1285679.874	462927.8123	SV-65	318535.1296	4311953.513	0.062017227	37mm Trenchart;Hotchkiss*****	1.20841335	0.82753	Don't Dig	82	60	0	Can't Analyze	*	data noisy			318535.2	4311954	-0.09
43	1285679.874	462927.8123	SV-65	318535.1296	4311953.513	0.062017227	37mm Trenchart;Hotchkiss*****	1.20841335	0.82753	Don't Dig	82	65	0	Can't Analyze	*	data noisy			318535.1	4311954	-0.02
45	1285682.649	462931.4828										56	0	Can't Analyze	*				318536	4311955	0.02
48	1285691.123	462938.5926										49	98	Don't Dig	0		37mm_BE365s	0	318538.6	4311957	0.05
50	1285695.015	462938.9012	SV-47	318539.8267	4311956.846	0.01199788	37mm Trenchart;Hotchkiss*****	3.01785968	0.33136	Don't Dig	311	47	95	Don't Dig	0.0739		37mm_BE365s	0.0305	318539.8	4311957	0.02
52	1285701.331	462946.8103	SV-30	318541.8614	4311959.321	0.37650601	37mm M55A1****	1.17827014	0.8487	Don't Dig	76	30	99	Don't Dig	0	weak/no response			318541.8	4311959	0.1
53	1285699.465	462950.2115	SV-28	318541.2901	4311960.24	0.467956281	57mm M1&6 PR***	1.04905237	0.95324	Don't Dig	60	28	0	Can't Analyze	*				318541.2	4311960	-0.18
54	1285699.036	462951.2784	SV-20	318541.1526	4311960.536	0.462942618	105mm M456A1**	1.11882374	0.8938	Don't Dig	71	20	19	Dig, Low Confidence	0.8763		37mm_BE670s	0.9957	318541.1	4311961	-0.2
54	1285699.036	462951.2784	SV-19	318541.9158	4311961.088	0.12904663	37mm Trenchart;Hotchkiss*****	3.67407019	0.27218	Don't Dig	361	20	19	Dig, Low Confidence	0.8763		37mm_BE670s	0.9957	318541.1	4311961	-0.2
55	1285697.303	462951.6374	SV-22	318540.5513	4311960.657	0.339037093	37mm HE**	1.37499029	0.72728	Don't Dig	132	22	28	Dig, Low Confidence	0.8429		81mm_BE742s	0.9358	318540.7	4311961	-0.6
58	1285707.278	462953.3166	SV-18	318543.6636	4311961.148	0.302000097	2.36-in M6**	1.6839849	0.59383	Don't Dig	183	18	31	Dig, Low Confidence	0.8357		60mm_29P_TP53s	0.9058	318543.7	4311961	-0.33
60	1285712.154	462953.6567	SV-15	318545.1227	4311961.131	0.161629438	37mm Trenchart;Hotchkiss*****	2.4014372	0.41642	Don't Dig	241	15	0	Can't Analyze	*				318545.2	4311961	-0.03
62	1285713.296	462958.4398										9	100	Don't Dig	0	lightpost			318545.5	4311963	0.05
66	1285729.876	462952.441	SV-21	318550.585	4311960.691	0.100930163	81mm M82***	1.12496385	19	Cannot analyz	11	21	17	Dig, Low Confidence	0.8928	gas line?	81mm_BE2m	0.8583	318550.5	4311961	-0.06
67	1285732.478	462953.9091	SV-17	318551.3305	4311961.172	0.19058885	2.36-in M6**	1.31924179	0.75801	Don't Dig	118	17	25	Dig, Low Confidence	0.8495		MK IV Booster_SV_TP8	0.768	318551.4	4311961	-0.1
68	1285736.411	462951.5705	SV-24	318552.5616	4311960.432	0.145477793	ISO Small 40****	0.99529417	1.00473	Don't Dig	54	24	10	Dig, High Confidence	0.9175		Small ISO_BE305s	0.9837	318552.5	4311960	-0.13
71	1285743.158	462950.4519	SV-27	318554.5834	4311960.141	0.221242663	37mm Trenchart;Hotchkiss*****	2.925463	0.34183	Don't Dig	296	27	71	Don't Dig	0.6409		60mm_29P_TP51s	0.7641	318554.6	4311960	-0.53
72	1285743.346	462944.7988	SV-37	318554.5925	4311958.323	0.170030986	37mm Trenchart;Hotchkiss*****	0.8326608	1.20097	Dig	37	37	41	Dig, Low Confidence	0.78		37mm_2011LSBP840m	0.9415	318554.6	4311958	-0.13
73	1285744.56	462944.1364	SV-40	318554.9053	4311958.044	2.33734E-14	37mm Trenchart;Hotchkiss*****	4.09174668	0.24439	Don't Dig	395	40	0	Can't Analyze	0.858	same as 38			318555.1	4311958	-0.19
73	1285744.56	462944.1364	SV-40	318554.9053	4311958.044	2.33734E-14	37mm Trenchart;Hotchkiss*****	4.09174668	0.24439	Don't Dig	395	38	12	Dig, Low Confidence	0.9054		37mm projectile_SR1781s	0.9785	318554.9	4311958	-0.21
74	1285745.58	462945.0185	SV-35	318555.3235	4311958.438	0.147440932	37mm German ERST**	0.91291903	1.09539	Dig	43	35	29	Dig, Low Confidence	0.8409		3in proj_BP110826_TP81m	0.9588	318555.3	4311958	-0.16
74	1285745.58	462945.0185	SV-38	318555.2056	4311958.335	0.178306859	57mm M1&6 PR***	1.27046895	0.78711	Don't Dig	104	35	29	Dig, Low Confidence	0.8409		3in proj_BP110826_TP81m	0.9588	318555.3	4311958	-0.16
75	1285747.792	462948.0893	SV-29	318555.9723	4311959.341	0.123740337	37mm Trenchart;Hotchkiss*****	2.853839	0.35041	Don't Dig	290	29	69	Don't Dig	0.6588		37mm_SWPG_TP4s	0.58	318556	4311959	-0.11
77	1285752.754	462946.1407	SV-33	318557.5144	4311958.686	0.273853128	37mm Trenchart;Hotchkiss*****	2.61307984	0.38269	Don't Dig	259	33	78	Don't Dig	0.6095		37mm_SR_IVS2s	0.6272	318557.4	4311959	-0.18
78	1285754.911	462945.7877	SV-36	318558.0844	4311958.561	0.389556915	57mm M1&6 PR***	1.26904455	0.78799	Don't Dig	103	36	80	Don't Dig	0.5909		60mm_29P_TP53s	0.4377	318558.2	4311959	-0.39
80	1285747.779	462942.6287	SV-42	318555.8652	4311957.767	0.215019842	MkIV booster	1.18590055	0.84324	Don't Dig	80	42	91	Don't Dig	0.3585		Small ISO_BE622s	0.7158	318555.9	4311958	-0.21
82	1285748	462939.6441										48	0	Can't Analyze	*				318556	4311957	-0.06
85	1285744.44	462929.8857										61	100	Don't Dig	0.539	near banister (metal)			318554.8	4311954	-0.03
86	1285742.09	462931.4453	SV-58	318554.168	4311954.291	0.27049592	81mm M82****	1.23989521	0.80652	Don't Dig	93	58	100	Don't Dig	0.2823	near light post			318554.1	4311954	0.1
87	1285740.17	462927.1012										69	0	Can't Analyze	*	data noisy			318553.5	4311953	-0.05

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
89	1285726.492	462924.5762	SV-75	318549.2099	4311952.243	0.204922636	37mm Trenchart;Hotchkiss*****	2.99159845	0.33427	Don't Dig	303	75	0	Can't Analyze	*				318549.4	4311952	0.02
89	1285726.492	462924.5762	SV-72	318549.8388	4311952.697	0.010024553	37mm Trenchart;Hotchkiss*****	5.77037696	0	Don't Dig	484	75	0	Can't Analyze	*				318549.4	4311952	0.02
91	1285719.51	462926.6838	SV-67	318547.1633	4311952.982	0.059973548	37mm Trenchart;Hotchkiss*****	4.69520516	0.21298	Don't Dig	445	67	0	Can't Analyze	*	data noisy			318547.2	4311953	0.04
91	1285719.51	462926.6838	SV-67	318547.1633	4311952.982	0.059973548	37mm Trenchart;Hotchkiss*****	4.69520516	0.21298	Don't Dig	445	71	0	Can't Analyze	*				318547.3	4311953	0.08
91	1285719.51	462926.6838	SV-71	318547.8144	4311952.987	0.497084517	2.75in MK1**	1.06646642	0	Don't Dig	483	67	0	Can't Analyze	*	data noisy			318547.2	4311953	0.04
91	1285719.51	462926.6838	SV-71	318547.8144	4311952.987	0.497084517	2.75in MK1**	1.06646642	0	Don't Dig	483	71	0	Can't Analyze	*				318547.3	4311953	0.08
94	1285718.785	462942.0612	SV-39	318547.0774	4311957.666	0.215885458	ISO S80	0.60365841	1.65657	Dig	22	39	9	Dig, High Confidence	0.9197		37mm_2011LSBP840s	0.9811	318547	4311958	-0.2
94	1285718.785	462942.0612	SV-43	318546.797	4311957.577	0.039113901	37mm Trenchart;Hotchkiss*****	5.75110288	0.17388	Don't Dig	477	39	9	Dig, High Confidence	0.9197		37mm_2011LSBP840s	0.9811	318547	4311958	-0.2
94	1285718.785	462942.0612	SV-46	318546.9202	4311956.87	5.04205E-05	37mm Trenchart;Hotchkiss*****	5.66508044	0	Don't Dig	480	39	9	Dig, High Confidence	0.9197		37mm_2011LSBP840s	0.9811	318547	4311958	-0.2
94	1285718.785	462942.0612	SV-39	318547.0774	4311957.666	0.215885458	ISO S80	0.60365841	1.65657	Dig	22	43	26	Dig, Low Confidence	0.8434		37mm_2011LSBP840s	0.9918	318547.1	4311958	-0.29
94	1285718.785	462942.0612	SV-43	318546.797	4311957.577	0.039113901	37mm Trenchart;Hotchkiss*****	5.75110288	0.17388	Don't Dig	477	43	26	Dig, Low Confidence	0.8434		37mm_2011LSBP840s	0.9918	318547.1	4311958	-0.29
94	1285718.785	462942.0612	SV-46	318546.9202	4311956.87	5.04205E-05	37mm Trenchart;Hotchkiss*****	5.66508044	0	Don't Dig	480	43	26	Dig, Low Confidence	0.8434		37mm_2011LSBP840s	0.9918	318547.1	4311958	-0.29
96	1285715.885	462940.9048	SV-41	318546.2234	4311957.247	0.052333219	37mm Trenchart;Hotchkiss*****	3.663063	0.273	Don't Dig	360	41	0	Can't Analyze	*				318546.2	4311957	0.02
98	1285709.125	462940.5071	SV-45	318544.1381	4311957.226	0.279266935	MkIV booster	0.97963724	1.02079	Don't Dig	51	45	51	Don't Dig	0.8225		37mm_BE365s	0.7796	318544.1	4311957	-0.2
99	1285702.005	462925.4268	SV-64	318544.0774	4311953.602	0.181622621	37mm Trenchart;Hotchkiss*****	2.04881159	0	Don't Dig	481	70	43	Dig, Low Confidence	0.7574		37mm_2011LSBP840m	0.9884	318541.9	4311953	-0.03
99	1285702.005	462925.4268	SV-70	318541.8375	4311952.714	0.027144372	ISO Small 40****	1.54595918	0.64685	Don't Dig	166	70	43	Dig, Low Confidence	0.7574		37mm_2011LSBP840m	0.9884	318541.9	4311953	-0.03
100	1285701.278	462923.1335	SV-77	318541.5228	4311951.932	0.303772341	ISO S80	0.89156626	1.12162	Dig	42	77	48	Dig, Low Confidence	0.4986	feature space addition	155mm_CE2135m	0.906	318541.7	4311952	-0.75
101	1285703.577	462917.0608	SV-82	318542.3125	4311950.019	0.004815801	MkIV booster	3.62805988	0.27563	Don't Dig	357	82	98	Don't Dig	0		37mm_BE365s	0	318542.3	4311950	0.03
102	1285716.825	462920.2884										79	44	Dig, Low Confidence	0.741		105mm heat_BP110826_TP59s	0.9641	318546.4	4311951	-0.63
103	1285717.929	462922.2816										74	0	Can't Analyze	0.4701				318546.7	4311952	0.14
105	1285722.855	462916.1549										83	34	Dig, Low Confidence	0.8207		81mm_MMRIVS_10003	0.9256	318548.2	4311950	-0.5
107	1285725.183	462910.2338										85	37	Dig, Low Confidence	0.8049		medium ISO80_SR2653s	0.9668	318548.8	4311948	-0.26
108	1285729.459	462909.1529	SV-87	318550.0731	4311947.499	0.175185195	MkIV booster	2.4252967	0.41232	Don't Dig	243	87	100	Don't Dig	0	metal downspout			318550.2	4311948	0.02
110	1285738.559	462906.9342	SV-92	318552.9084	4311946.86	0.136852315	37mm Trenchart;Hotchkiss*****	4.2085458	0.23761	Don't Dig	411	92	94	Don't Dig	0.1287		37mm_BE365s	0.1518	318552.9	4311947	0.06
111	1285740.854	462909.3964										90	0	Can't Analyze	*				318553.6	4311948	0.05
114	1285747.064	462913.5361	SV-84	318555.5957	4311948.683	0.148642037	37mm Trenchart;Hotchkiss*****	1.80909935	0.55276	Don't Dig	195	84	0	Can't Analyze	*				318555.5	4311949	-0.09
116	1285755.666	462923.6283	SV-78	318558.1878	4311951.716	0.08108057	37mm Trenchart;Hotchkiss*****	3.7988733	0.26324	Don't Dig	369	78	0	Can't Analyze	*				318558.2	4311952	-0.05
120	1285757.349	462919.0089	SV-81	318558.6834	4311950.245	0.19126323	37mm Trenchart;Hotchkiss*****	1.9398248	0.51551	Don't Dig	212	80	0	Can't Analyze	*				318558.7	4311951	-0.69
120	1285757.349	462919.0089	SV-81	318558.6834	4311950.245	0.19126323	37mm Trenchart;Hotchkiss*****	1.9398248	0.51551	Don't Dig	212	81	76	Don't Dig	0.6169		37mm_BE365s	0.7586	318558.7	4311950	-0.21
121	1285758.126	462910.3662	SV-88	318558.7918	4311947.585	0.491316122	3.5-in M30A1**	1.53229379	0.65262	Don't Dig	165	88	59	Don't Dig	0.7509		37mm_SWPG_TP4s	0.7225	318558.9	4311948	-0.1
122	1285758.32	462908.3327	SV-91	318558.9588	4311946.949	4.26326E-14	37mm Trenchart;Hotchkiss*****	1.20883146	0.82725	Don't Dig	83	91	15	Dig, Low Confidence	0.8945		60mm_29P_TP53s	0.8642	318558.9	4311947	-0.21
124	1285750.336	462909.3125	SV-89	318556.5383	4311947.531	0.060074496	37mm Trenchart;Hotchkiss*****	2.53221514	0.39491	Don't Dig	255	89	70	Don't Dig	0.6583		37mm_BE365s	0.441	318556.4	4311947	-0.04
125	1285749	462906.5891	SV-93	318555.9866	4311946.735	0.248167598	37mm Trenchart;Hotchkiss*****	2.27652534	0.43927	Don't Dig	232	93	98	Don't Dig	0		37mm_BE365s	0.0218	318556.1	4311947	-0.06
129	1285745.46	462901.2217	SV-94	318555.0848	4311945.039	0.197481491	BDU33 MK76**	0.47451598	2.10741	Dig	19	94	7	Dig, High Confidence	0.9337	same as 96	5in proj_BP110826_TP77s	0.947	318554.8	4311945	-0.05
129	1285745.46	462901.2217	SV-94	318555.0848	4311945.039	0.197481491	BDU33 MK76**	0.47451598	2.10741	Dig	19	96	3	Dig, High Confidence	0.9695		3in stokes mortar_SR2227s	0.9774	318555.1	4311945	-0.11
129	1285745.46	462901.2217	SV-96	318555.012	4311944.769	0.15340049	81mm M82****	1.29821533	0.77029	Don't Dig	114	94	7	Dig, High Confidence	0.9337	same as 96	5in proj_BP110826_TP77s	0.947	318554.8	4311945	-0.05
129	1285745.46	462901.2217	SV-96	318555.012	4311944.769	0.15340049	81mm M82****	1.29821533	0.77029	Don't Dig	114	96	3	Dig, High Confidence	0.9695		3in stokes mortar_SR2227s	0.9774	318555.1	4311945	-0.11
130	1285743.578	462898.5061	SV-97	318554.3148	4311944.265	0.133313723	ISO Small 40****	0.95620233	1.0458	Dig	48	97	50	Dig, Low Confidence	0.3766		60mm_BP110826_TP33m	0.9901	318554.4	4311944	-0.1
132	1285738.173	462896.9994										98	36	Dig, Low Confidence	0.8063		Small ISO_BE622s	0.9278	318552.7	4311944	-0.06
133	1285743.031	462896.197	SV-102	318554.1003	4311943.495	0.060278193	37mm Trenchart;Hotchkiss*****	1.26284225	0.79186	Dig	50	102	53	Don't Dig	0.7919		Livens Projector_SV_TP2	0.867	318554.3	4311944	-0.85
135	1285753.407	462896.6118										100	98	Don't Dig	0		37mm_BE365s	0	318557.3	4311944	0.03
137	1285750.551	462884.1617	SV-110	318556.3925	4311939.75	0.234135366	ISO S80	1.26035716	0.79343	Don't Dig	100	110	47	Dig, Low Confidence	0.5348		60mm_BP110826_TP16s	0.9852	318556.4	4311940	-0.26
139	1285732.059	462878.4333	SV-116	318550.5853	4311938.145	0.322266687	ISO Medium 40****	1.42112229	0.70367	Don't Dig	143	116	60	Don't Dig	0.7401		Small ISO_BE622s	0.7681	318550.8	4311938	0.01
140	1285729.904	462873.349	SV-119	318549.946	4311936.629	0.162833295	37mm Trenchart;Hotchkiss*****	1.21478496	0.82319	Don't Dig	85	119	5	Dig, High Confidence	0.9475		Small ISO_BE305s	0.9956	318550	4311937	-0.26
140	1285729.904	462873.349	SV-121	318549.9351	4311936.629	0.166340046	37mm Trenchart;Hotchkiss*****	0.98446518	1.01578	Don't Dig	52	119	5	Dig, High Confidence	0.9475		Small ISO_BE305s	0.9956	318550	4311937	-0.26
140	1285729.904	462873.349	SV-119	318549.946	4311936.629	0.162833295	37mm Trenchart;Hotchkiss*****	1.21478496	0.82319	Don't Dig	85	121	23	Dig, Low Confidence	0.8529	same as 119	Small ISO_BE622s	0.97	318550.1	4311937	-0.15
140	1285729.904	462873.349	SV-121	318549.9351	4311936.629	0.166340046	37mm Trenchart;Hotchkiss*****	0.98446518	1.01578	Don't Dig	52	121	23	Dig, Low Confidence	0.8529	same as 119	Small ISO_BE622s	0.97	318550.1	4311937	-0.15
142	1285740.097	462863.0327	SV-139	318553.0082	4311933.301	0.071924042	37mm Trenchart;Hotchkiss*****	2.67454863	0.37389	Don't Dig	269	139	72	Don't Dig	0.6405		37mm_BE365s	0.5281	318553.1	4311934	-0.09
143	1285728.657	462863.264	SV-140	318549.5191	4311933.635	0.055647074	37mm Trenchart;Hotchkiss*****	1.9689224	0.50789	Don't Dig	215	140	77	Don't Dig	0.6131		37mm_BE365s	0.7417	318549.6	4311934	-0.03
145	1285721.565	462864.7064	SV-133	318547.4157	4311934.12	0.018906833	37mm Trenchart;Hotchkiss*****	5.58720939	0	Don't Dig	485	133	98	Don't Dig	0		37mm_BE365s	0	318547.4	4311934	-0.04
148	1285711.579	462866.5512	SV-129	318544.2096	4311934.517	0.247609211	37mm M55A1****	0.69295617	1.44309	Dig	29	128	33	Dig, Low Confidence	0.8258		60mm_29P_TP122s	0.9663	318544.5	4311935	-0.39
148	1285711.579	462866.5512	SV-129	318544.2096	4311934.517	0.247609211	37mm M55A1****	0.69295617	1.44309	Dig	29	129	35	Dig, Low Confidence	0.8175		Small ISO_BE460s	0.9869	318544.5	4311935	-0.3
148	1285711.579	462866.5512	SV-129	318544.2096	4311934.517	0.247609211	37mm M55A1****	0.69295617	1.44309	Dig	29	131	16	Dig, Low Confidence	0.8928		37mm projectile_SR1781s	0.9958	318544.3	4311935	-0.29
148	1285711.579	462866.5512	SV-131	318544.3151	4311934.532	0.284058196	60mm M49A4***	1.02134579	0.9791	Don't Dig	55	128	33	Dig, Low Confidence	0.8258		60mm_29P_TP122s	0.9663	318544.5	4311935	-0.39
148	1285711.579	462866.5512	SV-131	318544.3151	4311934.532	0.284058196	60mm M49A4***	1.02134579	0.9791	Don't Dig	55	129	35	Dig, Low Confidence	0.8175		Small ISO_BE460s	0.9869	318544.5	4311935	-0.3
148	1285711.579	462866.5512	SV-131	318544.3151	4311934.532	0.284058196	60mm M49A4***	1.02134579	0.9791	Don't Dig	55	131	16	Dig, Low Confidence	0.8928		37mm projectile_SR1781s	0.9958	318544.3	4311935	-0.29
150	1285716.495	462875.7914	SV-118	318545.9337	4311937.333	0.112716768	37mm Trenchart;Hotchkiss*****	4.09707267	0.24408	Don't Dig	398	118	0	Can't Analyze	*				318546	4311938	0.02
151	1285715.671	462878.5822	SV-114	318545.7291	4311938.355	0.188326416	37mm HE**	2.48188678	0.40292	Don't Dig	249	114	0	Can't Analyze	*				318545.7	4311938	0.02
152	1285707.275	462882.0633	SV-112	318543.1123	4311939.381	0.498703299	4.5-in T160ES HE**	0.87893279	1.13774	Dig	40	112	21	Dig, Low Confidence	0.8755		81mm_MMRIVS_10003	0.9846	318543.2	4311939	-0.47
152	1285707.275	462882.0633	SV-113	318543.1844	4311939.296	0.613761416	7.2-in Depth Charge Mousetrap**	1.13971858	0.87741	Don't Dig	73	112	21	Dig, Low Confidence	0.8755		81mm_MMRIVS_10003	0.9846	318543.2	4311939	-0.47

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
153	1285705.213	462881.1813										113	0	Can't Analyze	*	same as 112			318542.6	4311939	-0.07
154	1285707.756	462862.6182	SV-141	318543.1725	4311933.54	0.162397628	37mm Trenchart;Hotchkiss*****	2.22691004	0.44905	Don't Dig	228	137	84	Don't Dig	0.4427	same as 141	37mm_BE365s	0.727	318543.2	4311933	-0.12
154	1285707.756	462862.6182	SV-141	318543.1725	4311933.54	0.162397628	37mm Trenchart;Hotchkiss*****	2.22691004	0.44905	Don't Dig	228	141	83	Don't Dig	0.4827		37mm_BE365s	0.7284	318543.4	4311934	-0.13
154	1285707.756	462862.6182	SV-137	318543.1876	4311933.538	0.167304011	MkIV booster	1.87823281	0.53242	Don't Dig	202	137	84	Don't Dig	0.4427	same as 141	37mm_BE365s	0.727	318543.2	4311933	-0.12
154	1285707.756	462862.6182	SV-137	318543.1876	4311933.538	0.167304011	MkIV booster	1.87823281	0.53242	Don't Dig	202	141	83	Don't Dig	0.4827		37mm_BE365s	0.7284	318543.4	4311934	-0.13
156	1285702.686	462859.7932	SV-147	318541.6295	4311932.69	0.095093381	MkIV booster	1.03544252	0.96577	Don't Dig	56	147	62	Don't Dig	0.7337		MK IV Booster_SV_TP10	0.7997	318541.7	4311933	-0.07
157	1285698.952	462863.8557	SV-135	318540.5326	4311933.972	0.396557099	ISO Medium 40****	0.40190464	2.48815	Dig	17	135	4	Dig, High Confidence	0.9581		3in stokes mortar_SR2609s	0.9886	318540.5	4311934	-0.47
158	1285698.392	462857.0705	SV-156	318540.2799	4311931.832	0.12499246	37mm Trenchart;Hotchkiss*****	1.33961909	0.74648	Don't Dig	124	154	30	Dig, Low Confidence	0.8408		37mm_BE365s	0.7215	318540.3	4311932	-0.1
158	1285698.392	462857.0705	SV-156	318540.2799	4311931.832	0.12499246	37mm Trenchart;Hotchkiss*****	1.33961909	0.74648	Don't Dig	124	156	27	Dig, Low Confidence	0.8433	same as 154	37mm_2011LSBP840m	0.8628	318540.4	4311932	-0.1
158	1285698.392	462857.0705	SV-154	318540.2907	4311931.98	0.108681126	37mm Trenchart;Hotchkiss*****	1.93392296	0.51708	Don't Dig	209	154	30	Dig, Low Confidence	0.8408		37mm_BE365s	0.7215	318540.3	4311932	-0.1
158	1285698.392	462857.0705	SV-154	318540.2907	4311931.98	0.108681126	37mm Trenchart;Hotchkiss*****	1.93392296	0.51708	Don't Dig	209	156	27	Dig, Low Confidence	0.8433	same as 154	37mm_2011LSBP840m	0.8628	318540.4	4311932	-0.1
160	1285682.8	462863.5832	SV-136	318535.6338	4311934.024	0.328245369	37mm M55A1****	1.4800843	0.67564	Don't Dig	157	136	98	Don't Dig	0		37mm_BE365s	0	318535.6	4311934	0.13
163	1285668.821	462868.7104	SV-126	318531.3871	4311935.464	0.15087789	MkIV booster	2.46473089	0.40572	Don't Dig	247	126	32	Dig, Low Confidence	0.8259		37mm_BE365s	0.8206	318531.4	4311936	-0.12
163	1285668.821	462868.7104	SV-123	318531.4375	4311935.758	0.071176907	37mm Trenchart;Hotchkiss*****	3.54777591	0.28187	Don't Dig	346	126	32	Dig, Low Confidence	0.8259		37mm_BE365s	0.8206	318531.4	4311936	-0.12
163	1285668.821	462868.7104	SV-126	318531.3871	4311935.464	0.15087789	MkIV booster	2.46473089	0.40572	Don't Dig	247	123	61	Don't Dig	0.7386		Small ISO_BE622s	0.6599	318531.3	4311936	-0.22
163	1285668.821	462868.7104	SV-123	318531.4375	4311935.758	0.071176907	37mm Trenchart;Hotchkiss*****	3.54777591	0.28187	Don't Dig	346	123	61	Don't Dig	0.7386		Small ISO_BE622s	0.6599	318531.3	4311936	-0.22
164	1285664.211	462865.8725	SV-130	318530.0047	4311934.817	0.325458996	ISO S80	1.22390678	0.81706	Don't Dig	87	130	52	Don't Dig	0.7958		37mm_BE365s	0.7291	318529.9	4311935	-0.26
165	1285662.596	462868.5771	SV-127	318529.4096	4311935.745	0.044050574	37mm Trenchart;Hotchkiss*****	3.44445151	0.29032	Don't Dig	340	125	97	Don't Dig	0.0035		37mm_BE365s	0.0002	318529.5	4311936	-0.03
165	1285662.596	462868.5771	SV-127	318529.4096	4311935.745	0.044050574	37mm Trenchart;Hotchkiss*****	3.44445151	0.29032	Don't Dig	340	127	98	Don't Dig	0		37mm_BE365s	0	318529.6	4311936	0.05
165	1285662.596	462868.5771	SV-125	318529.4742	4311935.661	0.157938772	37mm Trenchart;Hotchkiss*****	2.77158029	0.3608	Don't Dig	279	125	97	Don't Dig	0.0035		37mm_BE365s	0.0002	318529.5	4311936	-0.03
165	1285662.596	462868.5771	SV-125	318529.4742	4311935.661	0.157938772	37mm Trenchart;Hotchkiss*****	2.77158029	0.3608	Don't Dig	279	127	98	Don't Dig	0		37mm_BE365s	0	318529.6	4311936	0.05
166	1285657.793	462869.7284	SV-124	318527.8769	4311935.866	0.127102424	37mm Trenchart;Hotchkiss*****	2.93090829	0.34119	Don't Dig	297	122	39	Dig, Low Confidence	0.7996		Small ISO_BE_IVS2005s	0.9728	318528	4311936	-0.09
166	1285657.793	462869.7284	SV-122	318527.7147	4311936.037	1.42421E-09	37mm Trenchart;Hotchkiss*****	1.33244422	0.7505	Don't Dig	120	122	39	Dig, Low Confidence	0.7996		Small ISO_BE_IVS2005s	0.9728	318528	4311936	-0.09
166	1285657.793	462869.7284	SV-124	318527.8769	4311935.866	0.127102424	37mm Trenchart;Hotchkiss*****	2.93090829	0.34119	Don't Dig	297	124	67	Don't Dig	0.6609	same as 122	37mm_BE365s	0.7692	318528.1	4311936	0.01
166	1285657.793	462869.7284	SV-122	318527.7147	4311936.037	1.42421E-09	37mm Trenchart;Hotchkiss*****	1.33244422	0.7505	Don't Dig	120	124	67	Don't Dig	0.6609	same as 122	37mm_BE365s	0.7692	318528.1	4311936	0.01
168	1285649.565	462880.9443										111	0	Can't Analyze	*				318525.6	4311939	0.04
172	1285654.973	462887.2321	SV-108	318527.2763	4311941.36	0.23211053	MkIV booster	2.1760086	0.45956	Don't Dig	225	107	79	Don't Dig	0.5922		60mm_29P_TP53s	0.6534	318527.2	4311941	-0.42
172	1285654.973	462887.2321	SV-108	318527.2763	4311941.36	0.23211053	MkIV booster	2.1760086	0.45956	Don't Dig	225	108	86	Don't Dig	0.4286		37mm_SR_IVS2s	0.4997	318527.3	4311941	-0.16
172	1285654.973	462887.2321	SV-107	318527.1726	4311941.632	0.922263191	4-in 4-in Stokes**	1.34476006	0.74363	Don't Dig	128	107	79	Don't Dig	0.5922		60mm_29P_TP53s	0.6534	318527.2	4311941	-0.42
172	1285654.973	462887.2321	SV-107	318527.1726	4311941.632	0.922263191	4-in 4-in Stokes**	1.34476006	0.74363	Don't Dig	128	108	86	Don't Dig	0.4286		37mm_SR_IVS2s	0.4997	318527.3	4311941	-0.16
173	1285652.76	462893.0048	SV-101	318526.7029	4311943.154	0.061131853	Rocket Motor**	0.71507099	1.39846	Dig	33	101	14	Dig, Low Confidence	0.8947		81mm_BE742s	0.9788	318526.6	4311943	-0.2
173	1285652.76	462893.0048	SV-101	318526.7029	4311943.154	0.061131853	Rocket Motor**	0.71507099	1.39846	Dig	33	103	38	Dig, Low Confidence	0.802		105mm heat_BP110826_TP56m	0.9712	318526.7	4311943	-0.31
173	1285652.76	462893.0048	SV-103	318526.7222	4311943.107	0.2743967	81mm M82****	0.88511984	1.12979	Dig	41	101	14	Dig, Low Confidence	0.8947		81mm_BE742s	0.9788	318526.6	4311943	-0.2
173	1285652.76	462893.0048	SV-103	318526.7222	4311943.107	0.2743967	81mm M82****	0.88511984	1.12979	Dig	41	103	38	Dig, Low Confidence	0.802		105mm heat_BP110826_TP56m	0.9712	318526.7	4311943	-0.31
174	1285650.239	462890.4129	SV-106	318525.8973	4311942.331	0.096168198	MkIV booster	1.04639573	0.95566	Don't Dig	59	106	8	Dig, High Confidence	0.933		MK IV Booster_SV_TP10	0.8818	318525.8	4311942	-0.11
176	1285639.041	462895.4798										99	0	Can't Analyze	*				318522.5	4311944	0.14
179	1285641.603	462892.3858										104	100	Don't Dig	0.7864	Metal hand railing			318523.2	4311943	0.27
180	1285638.951	462884.6163										109	87	Don't Dig	0.4156		37mm_BE365s	0.9065	318522.4	4311941	-0.05
182	1285643.586	462876.4848	SV-115	318523.676	4311938.271	0.1225962	37mm Trenchart;Hotchkiss*****	3.96456517	0.25223	Don't Dig	383	115	0	Can't Analyze	*				318523.8	4311938	0.01
183	1285641.759	462871.7982	SV-120	318523.1396	4311936.759	0.302131884	75 mm	0.12285834	8.13946	Dig	12	120	6	Dig, High Confidence	0.9442		3in proj_BP110826_TP73s	0.9912	318523.2	4311937	-0.3
185	1285629.549	462858.4143										145	22	Dig, Low Confidence	0.8664		81mm_BP110826_TP36s	0.9896	318519.3	4311933	-0.33
186	1285631.306	462857.6095	SV-148	318519.8892	4311932.482	0.484461262	Livens Vertical	0.60778215	1.64533	Dig	23	148	18	Dig, Low Confidence	0.8823		81mm illumination_RSA_TS15	0.9548	318519.9	4311933	-0.34
186	1285631.306	462857.6095	SV-145	318519.7289	4311932.591	0.411340859	2.25in MK3 MOD2**	0.65566369	1.52517	Dig	27	148	18	Dig, Low Confidence	0.8823		81mm illumination_RSA_TS15	0.9548	318519.9	4311933	-0.34
187	1285636.143	462855.5992	SV-155	318521.3901	4311931.762	0.662266912	Livens Horiz	0.83795893	1.19338	Dig	39	155	45	Dig, Low Confidence	0.7169		4.2in Proj_RSA_TS18	0.9824	318521.3	4311932	-0.45
189	1285641.371	462858.956	SV-144	318522.9719	4311932.828	0.107844223	37mm Trenchart;Hotchkiss*****	1.63841609	0.61035	Don't Dig	173	144	75	Don't Dig	0.6173		37mm_BE365s	0.7526	318522.9	4311933	-0.13
190	1285648.617	462861.668	SV-138	318525.1344	4311933.633	0.202164409	37mm Trenchart;Hotchkiss*****	2.76578469	0.36156	Don't Dig	278	138	0	Can't Analyze	*	same as 134			318525.2	4311934	0
191	1285650.103	462862.5768	SV-134	318525.6522	4311933.987	0.307073412	60mm M49A4***	1.23460063	0.80998	Don't Dig	92	134	42	Dig, Low Confidence	0.7667		Small ISO_BE_IVS2005s	0.9377	318525.6	4311934	-0.25
193	1285651.169	462857.9832	SV-149	318525.8891	4311932.482	0.074215006	MkIV booster	1.11787217	0.89456	Don't Dig	70	149	68	Don't Dig	0.6597		37mm_BE365s	0.5967	318526	4311932	-0.07
194	1285652.409	462854.6338	SV-157	318526.231	4311931.445	0.16451542	37mm Trenchart;Hotchkiss*****	1.2315914	0.81196	Don't Dig	90	157	74	Don't Dig	0.63		37mm_BE365s	0.4684	318526.3	4311931	-0.05
196	1285654.463	462853.0316	SV-160	318526.8515	4311930.942	0.18446811	37mm Trenchart;Hotchkiss*****	2.13071611	0.46933	Don't Dig	221	160	92	Don't Dig	0.3403		37mm_BE365s	0.0857	318526.9	4311931	-0.07
199	1285671.756	462858.1659										150	88	Don't Dig	0.3924		37mm_BE365s	0.4203	318532.2	4311932	-0.13
201	1285682.129	462859.5159	SV-143	318535.3314	4311932.646	0.591522297	4.5-in T160ES HE**	0.5766965	1.73401	Dig	20	143	11	Dig, Low Confidence	0.9085		Small ISO_BE305s	0.9878	318535.4	4311933	-0.3
201	1285682.129	462859.5159	SV-143	318535.3314	4311932.646	0.591522297	4.5-in T160ES HE**	0.5766965	1.73401	Dig	20	146	13	Dig, Low Confidence	0.9013		37mm projectile_SR1781s	0.9576	318535.3	4311933	-0.26
202	1285684.443	462858.9202	SV-151	318535.969	4311932.472	0.115547388	37mm HE**	2.01655409	0.4959	Don't Dig	216	151	0	Can't Analyze	0.6993	same as 146			318536.1	4311933	-0.16
202	1285684.443	462858.9202	SV-146	318536.1169	4311932.553	0.181072699	37mm HE**	1.03925637	0.96223	Don't Dig	58	151	0	Can't Analyze	0.6993	same as 146			318536.1	4311933	-0.16
205	1285696.236	462847.4676	SV-166	318539.5958	4311928.946	0.047014916	37mm Trenchart;Hotchkiss*****	4.70677845	0.21246	Don't Dig	447	165	96	Don't Dig	0.0139		37mm_BE365s	0.0021	318539.6	4311929	-0.06
205	1285696.236	462847.4676	SV-166	318539.5958	4311928.946	0.047014916	37mm Trenchart;Hotchkiss*****	4.70677845	0.21246	Don't Dig	447	166	98	Don't Dig	0		37mm_BE365s	0.0026	318539.6	4311929	-0.03
205	1285696.236	462847.4676	SV-165	318539.5595	4311928.936	0.057547542	37mm Trenchart;Hotchkiss*****	4.41308317	0.2266	Don't Dig	432	165	96	Don't Dig	0.0139		37mm_BE365s	0.0021	318539.6	4311929	-0.06
205	1285696.236	462847.4676	SV-165	318539.5595	4311928.936	0.057547542	37mm Trenchart;Hotchkiss*****	4.41308317	0.2266	Don't Dig	432	166	98	Don't Dig	0		37mm_BE365s	0.0026	318539.6	4311929	-0.03
206	1285698.536	462848.2466	SV-164	318540.3296	4311929.155	0.162173592	37mm Trenchart;Hotchkiss*****	3.10920857	0.32163	Don't Dig	319	164	85	Don't Dig	0.4348		37mm_BE365s	0.3574	318540.3	4311929	-0.15

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
207	1285705.91	462850.1476	SV-163	318542.5592	4311929.695	0.04790951	37mm Trenchart;Hotchkiss*****	3.96797702	0.25202	Don't Dig	384	163	98	Don't Dig	0		37mm_BE365s	0	318542.6	4311930	0
208	1285707.418	462852.7139	SV-161	318543.1127	4311930.489	3.95239E-14	37mm Trenchart;Hotchkiss*****	5.77037696	0	Don't Dig	486	161	98	Don't Dig	0		37mm_BE365s	0.0023	318543	4311931	-0.13
209	1285709.694	462858.1159	SV-152	318543.7425	4311932.082	0.187381264	37mm Trenchart;Hotchkiss*****	3.33294813	0.30003	Don't Dig	333	152	98	Don't Dig	0		37mm_BE365s	0.0013	318543.8	4311932	-0.09
210	1285714.308	462857.2722	SV-153	318545.1535	4311931.896	0.130171476	37mm Trenchart;Hotchkiss*****	2.64855898	0.37756	Don't Dig	266	153	56	Don't Dig	0.7606		37mm_BE365s	0.5941	318545.2	4311932	-0.08
211	1285717.822	462854.944	SV-159	318546.1921	4311931.098	0.073146554	37mm Trenchart;Hotchkiss*****	4.0392267	0.24757	Don't Dig	388	159	93	Don't Dig	0.1344		37mm_BE365s	0.1146	318546.2	4311931	-0.12
212	1285723.688	462844.093	SV-168	318547.8942	4311927.758	0.251131676	75 mm	0.15342977	6.51764	Dig	13	168	2	Dig, High Confidence	0.9751		105mm heat_BP110826_TP59s	0.9755	318548	4311928	-0.25
214	1285716.407	462844.012	SV-167	318545.7179	4311927.872	0.126387937	37mm Trenchart;Hotchkiss*****	4.39024546	0.22778	Don't Dig	429	167	0	Can't Analyze	*				318545.7	4311928	0
215	1285710.198	462839.111	SV-170	318543.7254	4311926.321	0.138533398	37mm Trenchart;Hotchkiss*****	3.43686776	0.29096	Don't Dig	339	170	90	Don't Dig	0.378		37mm_2011LSBP840s	0.3977	318543.9	4311926	-0.17
225	1285701.016	462953.6009										19	98	Don't Dig	0	weak response	37mm_BE365s	0.0709	318541.7	4311961	-0.06
226	1285727.426	462841.1808										169	99	Don't Dig	0	weak/no response			318549.2	4311927	0.07
227	1285728.184	462925.9308										72	99	Don't Dig	0	weak/no response			318549.9	4311953	-0.44
228	1285685.71	462962.4989										7	99	Don't Dig	0	weak/no response			318537.2	4311964	-0.06
229	1285698.048	462957.8804										10	98	Don't Dig	0	weak response	37mm_BE365s	0.0535	318540.9	4311963	-0.11
230	1285717.848	462939.4581										46	99	Don't Dig	0	weak/no response			318546.7	4311957	0.09
231	1285674.405	462957.4566										11	99	Don't Dig	0	weak/no response			318533.6	4311963	0.04
232	1285684.797	462854.5473										158	99	Don't Dig	0	weak/no response			318536.2	4311931	0.06
232	1285684.797	462854.5473										162	99	Don't Dig	0	weak/no response					
233	1285725.382	462866.7919										132	99	Don't Dig	0	weak/no response			318548.6	4311935	0.1
234	1285747.576	462911.1191										86	99	Don't Dig	0	weak/no response			318555.7	4311948	-0.37
235	1285760.791	462927.9804										68	98	Don't Dig	0	weak response	57mm_SWPG_TP2s	0.2921	318559.8	4311953	-0.35
236	1285708.661	462831.74										171	100	Don't Dig	0	no source under array			318543.3	4311924	-0.01
237	1285691.337	462967.1229										5	98	Don't Dig	0	weak amplitude	37mm_BE365s	0.0039	318538.9	4311966	-0.03
238	1285695.725	462923.2708										76	100	Don't Dig	0.7111	water valve			318539.9	4311952	-0.25
239	1285687.14	462859.9146										142	100	Don't Dig	0.6272	no source under array			318536.9	4311933	-0.1
240	1285746.396	462893.1109										105	100	Don't Dig	0	no sources under array			318555.2	4311943	0.05
241	1285744.344	462877.479										117	100	Don't Dig	0	no sources under array			318554.5	4311938	-0.03
242	1285672.41	462962.9239										8	100	Don't Dig	0.6237	over sprinkler head			318533.1	4311964	-0.62
243	1285707.642	462929.0124										64	99	Don't Dig	0	weak/no response			318543.6	4311954	0.06

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
2001	1285604.268	462718.8403	SV-2195	318510.6286	4311890.411	0.27844292	57mm M1&6 PR***	1.2969818	0.77102	Don't Dig	112	2195	67	Don't Dig	0		37mm_BE365s	0	318510.8	4311891	0.19
2001	1285604.268	462718.8403	SV-2196	318510.7369	4311890.408	0.139580288	37mm Trenchart;Hotchkiss****	2.62742844	0.3806	Don't Dig	262	2195	67	Don't Dig	0		37mm_BE365s	0	318510.8	4311891	0.19
2001	1285604.268	462718.8403	SV-2195	318510.6286	4311890.411	0.27844292	57mm M1&6 PR***	1.2969818	0.77102	Don't Dig	112	2196	0	Don't Dig	*				318510.7	4311890	0.12
2001	1285604.268	462718.8403	SV-2196	318510.7369	4311890.408	0.139580288	37mm Trenchart;Hotchkiss****	2.62742844	0.3806	Don't Dig	262	2196	0	Can't Analyze	*				318510.7	4311890	0.12
2002	1285596.39	462723.1867	SV-2000	318508.9204	4311891.694	0.101516679	37mm HE**	2.48913592	0.40175	Don't Dig	250	2000	0	Can't Analyze	*				318508.3	4311892	-0.88
2003	1285587.038	462726.7436	SV-2003	318505.6277	4311892.943	0.148096952	37mm Trenchart;Hotchkiss****	2.49191388	0.4013	Don't Dig	251	2003	0	Can't Analyze	*				318505.4	4311893	0.13
2004	1285589.464	462728.2128	SV-2004	318506.2555	4311893.365	0.145456128	37mm Trenchart;Hotchkiss****	3.01267374	0.33193	Don't Dig	310										
2005	1285590.459	462728.7991										2004	0	Can't Analyze	*				318506.6	4311894	0.13
2006	1285594.631	462733.0581										2005	0	Can't Analyze	*				318507.9	4311895	-0.26
2007	1285594.473	462734.1605	SV-2005	318507.8134	4311895.179	0.229145549	37mm HE**	1.29611344	0.77154	Don't Dig	111										
2008	1285597.772	462739.3388	SV-2006	318508.8685	4311896.766	0.133133485	37mm Trenchart;Hotchkiss****	3.60166652	0.27765	Don't Dig	353	2006	68	Don't Dig	0	weak/no response			318508.9	4311897	-0.2
2009	1285611.743	462738.3165	SV-2194	318513.005	4311896.044	0.444956463	90mm M71A1*	1.33435871	0.74942	Don't Dig	122	2194	0	Can't Analyze	*				318513.1	4311896	0.1
2010	1285606.914	462747.5626	SV-2193	318511.6969	4311898.987	0.00121799	37mm Trenchart;Hotchkiss****	5.70929935	0.17515	Don't Dig	476	2193	0	Can't Analyze	*				318511.6	4311899	0.16
2011	1285604.903	462748.5324	SV-2192	318511.1972	4311899.504	4.0531E-09	37mm Trenchart;Hotchkiss****	5.16197017	0.19372	Don't Dig	467	2192	0	Can't Analyze	*				318511	4311899	-1.12
2012	1285606.573	462754.7168	SV-2190	318511.678	4311901.231	1.89218E-10	37mm Trenchart;Hotchkiss****	5.49623048	0.18194	Don't Dig	471	2190	0	Can't Analyze	*				318511.6	4311901	-1.17
2013	1285610.301	462758.6287	SV-2189	318512.768	4311902.533	0.019077783	37mm Trenchart;Hotchkiss****	2.63309549	0.37978	Don't Dig	263	2187	26	Dig, Low Confidence	0.767		37mm_BE365s	0.9706	318512.8	4311902	-0.02
2013	1285610.301	462758.6287	SV-2187	318512.8607	4311902.496	0.044167689	ISO S80	0.83436613	110.19851	Training	6	2187	26	Dig, Low Confidence	0.767		37mm_BE365s	0.9706	318512.8	4311902	-0.02
2013	1285610.301	462758.6287	SV-2188	318512.8058	4311902.536	0.017797138	37mm Trenchart;Hotchkiss****	2.61759979	0.38203	Don't Dig	261	2187	26	Dig, Low Confidence	0.767		37mm_BE365s	0.9706	318512.8	4311902	-0.02
2013	1285610.301	462758.6287	SV-2189	318512.768	4311902.533	0.019077783	37mm Trenchart;Hotchkiss****	2.63309549	0.37978	Don't Dig	263	2189	28	Dig, Low Confidence	0.7484		37mm_SWPG_TP4s	0.9537	318512.9	4311902	-0.04
2013	1285610.301	462758.6287	SV-2187	318512.8607	4311902.496	0.044167689	ISO S80	0.83436613	110.19851	Training	6	2189	28	Dig, Low Confidence	0.7484		37mm_SWPG_TP4s	0.9537	318512.9	4311902	-0.04
2013	1285610.301	462758.6287	SV-2188	318512.8058	4311902.536	0.017797138	37mm Trenchart;Hotchkiss****	2.61759979	0.38203	Don't Dig	261	2189	28	Dig, Low Confidence	0.7484		37mm_SWPG_TP4s	0.9537	318512.9	4311902	-0.04
2013	1285610.301	462758.6287	SV-2189	318512.768	4311902.533	0.019077783	37mm Trenchart;Hotchkiss****	2.63309549	0.37978	Don't Dig	263	2188	30	Dig, Low Confidence	0.7424		37mm_BE365s	0.9775	318512.9	4311903	-0.03
2013	1285610.301	462758.6287	SV-2187	318512.8607	4311902.496	0.044167689	ISO S80	0.83436613	110.19851	Training	6	2188	30	Dig, Low Confidence	0.7424		37mm_BE365s	0.9775	318512.9	4311903	-0.03
2013	1285610.301	462758.6287	SV-2188	318512.8058	4311902.536	0.017797138	37mm Trenchart;Hotchkiss****	2.61759979	0.38203	Don't Dig	261	2188	30	Dig, Low Confidence	0.7424		37mm_BE365s	0.9775	318512.9	4311903	-0.03
2014	1285605.242	462760.5302	SV-2186	318511.2273	4311903.329	9.99097E-10	37mm Trenchart;Hotchkiss****	4.72315072	0.21172	Don't Dig	448	2186	0	Can't Analyze	*				318511.3	4311903	0.17
2015	1285604.843	462758.2606																			
2016	1285603.969	462758.7221	SV-2184	318510.8548	4311902.497	0.019900177	37mm Trenchart;Hotchkiss****	4.09676597	0.24409	Don't Dig	397	2185	0	Can't Analyze	*				318510.9	4311903	-0.06
2016	1285603.969	462758.7221	SV-2185	318510.9515	4311902.573	0.044673464	37mm Trenchart;Hotchkiss****	3.09762288	0.32283	Don't Dig	316	2185	0	Can't Analyze	*				318510.9	4311903	-0.06
2017	1285602.677	462758.2064										2184	68	Don't Dig	0	weak/no response			318510.5	4311902	0.14
2018	1285603.189	462753.3694	SV-2191	318510.259	4311900.87	0.139884794	37mm HE**	3.03422695	0.32957	Don't Dig	314	2191	0	Can't Analyze	*				318510.7	4311901	0
2019	1285599.248	462747.5124	SV-2008	318509.3636	4311899.164	0.192829425	37mm HE**	2.85232308	0.35059	Don't Dig	289										
2020	1285599.731	462746.3631	SV-2007	318509.5331	4311898.75	6.29466E-14	37mm HE**	4.3404816	0.23039	Don't Dig	425	2008	0	Can't Analyze	*				318509.5	4311899	-0.28
2021	1285599.619	462745.0136										2007	0	Can't Analyze	*				318509.5	4311898	0.05
2022	1285595.486	462744.5865	SV-2009	318508.2111	4311898.377	0.093620166	37mm Trenchart;Hotchkiss****	3.37661207	0.29615	Don't Dig	335	2009	0	Can't Analyze	*				318508.2	4311898	-0.06
2023	1285589.657	462742.3568	SV-2010	318506.3927	4311897.744	0.178227896	MkIV booster	1.03589239	0.96535	Don't Dig	57	2010	33	Dig, Low Confidence	0.5945		37mm projectile_SR1781s	0.9356	318506.4	4311898	-0.16
2024	1285586.803	462736.8076	SV-2011	318505.4979	4311895.984	0.063211756	37mm Trenchart;Hotchkiss****	3.82534458	0.26141	Don't Dig	371										
2025	1285586.251	462735.1383										2011	0	Can't Analyze	*				318505.3	4311895	0.03
2026	1285584.673	462739.7633										2012	0	Can't Analyze	*				318504.9	4311897	0.14
2027	1285584.796	462741.0327	SV-2012	318504.916	4311897.286	0.04518489	37mm Trenchart;Hotchkiss****	3.39291219	0.29473	Don't Dig	337										
2028	1285582.44	462745.8178										2013	68	Don't Dig	0	weak/no response			318504.2	4311899	0.17
2029	1285582.675	462746.8304	SV-2013	318504.3085	4311899.067	0.232192903	37mm HE**	1.95398983	0.51177	Don't Dig	213										
2030	1285572.062	462741.2946	SV-2014	318501.1228	4311897.46	0.529042652	90mm M71A1**	2.17453421	0.45987	Don't Dig	224										
2031	1285571.722	462742.2355										2014	0	Can't Analyze	*				318500.9	4311898	0.11
2032	1285577.621	462753.6482	SV-2015	318502.8879	4311901.262	0.160988008	37mm HE**	2.58411716	0.38698	Don't Dig	258	2015	0	Can't Analyze	*				318502.7	4311901	0.03
2033	1285578.168	462755.2927	SV-2016	318502.9689	4311901.666	0.105544267	37mm Trenchart;Hotchkiss****	4.15126964	0.24089	Don't Dig	405										
2034	1285579.68	462754.9453										2016	0	Can't Analyze	*				318503.5	4311902	0.11
2035	1285580.735	462756.6934	SV-2017	318503.7185	4311902.19	0.193203399	37mm HE**	1.28262286	0.77965	Don't Dig	109	2017	13	Dig, Low Confidence	0.8377		37mm_SWPG_TP4s	0.9	318503.8	4311902	-0.21
2035	1285580.735	462756.6934	SV-2018	318503.7606	4311902.157	0.241525721	37mm M55A1****	1.4096113	0.70942	Don't Dig	141	2017	13	Dig, Low Confidence	0.8377		37mm_SWPG_TP4s	0.9	318503.8	4311902	-0.21
2035	1285580.735	462756.6934	SV-2017	318503.7185	4311902.19	0.193203399	37mm HE**	1.28262286	0.77965	Don't Dig	109	2018	41	Don't Dig	0.7117		37mm_BE365s	0.8049	318503.8	4311902	-0.17
2035	1285580.735	462756.6934	SV-2018	318503.7606	4311902.157	0.241525721	37mm M55A1****	1.4096113	0.70942	Don't Dig	141	2018	41	Don't Dig	0.7117		37mm_BE365s	0.8049	318503.8	4311902	-0.17
2036	1285579.407	462758.1928	SV-2019	318503.318	4311902.613	0.023776288	37mm Trenchart;Hotchkiss****	4.6049248	0.21716	Don't Dig	441	2019	0	Can't Analyze	*				318503.5	4311902	-0.06
2037	1285574.027	462760.4833	SV-2020	318501.8826	4311903.309	0.024540455	37mm Trenchart;Hotchkiss****	5.38555503	0.18568	Don't Dig	469	2020	0	Can't Analyze	*				318501.8	4311903	0.05
2038	1285572.704	462757.5847	SV-2021	318501.4585	4311902.767	0.395978025	57mm M1&6 PR***	2.24362796	0.44571	Don't Dig	230										
2039	1285571.862	462758.3176										2021	0	Can't Analyze	*				318501.1	4311903	0.15
2040	1285559.752	462759.2988	SV-2022	318497.4193	4311903.056	0.025471924	60mm M49A4***	1.14229578	0.87543	Don't Dig	74										
2041	1285557.985	462759.621										2022	0	Can't Analyze	*				318496.9	4311903	0.05
2042	1285555.95	462758.5689	SV-2024	318496.1402	4311902.815	0.371384769	57mm M1&6 PR***	1.42780245	0.70038	Don't Dig	145										
2043	1285554.666	462758.334										2024	0	Can't Analyze	*				318495.9	4311903	-0.21
2044	1285553.603	462759.7315	SV-2023	318495.5109	4311903.194	5.61833E-05	30mm TP-T PGU-16/A*	3.89820017	0.25653	Don't Dig	376										
2045	1285552.722	462760.1946										2023	0	Can't Analyze	*				318495.3	4311903	0.19
2046	1285554.513	462752.5044	SV-2025	318495.7866	4311900.982	0.180199418	37mm M55A1****	0.90071246	110.11023	Training	7	2025	6	Dig, Low Confidence	0.8947		small ISO80_FR_IVS2	0.9442	318495.8	4311901	-0.1
2047	1285547.452	462752.3724	SV-2027	318493.7284	4311900.846	0.284629755	60mm TAM 1.8 British**	0.72870024	1.37231	Dig	34	2027	8	Dig, Low Confidence	0.8691		60mm_BP110826_TP18s	0.9497	318493.7	4311901	-0.25
2047	1285547.452	462752.3724	SV-2026	318493.6035	4311900.994	0.385075932	81mm M43A1 TP**	1.08400373	0.92251	Don't Dig	68	2027	8	Dig, Low Confidence	0.8691		60mm_BP110826_TP18s	0.9497	318493.7	4311901	-0.25

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
2047	1285547.452	462752.3724	SV-2027	318493.7284	4311900.846	0.284629755	60mm TAM 1.8 British**	0.72870024	1.37231	Dig	34	2026	27	Dig, Low Confidence	0.7504	feature space addition	105mm heat_BP110413_TP24m	0.8159	318493.5	4311901	-0.44
2047	1285547.452	462752.3724	SV-2026	318493.6035	4311900.994	0.385075932	81mm M43A1 TP**	1.08400373	0.92251	Don't Dig	68	2026	27	Dig, Low Confidence	0.7504	feature space addition	105mm heat_BP110413_TP24m	0.8159	318493.5	4311901	-0.44
2048	1285545.604	462750.8257	SV-2028	318493.0264	4311900.555	0.020524299	37mm Trenchart;Hotchkiss****	3.86698267	0.2586	Don't Dig	374	2028	67	Don't Dig	0		37mm_BE365s	0	318493.1	4311901	0.05
2049	1285543.967	462750.9456										2042	0	Can't Analyze	*				318492.5	4311901	-0.89
2050	1285547.366	462748.5591										2029	0	Can't Analyze	*				318493.6	4311900	-0.79
2051	1285547.923	462747.6624	SV-2029	318493.7218	4311899.563	0.188889159	37mm HE**	1.36538221	0.7324	Don't Dig	130										
2052	1285549.507	462748.2124										2030	0	Can't Analyze	*				318494.2	4311900	0.11
2053	1285549.261	462747.1733	SV-2030	318494.105	4311899.28	0.380956949	57mm M1&6 PR***	1.38150474	0.72385	Don't Dig	134										
2054	1285544.62	462742.7662	SV-2036	318492.5777	4311898.035	0.052404863	37mm Trenchart;Hotchkiss****	4.2610387	0.23468	Don't Dig	417	2036	0	Can't Analyze	*				318492.8	4311898	0.03
2055	1285544.77	462739.9031	SV-2035	318492.712	4311897.229	0.064481752	37mm Trenchart;Hotchkiss****	2.04073203	0.49002	Don't Dig	218	2035	0	Can't Analyze	*				318492.7	4311897	-0.3
2056	1285549.369	462739.5463										2031	0	Can't Analyze	*				318494.1	4311897	-0.33
2057	1285550.725	462737.3086	SV-2031	318494.5083	4311896.379	0.173689088	37mm HE**	2.70237282	0.37005	Don't Dig	274										
2058	1285547.998	462736.0822	SV-2032	318493.6734	4311896.049	0.153168128	MkIV booster	0.76256674	1.31136	Dig	35	2032	40	Don't Dig	0.7216		37mm_BE365s	0.6961	318493.6	4311896	-0.06
2059	1285546.895	462734.1433										2033	0	Can't Analyze	*				318493.3	4311895	-0.02
2060	1285546.766	462735.3874	SV-2033	318493.2889	4311895.82	0.134130146	ISO S80	2.30286043	0.43424	Don't Dig	235										
2061	1285543.987	462737.2526	SV-2034	318492.4794	4311896.393	0.051120021	37mm Trenchart;Hotchkiss****	1.59915618	0.62533	Don't Dig	171	2034	59	Don't Dig	0.407		37mm_BE365s	0.377	318492.4	4311896	0.01
2062	1285536.5	462737.0006																			
2063	1285537.586	462740.3771																			
2064	1285537.739	462741.5213	SV-2038	318490.6143	4311897.762	6.07138E-09	37mm Trenchart;Hotchkiss****	2.30711409	0.43344	Don't Dig	236	2038	32	Dig, Low Confidence	0.6022		37mm_2011LSBP840m	0.9779	318490.6	4311898	-0.02
2064	1285537.739	462741.5213	SV-2039	318489.6909	4311898.737	0.999999998	Underwater Mine Mk6*	2.32219793	0	Don't Dig	493	2038	32	Dig, Low Confidence	0.6022		37mm_2011LSBP840m	0.9779	318490.6	4311898	-0.02
2064	1285537.739	462741.5213	SV-2037	318490.6157	4311897.79	0.083031487	ISO S80	0.78690115	1.27081	Dig	36	2038	32	Dig, Low Confidence	0.6022		37mm_2011LSBP840m	0.9779	318490.6	4311898	-0.02
2064	1285537.739	462741.5213	SV-2038	318490.6143	4311897.762	6.07138E-09	37mm Trenchart;Hotchkiss****	2.30711409	0.43344	Don't Dig	236	2037	29	Dig, Low Confidence	0.7478		small ISO80_SR_IVS5s	0.9732	318490.6	4311898	-0.1
2064	1285537.739	462741.5213	SV-2039	318489.6909	4311898.737	0.999999998	Underwater Mine Mk6*	2.32219793	0	Don't Dig	493	2037	29	Dig, Low Confidence	0.7478		small ISO80_SR_IVS5s	0.9732	318490.6	4311898	-0.1
2064	1285537.739	462741.5213	SV-2037	318490.6157	4311897.79	0.083031487	ISO S80	0.78690115	1.27081	Dig	36	2037	29	Dig, Low Confidence	0.7478		small ISO80_SR_IVS5s	0.9732	318490.6	4311898	-0.1
2065	1285538.825	462750.1888	SV-2041	318491.0156	4311900.343	0.030352765	37mm Trenchart;Hotchkiss****	2.99595674	0.33378	Don't Dig	304	2040	0	Can't Analyze	*				318491	4311900	0.03
2065	1285538.825	462750.1888	SV-2040	318490.9589	4311899.992	0.554033576	90mm M71A1**	1.75209639	0.57074	Don't Dig	191	2040	0	Can't Analyze	*				318491	4311900	0.03
2065	1285538.825	462750.1888	SV-2041	318491.0156	4311900.343	0.030352765	37mm Trenchart;Hotchkiss****	2.99595674	0.33378	Don't Dig	304	2041	0	Can't Analyze	*				318490.9	4311900	0.02
2065	1285538.825	462750.1888	SV-2040	318490.9589	4311899.992	0.554033576	90mm M71A1**	1.75209639	0.57074	Don't Dig	191	2041	0	Can't Analyze	*				318490.9	4311900	0.02
2066	1285541.533	462752.0883	SV-2042	318491.7773	4311900.936	2.35367E-14	37mm Trenchart;Hotchkiss****	2.87435965	0.3479	Don't Dig	291	2043	0	Can't Analyze	*				318491.6	4311901	0.16
2066	1285541.533	462752.0883	SV-2043	318491.918	4311900.991	5.11609E-05	ISO S80	3.02953022	0.33008	Don't Dig	313	2043	0	Can't Analyze	*				318491.6	4311901	0.16
2067	1285539	462753.5006																			
2068	1285541	462757.0006																			
2069	1285543.854	462758.6004	SV-2044	318492.5743	4311902.942	0.179897587	MkIV booster	1.47068122	0.67996	Don't Dig	155	2044	54	Don't Dig	0.5667		37mm_BE74s	0.684	318492.5	4311903	-0.16
2070	1285542.537	462761.3377	SV-2045	318492.227	4311903.772	0.062124498	37mm Trenchart;Hotchkiss****	2.91191534	0.34342	Don't Dig	294	2045	0	Can't Analyze	*				318492.1	4311904	-0.06
2071	1285541.5	462762.0006																			
2072	1285543.651	462766.8209										2046	0	Can't Analyze	*				318492.6	4311905	0.05
2073	1285543.19	462767.7722	SV-2046	318492.4161	4311905.713	0.042111185	37mm Trenchart;Hotchkiss****	4.13999198	0.24155	Don't Dig	404										
2074	1285551.375	462764.3472	SV-2047	318494.9025	4311904.642	0.377646748	2.75in MK1**	0.44552354	111.24455	Training	1	2047	15	Dig, Low Confidence	0.8277		105mm proj_BP110826_TP53s	0.9714	318494.9	4311905	-0.4
2075	1285558.545	462766.247	SV-2048	318497.1697	4311905.051	0.080724713	37mm Trenchart;Hotchkiss****	3.52685266	0.28354	Don't Dig	345	2048	0	Can't Analyze	*				318497	4311905	-0.96
2076	1285560.841	462769.4164	SV-2049	318497.5858	4311906.215	0.046399689	37mm Trenchart;Hotchkiss****	3.95687219	0.25272	Don't Dig	382	2049	0	Can't Analyze	*				318497.7	4311906	0.09
2077	1285564.047	462772.0168																			
2078	1285562.415	462773.0737	SV-2050	318498.1773	4311906.994	0.203835361	37mm HE**	2.10056887	0	Don't Dig	494	2050	0	Can't Analyze	*				318498.3	4311907	0.04
2079	1285560.872	462774.5952	SV-2051	318497.8445	4311907.699	0.142871597	60mm M49A4***	1.08540663	0.92131	Don't Dig	69	2051	2	Dig, High Confidence	0.9168		60mm_29P_TP53s	0.9516	318497.9	4311908	-0.15
2080	1285556.733	462776.3617	SV-2055	318496.6767	4311907.932	0.123526255	37mm HE**	2.42658504	0.4121	Don't Dig	245	2055	0	Can't Analyze	*				318496.6	4311908	0.01
2081	1285558.659	462778.1267	SV-2054	318497.1992	4311908.765	0.697586362	152mm HE USSR/Europe*	1.43389225	0	Don't Dig	495										
2082	1285558.995	462779.7469	SV-2053	318497.3497	4311909.358	0.055856015	37mm Trenchart;Hotchkiss****	3.86329981	0.25885	Don't Dig	373	2053	0	Can't Analyze	*				318497.4	4311909	0.08
2082	1285558.995	462779.7469	SV-2053	318497.3497	4311909.358	0.055856015	37mm Trenchart;Hotchkiss****	3.86329981	0.25885	Don't Dig	373	2054	0	Can't Analyze	*				318497.2	4311909	0.09
2083	1285560.627	462778.7704	SV-2052	318497.8763	4311908.969	0.273457012	37mm M55A1****	1.59229442	0.62802	Don't Dig	170	2052	0	Can't Analyze	*				318497.9	4311909	0.01
2084	1285561.644	462781.5819	SV-2061	318498.132	4311909.798	0.081895762	37mm Trenchart;Hotchkiss****	3.91828523	0.25521	Don't Dig	379										
2085	1285564.45	462781.1267	SV-2062	318499.0189	4311909.594	0.226114362	ISO S80	1.71160769	0.58425	Don't Dig	187	2062	0	Can't Analyze	*				318499	4311910	0.14
2086	1285564.776	462782.1495										2061	0	Can't Analyze	*				318499.1	4311910	-0.02
2087	1285566.039	462784.6514	SV-2063	318499.4919	4311910.704	2.7006E-14	37mm Trenchart;Hotchkiss****	5.12927071	0.19496	Don't Dig	465										
2088	1285567.586	462785.6567										2063	0	Can't Analyze	0.5669				318500	4311911	-0.51
2089	1285560.729	462784.8827										2059	0	Can't Analyze	*				318497.8	4311911	0.09
2089	1285560.729	462784.8827										2064	0	Can't Analyze	*				318498	4311911	0.12
2090	1285561.462	462783.9931	SV-2064	318498.0924	4311910.534	1.16831E-07	37mm Trenchart;Hotchkiss****	4.83631308	0.20677	Don't Dig	455										
2091	1285560.691	462783.0869	SV-2059	318497.7911	4311910.358	0.005732225	37mm Trenchart;Hotchkiss****	4.16700205	0.23998	Don't Dig	406	2060	0	Can't Analyze	*				318497.8	4311910	0.03
2091	1285560.691	462783.0869	SV-2060	318498.0057	4311910.049	0.206441446	37mm HE**	1.74047233	0.57456	Don't Dig	190	2060	0	Can't Analyze	*				318497.8	4311910	0.03
2092	1285553.366	462783.1788										2058	68	Don't Dig	0	weak/no response			318495.6	4311910	-0.05
2093	1285547.957	462783.4079	SV-2056	318493.9564	4311910.394	0.086581386	37mm Trenchart;Hotchkiss****	3.76366605	0.2657	Don't Dig	365	2056	0	Can't Analyze	*				318494	4311910	-0.01
2094	1285549.681	462784.0988	SV-2057	318494.3506	4311910.505	0.017013171	37mm Trenchart;Hotchkiss****	4.76123305	0.21003	Don't Dig	451	2057	68	Don't Dig	0	weak/no response			318494.6	4311911	0.17
2095	1285551.126	462784.4028	SV-2058	318495.2125	4311910.763	4.04074E-09	37mm Trenchart;Hotchkiss****	4.57846659	0.21841	Don't Dig	439										
2096	1285557.395	462786.5158										2065	47	Don't Dig	0.6149		37mm_BE365s	0.6174	318496.9	4311911	-0.14
2097	1285558.144	462788.1008	SV-2065	318497.0313	4311911.826	0.164362387	37mm HE**	2.21277394	0.45192	Don't Dig	226										

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
2098	1285558.86	462792.0625	SV-2066	318497.8399	4311912.944	0.913864879	250-lb Bomb Mk-81	1.5934088	109.62759	Training	10	2066	0	Can't Analyze	0.7462	within buried powerline area			318497.4	4311913	-0.32
2099	1285555	462792.5006																			
2100	1285556	462795.5006																			
2101	1285553.998	462799.2717										2068	68	Don't Dig	0	weak/no response			318495.9	4311915	0.08
2102	1285554.778	462800.1814	SV-2068	318496.2047	4311915.51	0.099915442	37mm Trenchart;Hotchkiss****	3.97880886	0.25133	Don't Dig	385										
2103	1285556	462800.5006																			
2104	1285559.207	462803.291	SV-2070	318497.5552	4311916.477	0.075245889	37mm Trenchart;Hotchkiss****	2.4959691	0.40065	Don't Dig	253	2070	0	Can't Analyze	*	within buried powerline area			318497.5	4311916	0.06
2105	1285556	462807.0006																			
2106	1285561.602	462813.1944	SV-2074	318498.2513	4311919.434	0.128380175	37mm Trenchart;Hotchkiss****	2.94564728	0.33948	Don't Dig	298	2074	45	Don't Dig	0.6615		37mm_BE365s	0.9304	318498.4	4311919	-0.15
2107	1285565.77	462807.883	SV-2072	318499.5315	4311917.755	0.27546612	ISO S80	1.44790281	0.69065	Don't Dig	151	2073	0	Can't Analyze	*				318499.6	4311918	-0.21
2108	1285566.776	462808.9863	SV-2073	318499.8792	4311918.115	0.00753884	37mm Trenchart;Hotchkiss****	4.3211748	0.23142	Don't Dig	424										
2109	1285568.633	462806.7465										2072	0	Can't Analyze	*				318500.4	4311917	0.15
2110	1285566.611	462803.7258	SV-2071	318499.8436	4311916.571	0.597052708	2.75in MK1**	1.44026555	0.69432	Don't Dig	147										
2111	1285566.785	462802.7354										2071	0	Can't Analyze	*				318499.8	4311916	0.06
2112	1285560.5	462799.5006																			
2113	1285561.781	462795.3079	SV-2067	318498.2046	4311914.017	0.232706221	37mm Trenchart;Hotchkiss****	2.2992694	0.43492	Don't Dig	233	2067	0	Can't Analyze	*				318498.3	4311914	-0.04
2114	1285594.2	462765.5529	SV-2183	318508.0168	4311904.752	0.178522286	37mm HE**	2.06507129	0.48424	Don't Dig	219	2183	0	Can't Analyze	*				318507.9	4311905	0.09
2115	1285594.894	462769.2286	SV-2182	318508.2541	4311905.852	0.114566138	37mm Trenchart;Hotchkiss****	4.50199705	0	Don't Dig	500	2182	0	Can't Analyze	*				318508.1	4311906	-0.49
2116	1285594.361	462776.9956	SV-2181	318508.193	4311908.123	0.025792149	37mm HE**	3.92958535	0.25448	Don't Dig	380	2181	0	Can't Analyze	*				318508	4311908	-0.03
2117	1285593.73	462780.6225	SV-2180	318508.0401	4311909.282	0.044469634	37mm Trenchart;Hotchkiss****	4.55485888	0.21955	Don't Dig	437	2180	67	Don't Dig	0		37mm_BE365s	0	318507.8	4311909	0.06
2118	1285597.337	462779.8277	SV-2178	318509.0956	4311908.962	0.178899442	ISO S80	1.28065286	0.78085	Don't Dig	108	2178	53	Don't Dig	0.5782		37mm_BE365s	0.7764	318509	4311909	-0.12
2118	1285597.337	462779.8277	SV-2179	318508.8284	4311909.102	0.234773034	37mm M55A1****	1.4408192	0.69405	Don't Dig	148	2178	53	Don't Dig	0.5782		37mm_BE365s	0.7764	318509	4311909	-0.12
2118	1285597.337	462779.8277	SV-2178	318509.0956	4311908.962	0.178899442	ISO S80	1.28065286	0.78085	Don't Dig	108	2179	63	Don't Dig	0.0218		37mm_BE365s	0.0124	318508.9	4311909	0
2118	1285597.337	462779.8277	SV-2179	318508.8284	4311909.102	0.234773034	37mm M55A1****	1.4408192	0.69405	Don't Dig	148	2179	63	Don't Dig	0.0218		37mm_BE365s	0.0124	318508.9	4311909	0
2119	1285599.513	462780.185	SV-2177	318509.6629	4311909.119	0.401634375	37mm German ERST**	1.72748687	0	Don't Dig	499										
2120	1285602.281	462780.7413										2177	0	Can't Analyze	*				318510.5	4311909	-0.26
2121	1285604.032	462776.399	SV-2176	318510.9496	4311907.92	0.023753028	37mm Trenchart;Hotchkiss****	3.59317917	0.27831	Don't Dig	352	2176	0	Can't Analyze	*				318511.1	4311908	-0.02
2122	1285610.455	462776.2331	SV-2174	318513.1931	4311907.837	0.542152628	2.75in MK1**	2.75559959	0.3629	Don't Dig	277	2174	0	Can't Analyze	*				318513	4311908	0.13
2122	1285610.455	462776.2331	SV-2175	318513.0199	4311907.883	0.048298367	37mm Trenchart;Hotchkiss****	4.21728871	0.23712	Don't Dig	413	2174	0	Can't Analyze	*				318513	4311908	0.13
2122	1285610.455	462776.2331	SV-2174	318513.1931	4311907.837	0.542152628	2.75in MK1**	2.75559959	0.3629	Don't Dig	277	2175	68	Don't Dig	0	weak/no response			318512.8	4311908	-0.27
2122	1285610.455	462776.2331	SV-2175	318513.0199	4311907.883	0.048298367	37mm Trenchart;Hotchkiss****	4.21728871	0.23712	Don't Dig	413	2175	68	Don't Dig	0	weak/no response			318512.8	4311908	-0.27
2123	1285618.562	462766.1927	SV-2173	318515.4087	4311904.715	0.021001564	37mm Trenchart;Hotchkiss****	5.38453263	0.18572	Don't Dig	468	2173	0	Can't Analyze	*				318515.3	4311905	0.12
2124	1285618.86	462767.7333	SV-2172	318515.5737	4311905.233	0.081193575	37mm Trenchart;Hotchkiss****	4.70454566	0.21256	Don't Dig	446	2172	0	Can't Analyze	*				318515.5	4311905	0.19
2125	1285618.657	462770.3277	SV-2171	318515.5018	4311906.074	0.015119642	37mm Trenchart;Hotchkiss****	4.80025725	0.20832	Don't Dig	453	2171	0	Can't Analyze	*				318515.4	4311906	0.14
2126	1285620.631	462773.7591	SV-2170	318516.0708	4311907.129	0.05280284	37mm Trenchart;Hotchkiss****	4.4899355	0.22272	Don't Dig	435	2170	68	Don't Dig	0	weak/no response			318516	4311907	0.17
2127	1285619.754	462778.2535	SV-2169	318515.8351	4311908.325	0.149025295	37mm HE**	1.27271284	0.78572	Don't Dig	105	2169	0	Can't Analyze	*				318515.9	4311908	-0.11
2127	1285619.754	462778.2535	SV-2169	318515.8351	4311908.325	0.149025295	37mm HE**	1.27271284	0.78572	Don't Dig	105	2166	0	Can't Analyze	*				318515.7	4311909	0.03
2128	1285621.534	462779.9095	SV-2167	318516.3318	4311909.082	0.121626234	MkIV booster	1.34121777	0.74559	Don't Dig	127	2167	10	Dig, Low Confidence	0.8567		3in proj_BP110826_TP73s	0.8857	318516.6	4311909	-0.32
2128	1285621.534	462779.9095	SV-2168	318516.1557	4311908.759	0.179756529	MkIV booster	1.30786357	0.76461	Don't Dig	117	2167	10	Dig, Low Confidence	0.8567		3in proj_BP110826_TP73s	0.8857	318516.6	4311909	-0.32
2128	1285621.534	462779.9095	SV-2167	318516.3318	4311909.082	0.121626234	MkIV booster	1.34121777	0.74559	Don't Dig	127	2168	5	Dig, Low Confidence	0.8973		60mm_BP110826_TP33s	0.8945	318516.4	4311909	-0.18
2128	1285621.534	462779.9095	SV-2168	318516.1557	4311908.759	0.179756529	MkIV booster	1.30786357	0.76461	Don't Dig	117	2168	5	Dig, Low Confidence	0.8973		60mm_BP110826_TP33s	0.8945	318516.4	4311909	-0.18
2129	1285617.746	462779.1939	SV-2166	318515.2128	4311908.695	0.004522509	37mm HE**	4.29927063	0.2326	Don't Dig	422										
2130	1285613.676	462782.6313	SV-2165	318514.0628	4311909.666	0.154566717	37mm M55A1****	1.20408052	0.83051	Don't Dig	81	2164	11	Dig, Low Confidence	0.8506		60mm_29P_TP53s	0.8854	318513.9	4311910	-0.2
2130	1285613.676	462782.6313	SV-2165	318514.0628	4311909.666	0.154566717	37mm M55A1****	1.20408052	0.83051	Don't Dig	81	2165	25	Dig, Low Confidence	0.7711	feature space addition	81mm_BE2m	0.798	318514.1	4311910	-0.32
2131	1285612.185	462783.1933	SV-2164	318513.5278	4311909.966	0.124033009	37mm Trenchart;Hotchkiss****	2.39652323	0.41727	Don't Dig	240										
2132	1285618.931	462784.754	SV-2163	318515.5818	4311910.393	0.378832201	60mm TAM 1.8 British**	1.33574481	0.74865	Don't Dig	123	2163	22	Dig, Low Confidence	0.8139	feature space addition	5in proj_BP110826_TP77m	0.8385	318515.6	4311910	-0.49
2133	1285625.25	462787.6869	SV-2162	318517.5323	4311911.245	0.363947042	81mm M43A1 TP**	0.69557232	110.43767	Training	4	2162	7	Dig, Low Confidence	0.8843		3in proj_BP110826_TP81s	0.9743	318517.6	4311911	-0.33
2134	1285625.144	462789.2925	SV-2160	318517.5995	4311911.736	0.055263392	37mm HE**	2.99667054	0.3337	Don't Dig	305	2160	0	Can't Analyze	*				318517.5	4311912	0.2
2135	1285623.687	462790.0907	SV-2161	318517.0519	4311911.912	4.85599E-09	37mm Trenchart;Hotchkiss****	4.79343426	0.20862	Don't Dig	452	2161	0	Can't Analyze	*				318517.1	4311912	0.19
2136	1285625.404	462793.3967	SV-2158	318517.7048	4311913.083	0.027814642	37mm Trenchart;Hotchkiss****	5.46705705	0.18291	Don't Dig	470	2158	0	Can't Analyze	*				318517.7	4311913	0.17
2137	1285626.947	462793.0122	SV-2159	318518.1179	4311912.799	0.14101075	37mm Trenchart;Hotchkiss****	3.22436648	0.31014	Don't Dig	327	2159	0	Can't Analyze	*				318518.1	4311913	0
2138	1285628.565	462796.7262	SV-2157	318518.6741	4311914.021	0.024664944	37mm Trenchart;Hotchkiss****	4.05042584	0.24689	Don't Dig	390	2157	0	Can't Analyze	*				318518.6	4311914	0
2139	1285626.35	462797.9393										2156	68	Don't Dig	0	weak/no response			318518	4311914	0.19
2140	1285625.874	462796.6064	SV-2156	318517.8069	4311914.174	2.11694E-09	37mm HE**	4.86118394	0.20571	Don't Dig	457										
2141	1285623.403	462798.2208	SV-2155	318517.0378	4311914.391	5.5204E-06	37mm Trenchart;Hotchkiss****	3.93621707	0.25405	Don't Dig	381	2155	0	Can't Analyze	*				318517.1	4311915	-0.07
2142	1285620.669	462796.6005										2154	0	Can't Analyze	*				318516.2	4311914	0.16
2143	1285619.485	462796.9551	SV-2154	318515.862	4311914.094	0.010579168	37mm Trenchart;Hotchkiss****	4.31909569	0.23153	Don't Dig	423										
2144	1285621.344	462800.2774	SV-2153	318516.4501	4311915.096	0.039645911	37mm Trenchart;Hotchkiss****	4.20679418	0.23771	Don't Dig	410										
2145	1285621.351	462801.4392										2153	0	Can't Analyze	*				318516.5	4311915	0.11
2146	1285622.361	462803.3449	SV-2152	318516.6909	4311915.998	0.023114575	37mm Trenchart;Hotchkiss****	4.38088526	0.22826	Don't Dig	428	2152	0	Can't Analyze	*				318516.9	4311916	0.09
2147	1285627.375	462800.6657	SV-2151	318518.2906	4311915.174	1.2108E-06	37mm HE**	4.675246	0.21389	Don't Dig	444										
2148	1285627.48	462801.7706										2151	0	Can't Analyze	*				318518.3	4311916	0.13
2149	1285627.021	462804.7138										2150	0	Can't Analyze	*				318518.2	4311916	0.28
2150	1285625.359	462805.1728	SV-2150	318517.7063	4311916.561	0.241172265	37mm M55A1****	1.93805942	0.51598	Don't Dig	211										

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
2151	1285626.176	462808.3442	SV-2149	318517.9532	4311917.514	0.999999966	8in M106**	1.9806997	0	Don't Dig	498	2149	0	Can't Analyze	*				318518	4311918	-0.03
2152	1285629.5	462807.0006																			
2153	1285632.197	462807.4033	SV-2148	318519.8906	4311917.15	8.06002E-09	37mm Trenchart;Hotchkiss****	5.02282526	0.19909	Don't Dig	462	2148	0	Can't Analyze	*				318519.7	4311917	0.12
2154	1285630.849	462809.3623	SV-2147	318519.3853	4311917.762	0.00160614	37mm Trenchart;Hotchkiss****	5.06678445	0.19736	Don't Dig	463	2147	0	Can't Analyze	*				318519.4	4311918	0.14
2155	1285631.107	462818.1803	SV-2146	318519.5103	4311920.533	0.030862163	37mm Trenchart;Hotchkiss****	4.9268733	0.20297	Don't Dig	459	2146	0	Can't Analyze	*				318519.6	4311920	0.15
2156	1285629.624	462818.1527	SV-2145	318518.8666	4311920.372	2.35367E-14	37mm Trenchart;Hotchkiss****	4.72649537	0.21157	Don't Dig	449	2145	0	Can't Analyze	*				318519.2	4311921	0.25
2157	1285623.358	462825.4377	SV-2143	318517.2321	4311922.75	2.22363E-14	57mm M1&6 PR***	1.40675707	0.71085	Don't Dig	140										
2158	1285622.569	462824.2161	SV-2144	318516.9108	4311922.354	0.153460949	60mm M49A4***	1.0495079	0.95283	Don't Dig	61	2144	3	Dig, Low Confidence	0.9018		Small ISO_BE622s	0.8991	318517.1	4311922	-0.13
2159	1285621.781	462825.1734										2143	0	Can't Analyze	*				318516.8	4311923	0.06
2160	1285619.882	462830.5713	SV-2142	318516.2122	4311924.283	0.111418265	37mm Trenchart;Hotchkiss****	2.64063455	0.3787	Don't Dig	264	2141	50	Don't Dig	0.5949		MK IV Booster_SV_TP10	0.7048	318516.2	4311924	-0.22
2160	1285619.882	462830.5713	SV-2142	318516.2122	4311924.283	0.111418265	37mm Trenchart;Hotchkiss****	2.64063455	0.3787	Don't Dig	264	2142	39	Don't Dig	0.7285		37mm_SR_IVS2s	0.8445	318516.2	4311924	-0.13
2161	1285620.532	462831.6334	SV-2141	318516.4125	4311924.657	4.71132E-06	37mm Trenchart;Hotchkiss****	5.49697065	0.18192	Don't Dig	472										
2162	1285622.349	462833.6848										2140	0	Can't Analyze	*				318517	4311925	0.11
2163	1285620.835	462834.006	SV-2140	318516.3926	4311925.35	0.081778934	37mm HE**	1.63054582	0	Don't Dig	497	2139	67	Don't Dig	0		37mm_BE365s	0	318516.7	4311925	0.02
2163	1285620.835	462834.006	SV-2139	318516.479	4311925.464	0.076862864	37mm Trenchart;Hotchkiss****	3.63038668	0.27545	Don't Dig	358	2139	67	Don't Dig	0		37mm_BE365s	0	318516.7	4311925	0.02
2164	1285616.739	462833.4764	SV-2138	318515.2457	4311925.289	0.081598387	37mm Trenchart;Hotchkiss****	3.90151302	0.25631	Don't Dig	377	2138	65	Don't Dig	0		37mm_BE365s	0	318515.3	4311925	0.01
2165	1285617.345	462834.4282										2137	0	Can't Analyze	*				318515.5	4311926	0.04
2166	1285616.912	462836.9399	SV-2137	318515.2141	4311926.225	0.037503049	37mm Trenchart;Hotchkiss****	4.08676333	0.24469	Don't Dig	394	2135	0	Can't Analyze	*				318515.4	4311926	0.06
2166	1285616.912	462836.9399	SV-2135	318515.144	4311926.451	0.040842801	37mm Trenchart;Hotchkiss****	4.21326202	0.23735	Don't Dig	412	2135	0	Can't Analyze	*				318515.4	4311926	0.06
2166	1285616.912	462836.9399	SV-2136	318515.4169	4311926.3	0.139033362	37mm Trenchart;Hotchkiss****	2.67567592	0.37374	Don't Dig	270	2135	0	Can't Analyze	*				318515.4	4311926	0.06
2166	1285616.912	462836.9399	SV-2137	318515.2141	4311926.225	0.037503049	37mm Trenchart;Hotchkiss****	4.08676333	0.24469	Don't Dig	394	2136	0	Can't Analyze	*				318515.3	4311927	0.08
2166	1285616.912	462836.9399	SV-2135	318515.144	4311926.451	0.040842801	37mm Trenchart;Hotchkiss****	4.21326202	0.23735	Don't Dig	412	2136	0	Can't Analyze	*				318515.3	4311927	0.08
2166	1285616.912	462836.9399	SV-2136	318515.4169	4311926.3	0.139033362	37mm Trenchart;Hotchkiss****	2.67567592	0.37374	Don't Dig	270	2136	0	Can't Analyze	*				318515.3	4311927	0.08
2167	1285613.162	462836.6334										2127	0	Can't Analyze	*				318514.2	4311926	0.09
2168	1285613.299	462834.5568	SV-2133	318514.1141	4311925.714	0.097449908	MkIV booster	1.91678629	0.52171	Don't Dig	207	2133	67	Don't Dig	0		37mm_BE365s	0	318514	4311925	0.06
2168	1285613.299	462834.5568	SV-2134	318514.1899	4311925.545	0.076239894	37mm Trenchart;Hotchkiss****	4.10914645	0.24336	Don't Dig	401	2133	67	Don't Dig	0		37mm_BE365s	0	318514	4311925	0.06
2168	1285613.299	462834.5568	SV-2132	318514.0774	4311925.421	0.27477103	37mm HE**	1.87810137	0.53245	Don't Dig	201	2133	67	Don't Dig	0		37mm_BE365s	0	318514	4311925	0.06
2168	1285613.299	462834.5568	SV-2133	318514.1141	4311925.714	0.097449908	MkIV booster	1.91678629	0.52171	Don't Dig	207	2134	0	Can't Analyze	*				318514.4	4311926	-0.3
2168	1285613.299	462834.5568	SV-2134	318514.1899	4311925.545	0.076239894	37mm Trenchart;Hotchkiss****	4.10914645	0.24336	Don't Dig	401	2134	0	Can't Analyze	*				318514.4	4311926	-0.3
2168	1285613.299	462834.5568	SV-2132	318514.0774	4311925.421	0.27477103	37mm HE**	1.87810137	0.53245	Don't Dig	201	2134	0	Can't Analyze	*				318514.4	4311926	-0.3
2169	1285612.719	462832.2407	SV-2131	318513.9863	4311924.913	0.068457059	37mm Trenchart;Hotchkiss****	4.17084288	0.23976	Don't Dig	407	2131	0	Can't Analyze	*				318514.1	4311925	0.1
2169	1285612.719	462832.2407	SV-2131	318513.9863	4311924.913	0.068457059	37mm Trenchart;Hotchkiss****	4.17084288	0.23976	Don't Dig	407	2132	0	Can't Analyze	*				318514	4311925	0.08
2170	1285610.188	462833.9478	SV-2130	318513.291	4311925.443	0.052739807	37mm Trenchart;Hotchkiss****	4.12644205	0.24234	Don't Dig	402	2130	66	Don't Dig	0		37mm_BE365s	0	318513.3	4311925	0.08
2171	1285609.198	462835.6112	SV-2129	318512.8703	4311925.92	0.111037795	37mm Trenchart;Hotchkiss****	4.09951601	0.24393	Don't Dig	400	2129	34	Dig, Low Confidence	0.5371		Livens Projector_SV_TP2	0.9572	318513.1	4311926	-0.81
2172	1285607.236	462839.2679	SV-2128	318512.2675	4311927.093	0.177678139	37mm Trenchart;Hotchkiss****	3.1163942	0.32088	Don't Dig	320	2128	49	Don't Dig	0.5984		37mm_BE365s	0.559	318512.5	4311927	-0.21
2173	1285611.6	462837.8657	SV-2127	318513.7312	4311926.613	0.060221474	37mm Trenchart;Hotchkiss****	4.26354479	0.23455	Don't Dig	418										
2174	1285613.281	462842.1308	SV-2126	318514.1461	4311927.919	0.058102342	37mm Trenchart;Hotchkiss****	4.94914963	0.20205	Don't Dig	460	2126	67	Don't Dig	0		37mm_BE365s	0	318514.4	4311928	0.08
2175	1285609.097	462845.7404	SV-2125	318512.9139	4311929.095	0.115722295	37mm HE**	2.2184342	0.45077	Don't Dig	227	2125	0	Can't Analyze	*				318513.1	4311929	-0.09
2176	1285606.67	462845.4689	SV-2124	318512.0478	4311928.665	0.278461193	37mm HE**	1.89320262	0.52821	Don't Dig	204	2124	62	Don't Dig	0.1037		37mm_2011LSBP840m	0.0719	318512.3	4311929	0
2177	1285607.968	462848.1357	SV-2123	318512.5538	4311929.987	0.171483174	ISO S80	2.30240648	0.43433	Don't Dig	234	2123	0	Can't Analyze	*				318512.8	4311930	-0.02
2178	1285610.471	462854.2596	SV-2122	318513.4655	4311931.679	0.078533319	37mm Trenchart;Hotchkiss****	3.57428442	0.27978	Don't Dig	349	2122	0	Can't Analyze	*				318513.5	4311932	0.1
2179	1285613.226	462854.9813	SV-2121	318514.342	4311931.821	2.35772E-14	37mm M55A1****	1.05612128	0.94686	Don't Dig	63										
2180	1285613.105	462857.1739										2121	0	Can't Analyze	0.545				318514.3	4311932	-0.36
2181	1285604	462858.0006																			
2182	1285601.423	462851.4999	SV-2120	318510.6752	4311930.899	0.293611948	ISO S80	0.69389225	1.44115	Dig	30	2120	21	Dig, Low Confidence	0.8173		Small ISO_BE622s	0.9862	318510.8	4311931	-0.27
2183	1285599.047	462847.3941	SV-2114	318510.1015	4311929.618	0.242618388	ISO S80	1.40004761	0.71426	Don't Dig	138	2113	0	Can't Analyze	*				318510	4311930	-0.03
2183	1285599.047	462847.3941	SV-2113	318510.0378	4311929.597	0.000361804	37mm Trenchart;Hotchkiss****	5.6449819	0	Don't Dig	496	2113	0	Can't Analyze	*				318510	4311930	-0.03
2183	1285599.047	462847.3941	SV-2114	318510.1015	4311929.618	0.242618388	ISO S80	1.40004761	0.71426	Don't Dig	138	2114	58	Don't Dig	0.4188		37mm_BE365s	0.4655	318509.9	4311930	-0.15
2183	1285599.047	462847.3941	SV-2113	318510.0378	4311929.597	0.000361804	37mm Trenchart;Hotchkiss****	5.6449819	0	Don't Dig	496	2114	58	Don't Dig	0.4188		37mm_BE365s	0.4655	318509.9	4311930	-0.15
2184	1285601.859	462845.4421	SV-2112	318510.8144	4311928.99	0.14561658	37mm Trenchart;Hotchkiss****	3.19342643	0.31314	Don't Dig	326										
2185	1285601.701	462843.0103										2112	0	Can't Analyze	*				318510.8	4311928	0
2186	1285598.523	462843.2244	SV-2111	318509.7756	4311928.393	0.350118285	ISO S80	1.27467684	0.78451	Don't Dig	106	2111	37	Don't Dig	0.7649		60mm_29P_TP53s	0.9081	318509.8	4311928	-0.37
2187	1285595.978	462844.8683	SV-2110	318509.2561	4311928.761	0.41726456	30mm TP-T PGU-16/A*	1.83747667	0.54422	Don't Dig	198	2110	57	Don't Dig	0.4714		37mm_BE365s	0.5183	318509	4311929	-0.17
2188	1285595.204	462840.0572	SV-2109	318508.7814	4311927.301	0.08324139	37mm Trenchart;Hotchkiss****	3.57663039	0.27959	Don't Dig	351	2109	0	Can't Analyze	*				318508.7	4311927	-0.01
2189	1285592.533	462842.7517	SV-2108	318508.0016	4311928.27	0.16261814	MkIV booster	0.65263451	1.53225	Dig	26	2108	38	Don't Dig	0.7463		37mm_BE365s	0.6682	318507.9	4311928	-0.09
2189	1285592.533	462842.7517	SV-2106	318507.7983	4311928.519	1.88489E-07	37mm Trenchart;Hotchkiss****	4.61324292	0.21677	Don't Dig	443	2108	38	Don't Dig	0.7463		37mm_BE365s	0.6682	318507.9	4311928	-0.09
2190	1285590.676	462842.3204	SV-2107	318507.39	4311928.185	0.05096839	37mm Trenchart;Hotchkiss****	4.13401612	0.2419	Don't Dig	403	2107	67	Don't Dig	0		37mm_BE365s	0	318507.4	4311928	0.1
2191	1285592.212	462844.7512										2106	64	Don't Dig	0		37mm_BE365s	0	318507.8	4311929	-0.02
2192	1285591.523	462847.3033	SV-2104	318507.8813	4311929.56	0.379806109	30mm TP-T PGU-16/A*	1.64208486	0.60898	Don't Dig	176	2104	24	Dig, Low Confidence	0.7744		37mm_BE365s	0.9375	318507.7	4311930	-0.14
2192	1285591.523	462847.3033	SV-2105	318507.7199	4311929.583	0.351771095	37mm M55A1****	1.41785099	0.70529	Don't Dig	142	2104	24	Dig, Low Confidence	0.7744		37mm_BE365s	0.9375	318507.7	4311930	-0.14
2192	1285591.523	462847.3033	SV-2104	318507.8813	4311929.56	0.379806109	30mm TP-T PGU-16/A*	1.64208486	0.60898	Don't Dig	176	2105	44	Don't Dig	0.6675		60mm_29P_TP53s	0.8279	318507.7	4311930	-0.39
2192	1285591.523	462847.3033	SV-2105	318507.7199	4311929.583	0.351771095	37mm M55A1****	1.41785099	0.70529	Don't Dig	142	2105	44	Don't Dig	0.6675		60mm_29P_TP53s	0.8279	318507.7	4311930	-0.39
2193	1285592.812	462848.479																			
2194	1285592	462850.0006																			

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
2195	1285593.054	462850.9224	SV-2117	318508.1128	4311930.747	0.33064034	MkIV booster	1.7752249	0.56331	Don't Dig	193	2118	0	Can't Analyze	*				318508.3	4311931	-0.21
2195	1285593.054	462850.9224	SV-2117	318508.1128	4311930.747	0.33064034	MkIV booster	1.7752249	0.56331	Don't Dig	193	2117	35	Don't Dig	0.8168		37mm_BE754s	0.8465	318508.1	4311931	-0.31
2196	1285594.737	462851.5139	SV-2118	318508.6846	4311930.888	0.151056567	37mm Trenchart;Hotchkiss****	3.01893138	0.33124	Don't Dig	312										
2197	1285595.196	462849.6126	SV-2116	318508.9166	4311930.398	0.354825894	37mm M55A1****	1.44564389	0.69173	Don't Dig	150	2116	60	Don't Dig	0.2678		37mm_BE365s	0.0701	318508.7	4311930	-0.08
2198	1285596.623	462849.6537	SV-2115	318509.3236	4311930.347	0.357885707	37mm HE**	1.57048488	0.63675	Don't Dig	168	2115	48	Don't Dig	0.6007		37mm_BE365s	0.6526	318509.2	4311930	-0.16
2199	1285597.74	462852.1229	SV-2119	318509.6177	4311931.087	0.188727937	MkIV booster	1.30000014	0.76923	Don't Dig	115	2119	55	Don't Dig	0.5037		37mm_BE365s	0.745	318509.6	4311931	-0.19
2200	1285593.328	462856.3363	SV-2097	318508.1917	4311932.423	0.132200445	37mm Trenchart;Hotchkiss****	2.95359796	0.33857	Don't Dig	299	2097	51	Don't Dig	0.5941		37mm_BE365s	0.6182	318508.4	4311932	-0.13
2201	1285591.308	462854.684										2098	0	Can't Analyze	*				318507.6	4311932	-0.11
2201	1285591.308	462854.684										2099	56	Don't Dig	0.4912		37mm_BE365s	0.5597	318507.7	4311932	-0.11
2202	1285591.065	462856.2505	SV-2098	318507.5973	4311932.356	0.174913041	ISO S80	2.0949756	0.47733	Don't Dig	220										
2202	1285591.065	462856.2505	SV-2099	318507.8186	4311932.187	0.000192989	37mm Trenchart;Hotchkiss****	3.72694607	0.26832	Don't Dig	363										
2203	1285587.728	462859.0398	SV-2096	318506.6772	4311933.315	0.120778522	37mm Trenchart;Hotchkiss****	4.29599359	0.23278	Don't Dig	421	2095	0	Can't Analyze	*				318506.5	4311933	0
2203	1285587.728	462859.0398	SV-2096	318506.6772	4311933.315	0.120778522	37mm Trenchart;Hotchkiss****	4.29599359	0.23278	Don't Dig	421	2096	0	Can't Analyze	*				318506.6	4311933	-0.14
2204	1285586.426	462859.8206	SV-2095	318506.2073	4311933.475	0.154982742	37mm HE**	3.79789494	0.2633	Don't Dig	368										
2205	1285584.955	462855.3288	SV-2090	318505.728	4311932.112	0.064179561	37mm HE**	3.57503113	0.27972	Don't Dig	350	2090	61	Don't Dig	0.2565		37mm_BE365s	0.0839	318505.7	4311932	-0.13
2206	1285580.953	462857.8038	SV-2091	318504.5619	4311932.954	0.292219925	ISO S80	1.9098172	0.52361	Don't Dig	206	2091	52	Don't Dig	0.583		37mm_BE365s	0.5752	318504.5	4311933	-0.18
2207	1285578.999	462852.8174	SV-2080	318504.0722	4311931.665	0.436142874	30mm TP-T PGU-16/A*	1.33032326	0.7517	Don't Dig	119	2080	4	Dig, Low Confidence	0.8982		81mm_BE2m	0.9162	318503.9	4311931	-0.48
2208	1285583.742	462852.1405										2089	23	Dig, Low Confidence	0.7996		60mm body_BP110427_TP51s	0.9282	318505.3	4311931	-0.24
2209	1285585	462851.0006	SV-2089	318505.6632	4311930.731	0.295329831	37mm German ERST**	1.23240866	0.81142	Don't Dig	91										
2210	1285584.687	462849.7642	SV-2088	318505.6001	4311930.484	0.409971867	90mm M71A1*	1.20720217	0.82836	Dig	49	2088	9	Dig, Low Confidence	0.8592		105mm heat_BP110413_TP24m	0.9807	318505.6	4311930	-0.44
2211	1285587.4	462850.5391	SV-2101	318506.4981	4311930.773	0.435638089	2.75in MK1**	1.34118433	0.74561	Don't Dig	126										
2212	1285588.233	462851.4182	SV-2102	318506.5217	4311930.875	0.220131997	37mm HE**	1.24029113	0.80626	Don't Dig	94	2101	14	Dig, Low Confidence	0.8292		60mm_29P_TP53s	0.811	318506.6	4311931	-0.25
2212	1285588.233	462851.4182	SV-2102	318506.5217	4311930.875	0.220131997	37mm HE**	1.24029113	0.80626	Don't Dig	94	2102	18	Dig, Low Confidence	0.8231		37mm_BE74s	0.9494	318506.7	4311931	-0.2
2213	1285588.919	462852.3378	SV-2100	318506.8989	4311931.175	0.195311865	MkIV booster	1.47590866	0.67755	Don't Dig	156	2100	36	Don't Dig	0.8083		Small ISO_BE622s	0.8573	318506.9	4311931	-0.13
2214	1285588.562	462848.0444	SV-2103	318506.7788	4311929.914	0.297691496	37mm M55A1****	1.24948459	0.80033	Don't Dig	99	2103	16	Dig, Low Confidence	0.8271		60mm_BP110826_TP16s	0.8303	318506.8	4311930	-0.4
2215	1285586.396	462845.6457	SV-2085	318506.0851	4311929.023	0.299330387	37mm M55A1****	1.24858538	0.80091	Don't Dig	98	2085	20	Dig, Low Confidence	0.8181		Small ISO_BE305s	0.9867	318506.2	4311929	-0.2
2215	1285586.396	462845.6457	SV-2086	318506.0987	4311929.239	0.183520891	ISO Small 40****	0.93809367	1.06599	Dig	44	2085	20	Dig, Low Confidence	0.8181		Small ISO_BE305s	0.9867	318506.2	4311929	-0.2
2215	1285586.396	462845.6457	SV-2085	318506.0851	4311929.023	0.299330387	37mm M55A1****	1.24858538	0.80091	Don't Dig	98	2086	1	Dig, High Confidence	0.9288		Small ISO_BE305s	0.9896	318506	4311929	-0.18
2215	1285586.396	462845.6457	SV-2086	318506.0987	4311929.239	0.183520891	ISO Small 40****	0.93809367	1.06599	Dig	44	2086	1	Dig, High Confidence	0.9288		Small ISO_BE305s	0.9896	318506	4311929	-0.18
2216	1285586.644	462844.3205										2084	0	Can't Analyze	*				318506.2	4311929	0.05
2217	1285585.033	462843.5633	SV-2084	318505.6742	4311928.53	0.427711188	57mm M1&6 PR***	1.38263408	0.72326	Don't Dig	135										
2218	1285584.308	462847.1652	SV-2087	318505.4546	4311929.625	0.217815833	37mm Trenchart;Hotchkiss****	1.93553925	0.51665	Don't Dig	210	2087	17	Dig, Low Confidence	0.8259		105mm proj_BP110826_TP53s	0.9361	318505.5	4311930	-0.57
2219	1285581.279	462848.1362	SV-2082	318504.508	4311930.089	0.126703291	37mm Trenchart;Hotchkiss****	3.01064226	0.33216	Don't Dig	308	2082	43	Don't Dig	0.6932		3in proj_BP110826_TP81s	0.827	318504.6	4311930	-0.57
2219	1285581.279	462848.1362	SV-2081	318504.5161	4311930.083	0.125471359	37mm Trenchart;Hotchkiss****	3.45470216	0.28946	Don't Dig	343	2082	43	Don't Dig	0.6932		3in proj_BP110826_TP81s	0.827	318504.6	4311930	-0.57
2219	1285581.279	462848.1362	SV-2082	318504.508	4311930.089	0.126703291	37mm Trenchart;Hotchkiss****	3.01064226	0.33216	Don't Dig	308	2081	67	Don't Dig	0		37mm_BE365s	0.0007	318504.5	4311930	-0.07
2219	1285581.279	462848.1362	SV-2081	318504.5161	4311930.083	0.125471359	37mm Trenchart;Hotchkiss****	3.45470216	0.28946	Don't Dig	343	2081	67	Don't Dig	0		37mm_BE365s	0.0007	318504.5	4311930	-0.07
2220	1285579.579	462845.8456	SV-2083	318504.0272	4311929.262	0.1372161	60mm TAM 1.8 British**	1.12534725	0.88861	Don't Dig	72										
2221	1285581.451	462844.6988										2083	0	Can't Analyze	*				318504.6	4311929	0.11
2222	1285562.469	462826.5509	SV-2075	318498.6183	4311923.493	0.106035043	ISO S80	2.32124741	0.4308	Don't Dig	237	2075	42	Don't Dig	0.7008		37mm_BE365s	0.6444	318498.8	4311924	-0.08
2223	1285565.992	462837.2781	SV-2076	318499.8294	4311926.742	0.262299215	60mm M49A4***	1.36737656	0.73133	Don't Dig	131										
2224	1285568.5	462849.0006																			
2225	1285573.852	462850.2466	SV-2077	318502.2615	4311930.55	0.134433011	37mm Trenchart;Hotchkiss****	2.2356146	0.4473	Don't Dig	229	2077	46	Don't Dig	0.6305		37mm_BE365s	0.769	318502.3	4311931	-0.07
2226	1285573.148	462853.3502	SV-2078	318502.1653	4311931.508	0.159736592	37mm HE**	1.24624054	0.80241	Don't Dig	97	2078	12	Dig, Low Confidence	0.8465		105mm proj_BP110826_TP50m	0.9819	318502.2	4311932	-0.31
2226	1285573.148	462853.3502	SV-2079	318502.1094	4311931.722	0.335044742	105mm M1***	0.63189148	110.58255	Training	3	2078	12	Dig, Low Confidence	0.8465		105mm proj_BP110826_TP50m	0.9819	318502.2	4311932	-0.31
2226	1285573.148	462853.3502	SV-2078	318502.1653	4311931.508	0.159736592	37mm HE**	1.24624054	0.80241	Don't Dig	97	2079	19	Dig, Low Confidence	0.8206	same as 78	3in proj_BP110826_TP81m	0.9322	318502.1	4311932	-0.19
2226	1285573.148	462853.3502	SV-2079	318502.1094	4311931.722	0.335044742	105mm M1***	0.63189148	110.58255	Training	3	2079	19	Dig, Low Confidence	0.8206	same as 78	3in proj_BP110826_TP81m	0.9322	318502.1	4311932	-0.19
2227	1285573	462855.0006																			
2228	1285573	462862.0006																			
2229	1285581.558	462864.0206	SV-2092	318504.6856	4311934.838	0.185093581	37mm HE**	1.78531404	0.56013	Don't Dig	194	2093	31	Dig, Low Confidence	0.7108		60mm_BP110826_TP18s	0.9563	318504.8	4311935	-0.42
2229	1285581.558	462864.0206	SV-2094	318504.6723	4311934.792	0.145463609	37mm HE**	2.13579192	0.46821	Don't Dig	222	2093	31	Dig, Low Confidence	0.7108		60mm_BP110826_TP18s	0.9563	318504.8	4311935	-0.42
2229	1285581.558	462864.0206	SV-2092	318504.6856	4311934.838	0.185093581	37mm HE**	1.78531404	0.56013	Don't Dig	194	2094	0	Can't Analyze	*				318504.9	4311935	-0.12
2229	1285581.558	462864.0206	SV-2094	318504.6723	4311934.792	0.145463609	37mm HE**	2.13579192	0.46821	Don't Dig	222	2094	0	Can't Analyze	*				318504.9	4311935	-0.12
2230	1285581.045	462865.6485	SV-2093	318504.535	4311935.316	0.051614093	37mm Trenchart;Hotchkiss****	4.47223448	0.2236	Don't Dig	433	2092	0	Can't Analyze	0.6714				318504.6	4311935	-0.58

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
1001	1285519.974	463024.8132										1000	63	Don't Dig	0.565		small ISO80_FR_IVS2	0.9135	318487.1	4311984	-0.35
1002	1285521.044	463023.0942	SV-1000	318487.3747	4311983.669	0.112816662	MkIV booster	2.6903934	0.37169	Don't Dig	272										
1003	1285522.261	463021.0257	SV-1001	318487.7334	4311983.091	0.131051928	MkIV booster	2.71952758	0.36771	Don't Dig	275	1001	55	Don't Dig	0.6436		37mm_BE365s	0.6012	318487.7	4311983	-0.18
1004	1285523.999	463018.6766																			
1005	1285524.382	463019.8237	SV-1002	318488.6048	4311982.611	0.2514905	37mm HE**	1.85640025	0.53868	Don't Dig	199	1002	33	Don't Dig	0.7909		37mm_BP110413_TP18s	0.8917	318488.4	4311983	-0.33
1006	1285526.95	463022.9252	SV-1003	318489.1569	4311983.486	0.218185652	MkIV booster	1.62425509	0.61567	Don't Dig	172	1003	43	Don't Dig	0.7281		MK IV Booster_SV_TP10	0.9167	318489.2	4311984	-0.29
1007	1285526.398	463019.6743	SV-1004	318488.9833	4311982.591	0.467460807	37mm German ERST**	1.87793153	0.5325	Don't Dig	200										
1008	1285526.343	463018.6854										1004	13	Dig, Low Confidence	0.834		60mm_BP110826_TP23m	0.9213	318489	4311982	-0.38
1009	1285526.612	463014.5928	SV-1005	318489.0429	4311981.012	0.18155815	37mm HE**	1.3410033	0.74571	Don't Dig	125	1005	22	Dig, Low Confidence	0.7143		37mm_SWPG_TP4s	0.9861	318489.1	4311981	-0.2
1010	1285529.044	463011.834	SV-1006	318489.7372	4311980.184	2.35367E-14	37mm Trenchart;Hotchkiss****	3.18642781	0.31383	Don't Dig	325										
1011	1285531.036	463012.5263	SV-1007	318490.1773	4311980.385	0.094605688	37mm Trenchart;Hotchkiss****	3.61087855	0.27694	Don't Dig	355	1007	57	Don't Dig	0.6258		Small ISO_BE622s	0.678	318490.5	4311980	-0.17
1011	1285531.036	463012.5263	SV-1007	318490.1773	4311980.385	0.094605688	37mm Trenchart;Hotchkiss****	3.61087855	0.27694	Don't Dig	355	1006	48	Don't Dig	0.7012		Small ISO_BE622s	0.7373	318490.4	4311980	-0.22
1012	1285536.233	463010.4856	SV-1008	318491.8484	4311979.8	0.037383396	37mm Trenchart;Hotchkiss****	2.83351188	0.35292	Don't Dig	287	1008	15	Dig, Low Confidence	0.8313		60mm_29P_TP53s	0.8225	318492	4311980	-0.32
1013	1285540.321	463003.2807	SV-1009	318493.1165	4311977.502	1.81842E-09	MkIV booster	2.9899409	0.33445	Don't Dig	302										
1014	1285541.238	463005.3288										1009	27	Dig, Low Confidence	0.613		Small ISO_BE305s	0.9388	318493.4	4311978	-0.21
1015	1285542.114	463008.6163	SV-1010	318493.6279	4311979.052	0.172146363	37mm Trenchart;Hotchkiss****	2.79895358	0.35728	Don't Dig	285	1010	66	Don't Dig	0.5071		37mm_BE365s	0.5008	318493.8	4311979	-0.16
1016	1285543.902	463008.6391	SV-1011	318494.108	4311979.142	0.094722554	37mm Trenchart;Hotchkiss****	3.78146997	0.26445	Don't Dig	367	1011	14	Dig, Low Confidence	0.8326		57mm_SWPG_TP2s	0.9008	318494.4	4311979	-0.38
1017	1285545.138	463012.4629	SV-1012	318494.5525	4311980.256	0.479179467	37mm M55A1****	1.65208294	0.6053	Don't Dig	179	1012	0	Can't Analyze	*				318494.7	4311980	0.15
1018	1285554.48	463015.0043										1013	0	Can't Analyze	*				318497.5	4311981	0.01
1019	1285554.775	463015.9526	SV-1013	318497.6063	4311981.267	0.002269588	ISO S80	2.49222899	0.40125	Don't Dig	252										
1020	1285556.033	463010.8201	SV-1014	318497.9704	4311979.699	0.121117836	37mm Trenchart;Hotchkiss****	2.68656033	0.37222	Don't Dig	271	1014	0	Can't Analyze	*				318497.9	4311980	-0.13
1021	1285559.246	463008.6445										1015	80	Don't Dig	0		37mm_BE365s	0	318498.9	4311979	0.1
1022	1285560.287	463008.8839	SV-1015	318499.2386	4311979.076	0.035786476	37mm Trenchart;Hotchkiss****	2.57790919	0.38791	Don't Dig	257										
1023	1285561.633	463007.5484										1016	46	Don't Dig	0.7089		37mm_BE365s	0.6343	318499.6	4311979	-0.19
1024	1285562.279	463008.3796	SV-1016	318499.8425	4311978.909	0.322883699	37mm HE**	1.05849124	0.94474	Don't Dig	64										
1025	1285565.689	463007.9573	SV-1017	318500.9163	4311978.746	0.237894021	60mm M49A4***	0.45565444	2.19465	Dig	18	1017	2	Dig, High Confidence	0.9576		Small ISO_BE305s	0.9883	318500.8	4311979	-0.15
1026	1285565.869	463006.6487	SV-1018	318500.9096	4311978.245	0.185451313	MkIV booster	1.90322021	0.52543	Don't Dig	205	1018	52	Don't Dig	0.6892		81mm_BE2m	0.6795	318500.9	4311978	-0.45
1027	1285563.108	463002.7472	SV-1019	318500.065	4311977.064	0.056797547	37mm Trenchart;Hotchkiss****	3.45068337	0.2898	Don't Dig	342	1019	16	Dig, Low Confidence	0.8098		Small ISO_BE460s	0.9562	318500.1	4311977	-0.3
1028	1285561.865	463002.8823	SV-1020	318499.709	4311977.153	0.084880595	37mm Trenchart;Hotchkiss****	3.13767324	0.31871	Don't Dig	322	1020	50	Don't Dig	0.6915		37mm_BE365s	0.6757	318499.7	4311977	-0.11
1029	1285559.661	463003.5039	SV-1021	318499.0164	4311977.372	0.082647638	37mm Trenchart;Hotchkiss****	3.60440897	0.27744	Don't Dig	354	1021	39	Don't Dig	0.7428		Small ISO_BE622s	0.8577	318499	4311978	-0.22
1029	1285559.661	463003.5039	SV-1021	318499.0164	4311977.372	0.082647638	37mm Trenchart;Hotchkiss****	3.60440897	0.27744	Don't Dig	354	1022	80	Don't Dig	0		37mm_BE365s	0	318499	4311977	0.05
1030	1285557.7	463003.7868	SV-1022	318498.4163	4311977.54	0.121316314	37mm Trenchart;Hotchkiss****	3.26440842	0.30633	Don't Dig	332										
1031	1285554.217	463006.0402										1023	4	Dig, Low Confidence	0.9013		105mm heat_BP110826_TP57m	0.9667	318497.4	4311978	-0.16
1032	1285554.885	463004.4535	SV-1023	318497.5628	4311977.762	0.146953318	MkIV booster	1.83131036	0.54606	Don't Dig	197										
1033	1285555.178	462999.6297										1024	0	Can't Analyze	*				318497.6	4311976	0.03
1034	1285553.655	462999.0023	SV-1024	318497.1515	4311976.109	2.33147E-14	MkIV booster	3.22730001	0.30986	Don't Dig	328										
1035	1285562.475	462994.2475	SV-1025	318499.8077	4311974.601	0.044514595	37mm Trenchart;Hotchkiss****	3.13267456	0.31922	Don't Dig	321										
1036	1285562.062	462992.496										1025	35	Don't Dig	0.7742		60mm_29P_TP53s	0.8826	318499.7	4311974	-0.13
1037	1285564.839	462991.5725										1026	30	Don't Dig	0.8099		37mm_BE754s	0.8674	318500.5	4311974	-0.13
1038	1285565.77	462992.2394	SV-1026	318500.7984	4311973.967	0.02587045	37mm Trenchart;Hotchkiss****	3.24519156	0.30815	Don't Dig	329										
1039	1285567.709	463000.0983	SV-1027	318501.4419	4311976.349	0.119003595	MkIV booster	1.77257993	0.56415	Don't Dig	192										
1040	1285569.031	463000.9182										1027	20	Dig, Low Confidence	0.7221		37mm projectile_SR1781s	0.9784	318501.9	4311977	-0.22
1041	1285580	462998.5006																			
1042	1285582.313	463004.3172	SV-1028	318506.2785	4311977.682	1.28296E-10	37mm Trenchart;Hotchkiss****	5.0863466	0.1966	Don't Dig	464										
1043	1285583.578	463003.436										1028	51	Don't Dig	0.6914		37mm_BE754s	0.7619	318506.3	4311977	-0.36
1044	1285585.55	462997.8385	SV-1029	318506.9276	4311975.498	0.147575244	37mm Trenchart;Hotchkiss****	0.95387306	1.04836	Dig	47	1029	8	Dig, Low Confidence	0.8535		60mm_BP110826_TP33m	0.9903	318506.8	4311976	-0.16
1045	1285597.567	463004.9416																			
1046	1285593.975	462996.74																			
1047	1285593.5	462995.0006																			
1048	1285590.241	462989.759																			
1049	1285588.32	462977.3069																			
1050	1285585.31	462974.7586																			
1051	1285583.449	462971.2456																			
1052	1285581.754	462971.9106	SV-1049	318505.3869	4311968.074	0.243147233	37mm HE**	1.82801443	0.54704	Don't Dig	196										
1053	1285580.506	462971.473										1049	45	Don't Dig	0.7145		small ISO80_FR_IVS2	0.9138	318505.2	4311968	-0.34
1054	1285577.605	462972.0656										1048	81	Don't Dig	0	weak/no response			318504.3	4311968	0.12
1055	1285576.224	462970.6899										1047	81	Don't Dig	0	weak/no response			318503.8	4311967	0.12
1056	1285575.229	462971.1373	SV-1047	318503.5396	4311967.473	0.053183472	37mm Trenchart;Hotchkiss****	3.83038733	0.26107	Don't Dig	372										
1057	1285575.616	462972.9145	SV-1048	318503.6697	4311968.012	0.229592522	MkIV booster	1.46200895	0.68399	Don't Dig	152										
1058	1285571.966	462983.1496	SV-1030	318502.6414	4311971.141	0.115999193	MkIV booster	2.65386572	0.37681	Don't Dig	267	1030	59	Don't Dig	0.6093		Small ISO_BE622s	0.5451	318502.6	4311971	-0.18
1059	1285570.701	462980.1177										1031	72	Don't Dig	0.3537		37mm_BE365s	0.3434	318502.2	4311970	-0.05
1060	1285569.534	462980.3218	SV-1031	318501.8658	4311970.31	0.095366981	37mm Trenchart;Hotchkiss****	2.64477398	0.3781	Don't Dig	265										
1061	1285568.328	462980.5496	SV-1032	318501.5218	4311970.44	0.069788438	37mm Trenchart;Hotchkiss****	2.73967147	0.36501	Don't Dig	276										

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
1061	1285568.328	462980.5496	SV-1033	318501.4773	4311970.335	0.554273296	57mm M1&6 PR***	2.26892921	0.44074	Don't Dig	231										
1062	1285568.134	462978.9948										1033	60	Don't Dig	0.6079		37mm_BE365s	0.6005	318501.4	4311970	-0.14
1062	1285568.134	462978.9948										1032	54	Don't Dig	0.6564		37mm_BE365s	0.5474	318501.4	4311970	-0.02
1063	1285566.603	462978.7069	SV-1034	318500.9834	4311969.935	0.056498677	37mm Trenchart;Hotchkiss****	2.89581599	0.34533	Don't Dig	292	1034	12	Dig, Low Confidence	0.8407		60mm_29P_TP53s	0.8833	318500.9	4311970	-0.24
1064	1285563.793	462980.3155	SV-1035	318500.1822	4311970.423	0.071269271	37mm Trenchart;Hotchkiss****	2.92402244	0.34199	Don't Dig	295	1035	34	Don't Dig	0.7838		MK IV Booster_SV_TP10	0.7224	318500.1	4311970	-0.21
1065	1285561.463	462980.6516	SV-1036	318499.4064	4311970.509	0.107511542	MkIV booster	3.16062259	0.31639	Don't Dig	323	1036	29	Don't Dig	0.8196		MK IV Booster_SV_TP10	0.8721	318499.4	4311970	-0.29
1066	1285558.285	462981.7763	SV-1037	318498.5445	4311970.787	0.01743227	37mm Trenchart;Hotchkiss****	3.00556319	0.33272	Don't Dig	307	1037	49	Don't Dig	0.6961		37mm_BP110826_TP10s	0.6345	318498.4	4311971	-0.17
1067	1285552.954	462981.3689										1038	44	Don't Dig	0.7146		37mm_BE365s	0.6148	318496.8	4311971	-0.04
1068	1285552.685	462982.6919	SV-1038	318496.747	4311971.145	0.03847312	MkIV booster	3.04041781	0.3289	Don't Dig	315										
1069	1285548.2	462985.0021	SV-1039	318495.3957	4311971.879	0.115950237	37mm Trenchart;Hotchkiss****	2.85103033	0.35075	Don't Dig	288										
1070	1285546.683	462985.0426	SV-1040	318495.057	4311971.963	0.128020714	37mm HE**	1.46529566	0.68246	Don't Dig	153	1040	18	Dig, Low Confidence	0.7853		5in proj_BP110826_TP77m	0.97	318494.8	4311972	-0.49
1071	1285545.357	462983.6304										1039	0	Can't Analyze	0.7432				318494.5	4311971	-0.46
1072	1285529.369	462987.0826	SV-1136	318489.6709	4311972.639	0.231482071	MkIV booster	1.06560496	0.93843	Don't Dig	65										
1073	1285532.092	462990.2631	SV-1137	318490.5218	4311973.59	0.26729654	MkIV booster	1.40511335	0.71169	Don't Dig	139										
1074	1285530.989	462990.8951										1137	73	Don't Dig	0.2978		37mm_BE365s	0.4027	318490.2	4311974	-0.19
1075	1285527.432	462997.4866	SV-1140	318489.24	4311975.905	0.190235044	37mm Trenchart;Hotchkiss****	2.79480735	0.35781	Don't Dig	283	1140	81	Don't Dig	0	weak/no response			318489.1	4311976	-0.48
1076	1285523.506	462997.4415	SV-1139	318487.9671	4311975.84	0.075141016	37mm Trenchart;Hotchkiss****	3.77837724	0.26466	Don't Dig	366	1139	0	Can't Analyze	*				318487.9	4311976	-0.02
1077	1285526.588	463002.2163	SV-1141	318488.9489	4311977.249	0.044914045	37mm Trenchart;Hotchkiss****	3.37693432	0.29613	Don't Dig	336	1141	56	Don't Dig	0.6368		37mm_BE365s	0.5327	318488.9	4311977	-0.09
1078	1285527.3	463005.9449	SV-1143	318489.2266	4311978.364	0.002918047	37mm Trenchart;Hotchkiss****	3.16261449	0.31619	Don't Dig	324	1143	71	Don't Dig	0.3716		37mm_BE365s	0.493	318489.1	4311978	0.07
1079	1285523.941	463005.123	SV-1144	318488.1373	4311978.173	0.192263943	37mm HE**	1.64542497	0.60775	Don't Dig	177										
1080	1285523.862	463006.1287										1144	80	Don't Dig	0		37mm_BE365s	0	318488.1	4311978	0.05
1081	1285518.368	463011.2584										1146	0	Can't Analyze	*				318486.5	4311980	0.14
1082	1285517.752	463009.9914	SV-1146	318486.284	4311979.698	0.164341555	37mm HE**	1.29737473	0.77079	Don't Dig	113										
1083	1285517.593	463003.0082	SV-1145	318486.1888	4311977.571	0.044562566	37mm Trenchart;Hotchkiss****	1.27675272	0.78324	Don't Dig	107										
1084	1285514.794	462990.3789	SV-1129	318485.2512	4311973.741	0.15911617	37mm Trenchart;Hotchkiss****	1.48018485	0.67559	Don't Dig	158										
1085	1285511.229	462990.7075	SV-1128	318484.167	4311973.865	0.200165032	37mm Trenchart;Hotchkiss****	1.64885716	0.60648	Don't Dig	178										
1086	1285508.28	462989.2285	SV-1127	318483.2584	4311973.434	0.193794446	ISO S80	0.67798999	1.47495	Dig	28										
1087	1285510.961	462985.366	SV-1126	318484.0495	4311972.239	0.215659495	37mm Trenchart;Hotchkiss****	2.78208218	0.35944	Don't Dig	280										
1088	1285512.453	462979.6841	SV-1124	318484.4728	4311970.485	0.268458632	MkIV booster	2.38855023	0.41866	Don't Dig	239	1124	36	Don't Dig	0.7658		MK IV Booster_SV_TP10	0.8046	318484.5	4311971	-0.28
1089	1285506.475	462978.685	SV-1125	318482.9217	4311970.747	0.21077037	37mm HE**	0.94295458	1.0605	Dig	45										
1090	1285499.5	462968.5006																			
1091	1285501.204	462967.1006	SV-1120	318481.0527	4311966.746	0.133809323	37mm Trenchart;Hotchkiss****	3.61454856	0.27666	Don't Dig	356	1120	31	Don't Dig	0.8001		37mm_BE365s	0.8609	318481	4311967	-0.13
1092	1285499	462964.0006																			
1093	1285501.406	462964.749										1119	80	Don't Dig	0		37mm_BE365s	0	318481	4311966	0.05
1094	1285502.593	462963.6659	SV-1119	318481.3544	4311965.682	3.67971E-12	MkIV booster	1.63934281	0.61	Don't Dig	174										
1095	1285507.418	462973.0222	SV-1121	318482.8873	4311968.501	0.170105119	MkIV booster	1.73042891	0.57789	Don't Dig	189										
1096	1285509.506	462972.0689	SV-1122	318483.6292	4311968.225	0.197269832	2.36-in M6**	0.70489792	1.41865	Dig	32	1121	6	Dig, Low Confidence	0.8856		Small ISO_BE622s	0.9487	318483.4	4311968	-0.1
1097	1285511.655	462974.3917	SV-1123	318484.1876	4311968.89	0.296762677	MkIV booster	1.26820958	0.78851	Don't Dig	102										
1098	1285516.496	462976.2831	SV-1131	318485.6757	4311969.434	0.235241775	37mm Trenchart;Hotchkiss****	2.59171107	0	Don't Dig	492										
1099	1285519.491	462973.891	SV-1132	318486.5723	4311968.685	0.105586721	37mm Trenchart;Hotchkiss****	3.56506812	0.2805	Don't Dig	348										
1100	1285524.556	462974.3631	SV-1133	318488.119	4311968.795	0.13198017	37mm Trenchart;Hotchkiss****	4.04203568	0.2474	Don't Dig	389										
1101	1285529.782	462977.1194										1135	0	Can't Analyze	*				318489.7	4311970	0.15
1102	1285531.321	462977.0974	SV-1135	318490.1989	4311969.583	2.86063E-07	37mm Trenchart;Hotchkiss****	3.09787377	0.3228	Don't Dig	317										
1103	1285540.477	462971.1621	SV-1042	318492.9495	4311967.713	0.237936468	37mm HE**	1.14826284	0.87088	Don't Dig	75										
1104	1285545.676	462973.8817	SV-1041	318494.5521	4311968.507	0.080672615	37mm Trenchart;Hotchkiss****	4.49107789	0.22266	Don't Dig	436										
1105	1285547.8	462970.9422	SV-1043	318495.1796	4311967.597	0.110528677	37mm Trenchart;Hotchkiss****	2.55841918	0.39087	Don't Dig	256										
1106	1285552.305	462966.3092	SV-1044	318496.5379	4311966.154	0.265897031	60mm TAM 1.8 British**	1.14171936	109.87587	Training	9										
1107	1285560.009	462963.3183	SV-1045	318497.8492	4311965.192	1	16-in Mk13 Mod2*	1.56339282	0	Don't Dig	489										
1108	1285565.436	462968.202	SV-1046	318500.5359	4311966.644	0.100308645	37mm Trenchart;Hotchkiss****	4.07640236	0.24531	Don't Dig	393										
1109	1285573.265	462960.0554	SV-1054	318502.8339	4311964.068	0.207588993	ISO S80	2.79698968	0.35753	Don't Dig	284	1054	65	Don't Dig	0.5345		37mm projectile_SR1781s	0.5461	318502.9	4311964	-0.31
1110	1285574.474	462964.9221	SV-1053	318503.4968	4311965.845	0.069893694	37mm Trenchart;Hotchkiss****	4.91291864	0.20354	Don't Dig	458										
1111	1285576.247	462965.1448										1053	81	Don't Dig	0	weak/no response			318503.8	4311966	-0.1
1112	1285578.798	462968.008	SV-1052	318504.6431	4311966.631	0.205315384	37mm Trenchart;Hotchkiss****	3.25778408	0.30696	Don't Dig	331	1052	41	Don't Dig	0.7312		37mm_BE365s	0.8393	318504.6	4311966	-0.26
1113	1285578.881	462968.9522	SV-1051	318504.4006	4311967.168	0.1391291	37mm HE**	3.44794867	0.29003	Don't Dig	341	1051	67	Don't Dig	0.4687		37mm_BE365s	0.4598	318504.6	4311967	-0.27
1113	1285578.881	462968.9522	SV-1051	318504.4006	4311967.168	0.1391291	37mm HE**	3.44794867	0.29003	Don't Dig	341	1050	64	Don't Dig	0.5611		37mm_BE365s	0.4294	318504.6	4311967	-0.16
1114	1285580.051	462969.33	SV-1050	318504.997	4311966.89	0.298182076	37mm HE**	1.69750597	0.5891	Don't Dig	185										
1115	1285581.345	462969.0152																			
1116	1285586.259	462968.6613																			
1117	1285584.825	462965.6283																			
1118	1285582.624	462964.8476																			
1119	1285583.296	462959.0146																			
1120	1285579.384	462956.9926																			
1121	1285575.765	462949.7294																			
1122	1285577.784	462949.1366																			

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
1123	1285580.052	462949.0154																			
1124	1285577.731	462942.6801																			
1125	1285574.669	462931.8206																			
1126	1285566	462948.0006																			
1127	1285560.5	462939.0006																			
1128	1285562.262	462928.9437	SV-1055	318499.3915	4311954.793	0.312456072	37mm M55A1****	1.48655281	0.6727	Don't Dig	160	1055	26	Dig, Low Confidence	0.6149		5in proj_BP110826_TP77m	0.9457	318499.2	4311955	-0.82
1129	1285558.5	462928.5006																			
1130	1285558.106	462923.8139	SV-1056	318498.0601	4311953.142	0.230837562	2.36-in M6**	0.83281448	1.20075	Dig	38	1056	40	Don't Dig	0.7355		81mm_BE2m	0.8196	318498	4311953	-0.37
1131	1285555.827	462919.3585	SV-1057	318497.3413	4311951.707	0.342622369	2.75in M151 RWHE*	0.98652288	1.01366	Don't Dig	53	1057	17	Dig, Low Confidence	0.7922		MK IV Booster_SV_TP10	0.9935	318497.2	4311952	-0.15
1132	1285544.86	462913.1078	SV-1059	318493.8969	4311949.992	0.20726253	37mm HE**	1.46980816	0.68036	Don't Dig	154										
1133	1285545.195	462911.796										1059	11	Dig, Low Confidence	0.8459		60mm_29P_TP53s	0.9414	318494	4311950	-0.3
1134	1285546.796	462909.7704	SV-1060	318494.5388	4311949.084	0.237918039	37mm HE**	1.50955805	0.66245	Don't Dig	162	1060	68	Don't Dig	0.4129		37mm_BE365s	0.6299	318494.4	4311949	-0.14
1135	1285552.022	462905.744										1061	81	Don't Dig	0	weak/no response			318496	4311948	-0.65
1136	1285551.08	462906.0678	SV-1061	318495.7452	4311947.805	0.167042263	37mm Trenchart;Hotchkiss****	4.05195739	0.24679	Don't Dig	391										
1137	1285548.347	462893.9404	SV-1066	318494.8127	4311944.015	0.153103349	37mm Trenchart;Hotchkiss****	3.86976262	0.25841	Don't Dig	375	1066	0	Can't Analyze	*				318494.9	4311944	-0.82
1138	1285549.919	462896.1784	SV-1065	318495.3509	4311944.758	0.086308486	ISO S80	1.49271866	0.66992	Don't Dig	161	1065	25	Dig, Low Confidence	0.6465		37mm_2011LSBP840m	0.9414	318495.3	4311945	-0.08
1138	1285549.919	462896.1784	SV-1064	318495.3457	4311944.796	0.048405774	37mm HE**	1.17940889	0.84788	Don't Dig	78	1065	25	Dig, Low Confidence	0.6465		37mm_2011LSBP840m	0.9414	318495.3	4311945	-0.08
1139	1285549.093	462897.1479										1064	19	Dig, Low Confidence	0.7634		37mm_BE754s	0.9696	318495.1	4311945	-0.2
1140	1285548.241	462898.6814	SV-1063	318494.7699	4311945.708	0.295616457	3.5-in M30A1**	1.66240447	0.60154	Don't Dig	181										
1141	1285546.887	462898.9699										1063	32	Don't Dig	0.7933		Small ISO_BE622s	0.7411	318494.4	4311946	-0.04
1142	1285541.712	462903.3733	SV-1062	318492.8349	4311947.053	0.071428096	37mm Trenchart;Hotchkiss****	4.59125987	0.21781	Don't Dig	440	1062	80	Don't Dig	0		37mm_BE365s	0	318492.9	4311947	0
1143	1285535.643	462905.1941	SV-1105	318490.8247	4311947.768	0.002481531	37mm HE**	4.09386198	0.24427	Don't Dig	396	1105	0	Can't Analyze	*				318491	4311948	0.02
1144	1285536.762	462909.4288	SV-1107	318491.2789	4311949	0.061076214	37mm Trenchart;Hotchkiss****	3.91036728	0.25573	Don't Dig	378	1107	0	Can't Analyze	*				318491.5	4311949	0.05
1145	1285536.068	462914.3423	SV-1108	318491.2114	4311950.444	0.071491281	37mm Trenchart;Hotchkiss****	4.06278544	0.24614	Don't Dig	392	1108	80	Don't Dig	0		37mm_BE365s	0.0069	318491.2	4311950	-0.01
1146	1285534.121	462916.7016	SV-1109	318490.6167	4311951.088	0.066219793	37mm Trenchart;Hotchkiss****	4.34895142	0.22994	Don't Dig	426	1109	0	Can't Analyze	*				318490.7	4311951	0.05
1147	1285520.371	462911.9354	SV-1100	318486.4122	4311949.847	0.103364477	37mm Trenchart;Hotchkiss****	4.17430186	0.23956	Don't Dig	408	1100	62	Don't Dig	0.5696		37mm_SR_IVS2s	0.6291	318486.4	4311950	-0.13
1148	1285521.104	462917.2165	SV-1098	318486.6848	4311951.403	0.206855125	MkIV booster	1.89293023	0.52828	Don't Dig	203										
1149	1285520.483	462916.3727										1098	61	Don't Dig	0.5822		37mm_BE365s	0.4561	318486.5	4311951	-0.09
1150	1285518.968	462914.5051	SV-1099	318486.0312	4311950.632	0.053046733	37mm Trenchart;Hotchkiss****	2.43430226	0.4108	Don't Dig	246	1099	58	Don't Dig	0.6215		37mm_BE365s	0.613	318486	4311951	-0.07
1151	1285517.888	462916.8785	SV-1097	318485.7148	4311951.423	0.180722033	MkIV booster	2.46805936	0.40518	Don't Dig	248	1097	75	Don't Dig	0.1785		37mm_BE365s	0	318485.7	4311951	-0.02
1152	1285515.633	462917.5788										1096	78	Don't Dig	0.0176		37mm_BE365s	0.0025	318485	4311952	0.01
1153	1285515.167	462918.3561	SV-1096	318484.813	4311951.752	0.103911014	MkIV booster	2.40377402	0.41601	Don't Dig	242	1095	38	Don't Dig	0.7506		Small ISO_BE622s	0.8594	318485	4311952	-0.22
1153	1285515.167	462918.3561	SV-1095	318484.8667	4311951.708	0.118065328	37mm Trenchart;Hotchkiss****	2.49722689	0.40044	Don't Dig	254	1095	38	Don't Dig	0.7506		Small ISO_BE622s	0.8594	318485	4311952	-0.22
1154	1285514.326	462920.3689	SV-1094	318484.6609	4311952.468	0.112381972	MkIV booster	0.79362413	110.26004	Training	5	1094	10	Dig, Low Confidence	0.8464		3in proj_BP110826_TP81s	0.9386	318484.6	4311952	-0.4
1155	1285520.562	462925.2228	SV-1110	318486.5647	4311953.888	0.225672755	60mm M302A2 WP***	0.53302348	110.87609	Training	2	1110	5	Dig, Low Confidence	0.8868		37mm_2011LSBP840m	0.9672	318486.6	4311954	-0.12
1156	1285519.713	462926.7383	SV-1111	318486.4189	4311954.298	0.086144318	37mm Trenchart;Hotchkiss****	3.68179488	0.27161	Don't Dig	362	1111	0	Can't Analyze	*				318486.2	4311954	0
1157	1285513.417	462925.0611	SV-1112	318484.4293	4311953.83	0.124456564	37mm Trenchart;Hotchkiss****	3.63147387	0.27537	Don't Dig	359	1112	77	Don't Dig	0.1455		MK IV Booster_SV_TP10	0.0471	318484.4	4311954	-0.05
1158	1285510.325	462921.6954										1093	37	Don't Dig	0.7606		37mm_SR_IVS2s	0.8723	318483.4	4311953	-0.19
1159	1285510.486	462920.3338	SV-1093	318483.47	4311952.424	0.054125608	MkIV booster	2.78534647	0.35902	Don't Dig	281										
1160	1285509.375	462912.6144	SV-1092	318483.0591	4311950.098	0.029999788	37mm Trenchart;Hotchkiss****	3.41114209	0.29316	Don't Dig	338	1092	76	Don't Dig	0.1683		37mm_BE365s	0.0383	318483.1	4311950	-0.01
1161	1285503.488	462914.3278	SV-1091	318481.3141	4311950.651	0.03543745	37mm Trenchart;Hotchkiss****	3.73730296	0.26757	Don't Dig	364	1091	70	Don't Dig	0.3883		37mm_BE365s	0.283	318481.3	4311951	-0.07
1162	1285505.53	462916.476	SV-1090	318481.9376	4311951.293	0.295280399	ISO Medium 40****	0.18533363	5.39567	Dig	14	1090	3	Dig, High Confidence	0.9488		75mm_CE3022m	0.9884	318481.9	4311951	-0.28
1163	1285503.736	462918.9945	SV-1089	318481.4675	4311952.052	0.309876099	37mm HE**	1.67525742	0.59692	Don't Dig	182	1089	0	Can't Analyze	*				318481.3	4311952	-0.04
1164	1285502.718	462924.0732	SV-1088	318481.0451	4311953.731	0.210662809	37mm Trenchart;Hotchkiss****	2.81729903	0.35495	Don't Dig	286	1088	0	Can't Analyze	*				318481.2	4311954	-0.19
1165	1285507.037	462928.0909	SV-1113	318482.4734	4311954.785	0.038329091	37mm Trenchart;Hotchkiss****	4.56514564	0.21905	Don't Dig	438	1113	0	Can't Analyze	*				318482.5	4311955	-0.13
1166	1285505.721	462930.8045	SV-1115	318482.0168	4311955.617	0.154862624	MkIV booster	1.48246361	0.67455	Don't Dig	159	1114	28	Dig, Low Confidence	0.5805		MK IV Booster_SV_TP10	0.9348	318482.1	4311956	-0.21
1166	1285505.721	462930.8045	SV-1115	318482.0168	4311955.617	0.154862624	MkIV booster	1.48246361	0.67455	Don't Dig	159	1115	24	Dig, Low Confidence	0.6491		Small ISO_BE_IVS2005s	0.9511	318482.1	4311956	-0.21
1166	1285505.721	462930.8045	SV-1114	318482.0442	4311955.605	0.181987747	MkIV booster	1.54805843	0.64597	Don't Dig	167	1114	28	Dig, Low Confidence	0.5805		MK IV Booster_SV_TP10	0.9348	318482.1	4311956	-0.21
1166	1285505.721	462930.8045	SV-1114	318482.0442	4311955.605	0.181987747	MkIV booster	1.54805843	0.64597	Don't Dig	167	1115	24	Dig, Low Confidence	0.6491		Small ISO_BE_IVS2005s	0.9511	318482.1	4311956	-0.21
1167	1285505.293	462934.1266	SV-1116	318482.1192	4311956.684	0.160917169	MkIV booster	1.26744288	0.78899	Don't Dig	101	1116	0	Can't Analyze	*				318481.8	4311957	0.09
1168	1285500.629	462932.902										1117	74	Don't Dig	0.282		37mm_BE365s	0.8049	318480.6	4311956	-0.12
1169	1285499.171	462929.5065	SV-1118	318480.0461	4311955.31	0.120790179	37mm Trenchart;Hotchkiss****	3.25242685	0.30746	Don't Dig	330	1118	81	Don't Dig	0	weak/no response			318480.1	4311955	-0.28
1170	1285497.979	462920.6467	SV-1087	318479.6409	4311952.636	0.113864962	37mm Trenchart;Hotchkiss****	1.30655965	0.76537	Don't Dig	116	1087	21	Dig, Low Confidence	0.7214		Small ISO_BE_IVS2005s	0.9406	318479.7	4311953	-0.14
1170	1285497.979	462920.6467	SV-1087	318479.6409	4311952.636	0.113864962	37mm Trenchart;Hotchkiss****	1.30655965	0.76537	Don't Dig	116	1086	53	Don't Dig	0.6693		Small ISO_BE622s	0.9094	318479.7	4311953	-0.1
1171	1285497.507	462918.9398	SV-1086	318479.5053	4311952.086	0.141466009	37mm Trenchart;Hotchkiss****	4.00499799	0.24969	Don't Dig	387										
1172	1285485.5	462908.0006																			
1173	1285485.5	462905.0006																			
1174	1285488.081	462903.5858										1085	0	Can't Analyze	*				318476.5	4311947	0.12
1175	1285488.97	462904.1796	SV-1085	318476.805	4311947.645	0.152842839	37mm HE**	3.8066578	0.2627	Don't Dig	370										
1176	1285492.5	462906.5006																			
1177	1285496	462902.0006																			
1178	1285500	462899.0006																			
1179	1285501.232	462903.0016	SV-1084	318480.5474	4311947.198	0.228151685	90mm M71A1*	0.22462026	4.45196	Dig	16	1084	1	Dig, High Confidence	0.9589		3in proj_BP110826_TP80s	0.9963	318480.5	4311947	-0.21
1180	1285507	462904.5006																			

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
1181	1285510.568	462904.6372										1083	0	Can't Analyze	*				318483.4	4311948	0.1
1182	1285511.912	462903.3968	SV-1083	318483.7912	4311947.253	0.093434894	37mm Trenchart;Hotchkiss****	4.60586125	0.21711	Don't Dig	442										
1183	1285512.355	462902.4779	SV-1082	318483.9119	4311947.045	0.080894963	37mm Trenchart;Hotchkiss****	4.25769084	0.23487	Don't Dig	416	1082	0	Can't Analyze	*				318483.9	4311947	-0.08
1184	1285512.045	462899.5801	SV-1081	318483.8195	4311946.046	0.114324467	37mm Trenchart;Hotchkiss****	4.41117676	0.2267	Don't Dig	431	1081	0	Can't Analyze	*				318483.8	4311946	0.07
1185	1285512.5	462895.0006																			
1186	1285513.643	462895.8038	SV-1080	318484.2259	4311945.065	0.35179827	5-lb Bomb Mk106*	1.65864163	0.6029	Don't Dig	180	1080	9	Dig, Low Confidence	0.8508		Small ISO_BE_IVS2005s	0.8565	318484.3	4311945	-0.01
1187	1285517.329	462898.2441	SV-1079	318485.5251	4311945.703	0.021708555	37mm Trenchart;Hotchkiss****	4.17760349	0.23937	Don't Dig	409	1079	0	Can't Analyze	*				318485.3	4311946	0.11
1188	1285522.356	462896.5053	SV-1075	318486.9157	4311945.036	0.00452299	37mm Trenchart;Hotchkiss****	3.49798495	0.28588	Don't Dig	344	1075	80	Don't Dig	0		37mm_BE365s	0.0052	318486.9	4311945	-0.02
1189	1285520.559	462898.6185	SV-1076	318486.4428	4311945.777	0.22609416	37mm Trenchart;Hotchkiss****	2.657132	0	Don't Dig	490	1076	7	Dig, Low Confidence	0.8592		60mm_BP110826_TP26s	0.9139	318486.5	4311946	-0.45
1189	1285520.559	462898.6185	SV-1076	318486.4428	4311945.777	0.22609416	37mm Trenchart;Hotchkiss****	2.657132	0	Don't Dig	490	1077	0	Can't Analyze	*				318486.3	4311946	-0.79
1190	1285520.349	462899.7985	SV-1077	318486.3381	4311946.1	0.155485124	37mm Trenchart;Hotchkiss****	4.82032104	0.20746	Don't Dig	454										
1191	1285520.632	462901.8424	SV-1078	318486.4576	4311946.898	0.005707717	37mm Trenchart;Hotchkiss****	5.67739301	0.17614	Don't Dig	475										
1192	1285519.517	462902.11										1078	0	Can't Analyze	*				318486.1	4311947	0.07
1193	1285521.598	462905.7029	SV-1101	318486.8164	4311947.922	0.008165513	37mm HE**	4.00793312	0	Don't Dig	491	1101	81	Don't Dig	0	weak/no response			318486.7	4311948	0.07
1194	1285527.658	462904.1723	SV-1102	318488.6395	4311947.418	0.111815138	ISO S80	1.29033239	0.77499	Don't Dig	110	1102	23	Dig, Low Confidence	0.6951		37mm_SWPG_TP4s	0.9764	318488.6	4311947	-0.07
1195	1285530.593	462902.0119	SV-1103	318489.291	4311946.566	0.13419203	37mm HE**	4.36685828	0.229	Don't Dig	427										
1195	1285530.593	462902.0119	SV-1104	318489.4749	4311946.706	0.139893529	37mm Trenchart;Hotchkiss****	4.4889261	0.22277	Don't Dig	434										
1196	1285530.793	462900.5265										1104	0	Can't Analyze	*				318489.4	4311946	-0.59
1197	1285530.799	462899.4044										1103	0	Can't Analyze	*				318489.5	4311946	-0.01
1198	1285531.6	462896.2143	SV-1072	318489.7766	4311944.741	3.93621E-14	37mm HE**	2.99980911	0.33335	Don't Dig	306	1073	79	Don't Dig	0.0013		37mm_BE365s	0	318489.8	4311945	-0.03
1198	1285531.6	462896.2143	SV-1073	318489.6857	4311945.065	0.13643399	37mm Trenchart;Hotchkiss****	2.38433959	0.4194	Don't Dig	238	1073	79	Don't Dig	0.0013		37mm_BE365s	0	318489.8	4311945	-0.03
1199	1285526.244	462894.9926																			
1200	1285525.412	462893.642	SV-1074	318487.9869	4311944.271	0.013019846	37mm Trenchart;Hotchkiss****	4.75412628	0.21034	Don't Dig	450	1074	0	Can't Analyze	*				318487.8	4311944	0.04
1201	1285526	462890.5006																			
1202	1285532.666	462892.6478	SV-1071	318490.008	4311943.887	0.026431344	37mm Trenchart;Hotchkiss****	2.69835976	0.3706	Don't Dig	273	1071	69	Don't Dig	0.3971		37mm_BE365s	0.3595	318490.1	4311944	-0.04
1203	1285533.743	462894.9094										1072	0	Can't Analyze	*				318490.4	4311944	0.02
1204	1285537.458	462894.6218	SV-1070	318491.5549	4311944.506	0.070038757	37mm Trenchart;Hotchkiss****	2.66400864	0.37537	Don't Dig	268	1070	80	Don't Dig	0		37mm_BE365s	0	318491.5	4311944	0.1
1205	1285543.134	462889.0432	SV-1069	318493.2885	4311942.636	9.58269E-09	37mm Trenchart;Hotchkiss****	4.96372644	0.20146	Don't Dig	461	1069	80	Don't Dig	0		37mm_BE365s	0	318493.2	4311943	0.1
1206	1285542.666	462887.7794																			
1207	1285546.187	462888.1816	SV-1068	318494.0292	4311942.454	0.242459324	MkIV booster	1.57146666	0.63635	Don't Dig	169	1068	47	Don't Dig	0.7068		37mm_BE365s	0.6193	318494.2	4311942	-0.02
1208	1285550.159	462884.6034	SV-1067	318495.4191	4311941.341	0.05229631	37mm Trenchart;Hotchkiss****	2.95909718	0.33794	Don't Dig	300										
1209	1285549.232	462883.3361					MPV 'Extra' - Not Dug					1067	42	Don't Dig	0.7284	response due to fence	60mm_29P_TP53s	0.8269	318495	4311941	-0.37
1210	1285509.706	462995.1959					MPV 'Extra' - Not Dug														
1211	1285510.836	462997.1141					MPV 'Extra' - Not Dug														
1212	1285515.637	462995.6116					MPV 'Extra' - Not Dug														
1213	1285518.005	462995.9589					MPV 'Extra' - Not Dug														
1214	1285511.741	463000.1004					MPV 'Extra' - Not Dug														
1215	1285512.209	463002.132					MPV 'Extra' - Not Dug														
1216	1285518.232	463015.4918					MPV 'Extra' - Not Dug														
1217	1285523.912	463022.5501					MPV 'Extra' - Not Dug														
1218	1285524.589	463024.1368					MPV 'Extra' - Not Dug														
1219	1285530.451	463019.7207					MPV 'Extra' - Not Dug														
1220	1285559.772	463015.0384					MPV 'Extra' - Not Dug														
1221	1285562.104	463011.3357					MPV 'Extra' - Not Dug														
1222	1285562.804	463009.9826					MPV 'Extra' - Not Dug														
1223	1285580.922	462988.5522					MPV 'Extra' - Not Dug														
1224	1285554.611	462976.5684					MPV 'Extra' - Not Dug														
1225	1285549.992	462975.6171					MPV 'Extra' - Not Dug														
1226	1285546.968	462977.2341					MPV 'Extra' - Not Dug														
1227	1285547.462	462973.9865					MPV 'Extra' - Not Dug														
1228	1285550.479	462972.8648					MPV 'Extra' - Not Dug														
1229	1285550.006	462970.3704					MPV 'Extra' - Not Dug														
1230	1285559.054	462970.336					MPV 'Extra' - Not Dug														
1231	1285562.611	462970.775					MPV 'Extra' - Not Dug														
1232	1285562.589	462968.4775					MPV 'Extra' - Not Dug														
1233	1285563.94	462965.6655					MPV 'Extra' - Not Dug														
1234	1285567.419	462966.5523					MPV 'Extra' - Not Dug														
1235	1285568.528	462964.2928					MPV 'Extra' - Not Dug														
1236	1285570.467	462955.8134					MPV 'Extra' - Not Dug														
1237	1285572.5	462939.7495					MPV 'Extra' - Not Dug														
1238	1285541.242	462916.661					MPV 'Extra' - Not Dug														
1239	1285538.052	462914.7271					MPV 'Extra' - Not Dug														
1240	1285536.302	462912.244					MPV 'Extra' - Not Dug														
1241	1285540.117	462910.8117					MPV 'Extra' - Not Dug														

Target #	State Plane Easting	State Plane Northing	MPV Cued Target	MPV Fit X	MPV Fit Y	MPV Fit Z	MPV Best Fit	MPV Fit Metric	Decision Metric	MPV Category	MPV Rank	TT Cued Target	TT Rank	TT Category	TT Decision Statistic	TT COMMENTS	TT Best Fit	TT Fit Metric	TT Fit X	TT Fit Y	TT Fit Z
1242	1285548.008	462908.7404					MPV 'Extra' - Not Dug														
1243	1285545.093	462900.7419					MPV 'Extra' - Not Dug														
1244	1285533.398	462896.5344					MPV 'Extra' - Not Dug														
1245	1285515.531	462896.8116					MPV 'Extra' - Not Dug														
1246	1285517.236	462911.2382					MPV 'Extra' - Not Dug														
1247	1285522.722	462912.4447					MPV 'Extra' - Not Dug														
1248	1285527.967	462908.9535					MPV 'Extra' - Not Dug														
1249	1285533.515	462912.1435					MPV 'Extra' - Not Dug														
1250	1285530.935	462913.9671					MPV 'Extra' - Not Dug														
1251	1285524.816	462915.2504					MPV 'Extra' - Not Dug														
1252	1285516.812	462918.8976					MPV 'Extra' - Not Dug														
1253	1285516.32	462922.9328					MPV 'Extra' - Not Dug														
1254	1285516.201	462928.1903					MPV 'Extra' - Not Dug														
1255	1285514.959	462928.8358					MPV 'Extra' - Not Dug														
1256	1285511.415	462924.0688					MPV 'Extra' - Not Dug														
1257	1285507.425	462919.42					MPV 'Extra' - Not Dug														
1258	1285502.804	462910.3242					MPV 'Extra' - Not Dug														
1259	1285494.676	462902.5624					MPV 'Extra' - Not Dug														
1260	1285492.885	462903.4254					MPV 'Extra' - Not Dug														
1261	1285493.973	462908.5651					MPV 'Extra' - Not Dug														
1262	1285497.786	462932.6591					MPV 'Extra' - Not Dug														
1263	1285499.791	462936.3947					MPV 'Extra' - Not Dug														
1264	1285497.231	462955.2265					MPV 'Extra' - Not Dug														
1265	1285507.826	462968.89					MPV 'Extra' - Not Dug														
1266	1285505.818	462971.4317					MPV 'Extra' - Not Dug														
1267	1285503.5	462972.5031					MPV 'Extra' - Not Dug														
1268	1285504.689	462973.0706					MPV 'Extra' - Not Dug														
1269	1285506.628	462976.5062					MPV 'Extra' - Not Dug														
1270	1285508.377	462976.8038					MPV 'Extra' - Not Dug														
1271	1285509.635	462978.715					MPV 'Extra' - Not Dug														
1272	1285515.34	462973.2355					MPV 'Extra' - Not Dug														
1273	1285516.745	462971.5731					MPV 'Extra' - Not Dug														
1274	1285525.726	462980.85					MPV 'Extra' - Not Dug														
1275	1285527.127	462982.1966					MPV 'Extra' - Not Dug														
1276	1285520.206	462980.4499					MPV 'Extra' - Not Dug														
1277	1285507.733	462985.5511					MPV 'Extra' - Not Dug														
1278	1285509.902	462991.2166					MPV 'Extra' - Not Dug														

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Appendix G: Photo Log

Photo 01: IVS-1, Inert Stokes Mortar

Photo 02: IVS-2, Inert 75 mm

Photo 03: IVS-3, Medium Industry Standard Object (2 inch diameter pipe nipple)

Photo 04: IVS-4, Small Industry Standard Object (1 inch diameter pipe nipple)

Photo 05: Completed IVS. Four flags at left indicate seed line and two flags at right indicate noise line.
Date: 1 August 2016

Photo 06: MPV dynamic survey with RTS, 4740 Quebec Street. *Date*: 25 August 2016

Photo 07: MPV dynamic survey with RTK GPS, 4720 Quebec Street. *Date*: 19 August 2016

Photo 08: MPV cued survey, 4720 Quebec Street. *Date*: 29 August 2016

Photo 09: TEMTADS dynamic survey with RTK GPS, 4733 Woodway Lane. *Date*: 15 August 2016

Photo 10: TEMTADS dynamic survey with RTS, 4733 Woodway Lane. *Date*: 16 August 2016

Photo 11: EM61MK2A dynamic survey with RTS, 4720 Quebec Street. *Date*: 20 September 2016

Photo 12: Intrusive operations, 4740 Quebec Street. *Date*: 5 October 2016

Photo 13: Intrusive operations on sidewalk, 4720 Quebec Street. *Date*: 14 November 2016

Photo 14: Intrusive operations on sidewalk, 4720 Quebec Street. *Date*: 15 November 2016

Photo 15: Target 1, pipe fragment, 4720 Quebec Street.
MPV Fit item: MkIV booster. *TEMTADS Fit item*: Small ISO.
Date: 15 November 2016

Photo 16: Target 73/74, steel spike, 4720 Quebec Street.
MPV Fit item: MkIV booster/75 mm. *TEMTADS Fit item*: 37 mm projectile/3 inch projectile.
Date: 14 November 2016

Photo 17: Target 94, munitions debris, 4720 Quebec Street.
MPV Fit item: MkIV booster. *TEMTADS Fit item*: 37 mm projectile.
Date: 14 November 2016

Photo 18: Target 129, Stokes Mortar, unfuzed, 4720 Quebec Street.
MPV Fit item: Stokes Mortar. *TEMTADS Fit item*: 5 inch projectile.
Date: 14 November 2016

Photo 19: Target 201, munitions debris, 4720 Quebec Street.
MPV Fit item: Stokes Mortar. *TEMTADS Fit item*: 37 mm projectile.
Date: 15 November 2016

Photo 20: Target 202, munitions debris, 4720 Quebec Street.
MPV Fit item: MkIV booster. *TEMTADS Fit item*: 37 mm projectile.
Date: 15 November 2016

Photo 21: Target 1015, wire (lawn staple, a commonly found item), 4740 Quebec Street. Tape is 1 inch wide.
MPV Fit item: MkIV booster. *TEMTADS Fit item*: 37 mm projectile.
Date: 6 October 2016

Photo 22: Target 1025, pipe, 4740 Quebec Street. Tape is 1 inch wide.
MPV Fit item: MkIV booster. *TEMTADS Fit item*: Small ISO.
Date: 5 October 2016

Photo 23: Target 1089, steel band, 4740 Quebec Street. Tape is 1 inch wide.
MPV Fit item: Stokes Mortar. *TEMTADS Fit item*: none.
Date: 5 October 2016

Photo 24: Target 2013, tent stake, 4733 Woodway Lane. Tape is 1 inch wide.
MPV Fit item: Small ISO Schedule 80. *TEMTADS Fit item*: 37 mm projectile.
Date: 5 October 2016

Photo 25: Target 2158, metal gutter embedded in concrete, 4733 Woodway Lane.
MPV Fit item: MkIV booster. *TEMTADS Fit item*: Small ISO.
Date: 16 November 2016

Photo 26: Target 2189, steel scrap, 4733 Woodway Lane. Tape is 1 inch wide.
MPV Fit item: MkIV booster. *TEMTADS Fit item*: 37 mm projectile.
Date: 7 October 2016

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