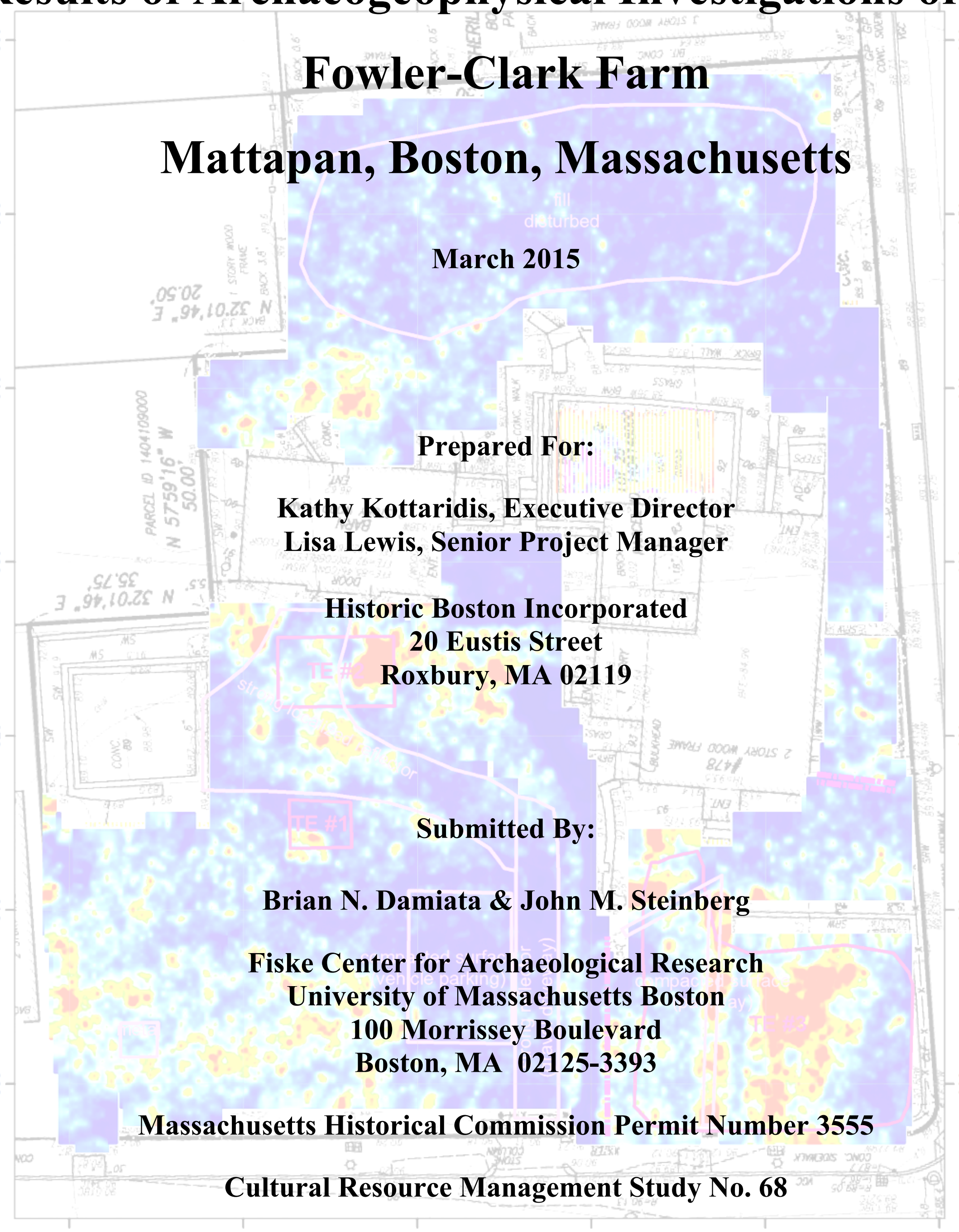
Results of Archaeogeophysical Investigations of the Fowler-Clark Farm

Mattapan, Boston, Massachusetts



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ARCHAEOLOGICAL ABSTRACT

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Ground penetrating radar (GPR) and Frequency-Domain Electromagnetic (FDEM) surveys were employed over an extensively modified 50 m x 65 m city lot containing a farmhouse initially constructed between 1786 and 1806 (BOS 15538) and a later barn. Both geophysical methods suggested that most of the lot had experienced substantial disturbance and that there was limited sub-surface preservation. Both the GPR and EM surveys indicated a scatter of metallic debris and other disturbances in the back yard at depths up to 1 m. Most of the front yard also presents as disturbed, except for two unusual but limited buried surfaces that were identified in the GPR. Three 50 cm x 50 cm shovel test pits in these two areas confirmed the presence of preserved surfaces or at least archaeological deposits, under more than 65 cm of unremarkable fill.

SUMMARY

The present-day property known as the Fowler-Clark Farm is located at 487 Norfolk Street in the neighborhood of Mattapan, Boston. Currently, there are three buildings on this property—a main house, a stable and an outbuilding attached to the main house. According to probate records, the main house was likely constructed sometime between 1786 and 1806. The standing stable dates to ca. 1860. However, documents reveal that other outbuildings may have been located on the property as early as the mid-18th century.

Given this information, the Fiske Center for Archaeological research conducted an archaeogeophysical investigation in late November and early December of 2014 with the broader aim of providing a cost-effective approach to focus the future-planned, intensive, below-ground testing to determine the archaeological sensitivity of the property. The specific objective of the investigation was to identify areas that may contain archaeologically relevant features such as: (1) buried foundations and other built structures (e.g., additions to the farm house, outbuildings, privies and wells), (2) buried surfaces and pathways, (3) in-filling and ground disturbance, and (4) buried utilities. Note that the soil in the vicinity of the site is currently classified as "Urban Land", which is described as excavated-and-filled material that is considered to be non-prime farmland.

A combination of Ground-Penetrating Radar (GPR) and Frequency-Domain Electromagnetic (FDEM) surveys were conducted to achieve the objective of the archaeogeophysical investigation. Initially, a relative orthogonal grid that covered more than 87% of the accessible area was established over the site. The GPR survey was performed using a Malå X3M system that was equipped with a 500 MHz antenna. Data were collected at a vertical scan interval of approximately 0.02 m (0.8 inches) along parallel contiguous transects that were separated by 0.25 m (10 inches). A total of 6,325 linear meters (20,750 linear feet) were traversed along 434 transects. The FDEM survey was performed over the same grid using a GF Instruments CMD Mini-Explorer, which operates at 30 kHz over three separate dipole lengths (0.32, 0.71, and 1.18 m [13, 28, and 46 inches]). Data were collected in the vertical dipole mode at a sampling rate of 10 Hz, which yielded a measurement spacing of approximately 0.06 m (2.4 inches) when walking at a normal pace. Both quadrature phase (bulk ground conductivity) and

in-phase (proportional to bulk ground magnetic susceptibility) components were recorded for each of the three dipole lengths, resulting in more than 201,200 combined measurements for each of the two components.

The archaeogeophysical investigation was successful in identifying several anomalous areas that are interpreted to be due to the presence of various below-ground features as summarized in Figures S1 and S2. These features include a northeasterly dipping compacted surface (TE#3) or boundary layer in the southeastern portion of the property (depth: 0.5 – 1.3 m [1.6 – 4.3 ft]), a strong but localized reflector () of unknown origin that lies between the driveway and the stable (depth: 0.5 – 0.9 m [1.6 – 2.9 ft]), a relatively recent trench-and-fill area (disturbed fill) in the northwestern portion of the property, compacted surfaces attributed to pathways from the entrance of the farm house and to vehicle parking adjacent to the present-day driveway (depth: near surface), two buried pipes (most likely including a water line) that connect from Hosmer Street to the eastern corner of the farm house (depth: 1.0 – 1.3 m [3.3 – 4.3 ft]; dashed lines), and a probable pipe that connects from Norfork Street to the southern corner of the farm house (depth: 1.4 – 1.5 m [4.6 – 4.9 ft]; dashed line). In addition, an anomalous rectangular area containing metal was identified (depth: near surface N315 E314). A second area with a smaller concentration of metal was also detected in the southwestern portion of the property (depth: near surface, N302 E304). In general, the archaeogeophysical investigation yielded high-quality data over an extensive portion of the site.

The Geophysical survey was followed up in three areas with small excavations. These excavations took place under Massachusetts Historical Commission Permit Number 3555. The shovel test pits revealed that there are, in fact, two small, very deep layers that are preserved, potentially from the earliest occupations. The three areas investigated, labeled in Figure S1 and S2) are:

- TE#1 area of substantial cement and metal
- TE#2 strong reflector near the driveway and stable
- TE#3 Northeasterly dipping reflector that is suspected to be a buried surface or boundary layer.

TE#1 was only partially explored. It consisted of two rebar reinforced cement rectangular boxes, 2 x 1.5 m each, that share a central long wall. The northwest bay was filled with modern trash, with a predominance of cat food cans, 8 track tapes, and turntables. It was mostly cleaned out during testing. The southeast bay was capped with a 7 cm think concrete slab and was not excavated. Small holes in the concrete slab did suggest a void space under the southeast bay. There is no suggestion of preserved archaeological remains in TE#1.

TE #2 was explored with two test pits. The first one (STP#1) presented with a galvanized pipe at 40 cm bgs, that clearly had disturbed the entire deposit. The second one (STP#2), placed 1 m southeast, presented with 68 cm of disturbed and poorly sorted soil mixed with a variety of non-descript artifacts. Most of the artifacts were at the bottom of this 68 cm deposit. From 68 to 75 cm bgs a distinct and dense layer of coal and coal ash was encountered. Below that (75-88 cm bgs) may be an original ground surface. There are likely preserved and significant archaeological deposits between 65 and 90 cm bgs over the TE#2 area.

TE#3 was explored with one test pit (STP#3) that had a mixed, rocky, poorly sorted, and low artifact density deposit for the top 60 cm. Below this disturbed deposit was a coherent archaeological deposit from 60-79 cm bgs. This deposit was on top of a potential preserved surface (with no artifacts) (between 79 and 85 cm bgs). There are likely preserved and significant archaeological deposits between 60 and 85 cm bgs over the TE#3 area.

Most of the grounds are archaeologically compromised. The two preserved archaeological deposits, described above, clearly limited in area, and will not be affected by the planned farming/gardening regime proposed for the property.

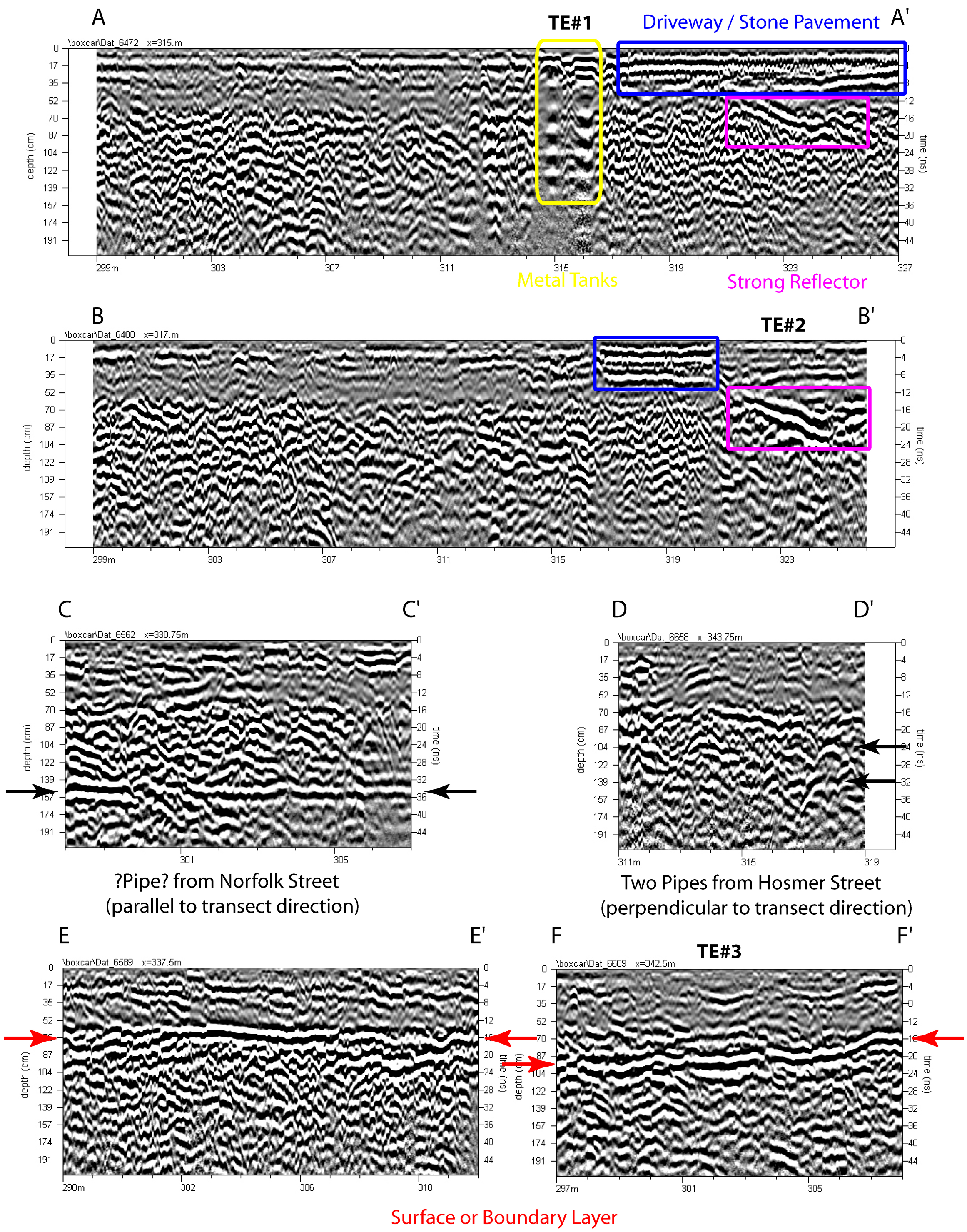

Figure S1. Representative annotated radar profiles over selected areas of interest.

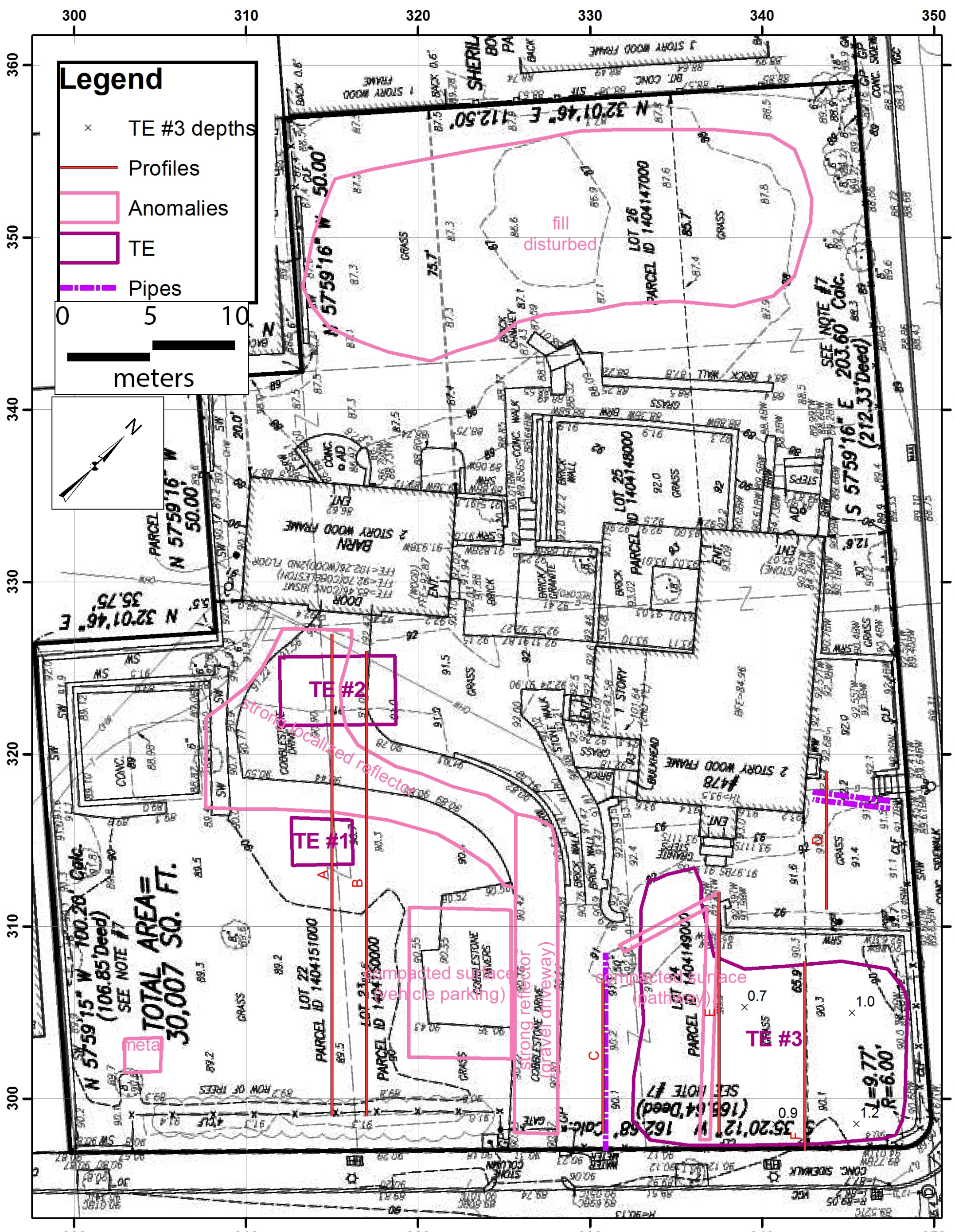

Figure S2. Summary of geophysical interpretations and excavated STP's.

CONTENTS

CONTENTS

FIGURES

CONTENTS

TABLES

FISKE CENTER FOR ARCHAEOLOGICAL RESEARCH

The Andrew Fiske Memorial Center for Archaeological Research at the University of Massachusetts Boston was established in 1999 through the generosity of the late Alice Fiske and her family as a living memorial to her late husband Andrew. The Fiske Center was formally known as the Center for Cultural and Environmental History.

As an international leader in interdisciplinary research, the Fiske Center promotes a vision of archaeology as a multi-faceted, theoretically rigorous field that integrates a variety of analytical perspectives into its studies of the cultural and biological dimensions of colonization, urbanization, and industrialization that have occurred over the past one thousand years in the Americas and the Atlantic World. Intellectually the Fiske Center's staff is committed to building a highly integrated archaeology which embraces the multiplicity of methodological and theoretical approaches that the field offers. As part of a public university, the Fiske Center maintains a program of local archaeology with a special emphasis on research that meets the needs of cities, towns, and Tribal Nations in New England and the greater Northeast. The Fiske Center also seeks to understand the local as part of a broader Atlantic World.

ACKNOWLEDGEMENTS

Lisa Lewis served as the main contact at Historic Boston Inc. Ramona Steel, Eric Johnson, and Joe Treblecock, helped clear the area. In addition to Eric, Ramona and Joe, Meredith Luze, Alison Carlson, and Adam Brinkman helped with the geophysical survey. John Steinberg obtained the fixed points and John Schoenfielder laid out the initial state plane grid and mapped the surface features. Brian Damiata, and John Steinberg supervised out the ground-penetrating radar survey. Eric and Joe helped with the illustrations and georeferencing. John Steinberg and Brian Damiata are responsible for the quality control of the surveys and the interpretation of the data. John Steinberg, Brian Damiata, and Richard Roy excavated the shovel test pits under permit 3555 granted to the Fiske Center for Archaeological Research, UMass Boston on May 15, 2015 by Brona Simon.

1.0 INTRODUCTION

The present-day property known as the Fowler-Clark Farm is located at 487 Norfolk Street in the neighborhood of Mattapan, Boston (Figure 1). An archaeogeophysical investigation was conducted at the farm in late November and early December of 2014 with the broader aim of providing a cost-effective approach to focus the future-planned, intensive, below-ground testing to determine the archaeological sensitivity of the property. The specific objective of the investigation was to identify areas that may contain archaeologically relevant features such as: (1) buried foundations and other built structures (e.g., additions to the farm house, outbuildings, privies and wells), (2) buried surfaces and pathways, (3) in-filling and ground disturbance, and (4) buried utilities. A combination of Ground-Penetrating Radar (GPR) and Frequency-Domain Electromagnetic (FDEM) surveys were conducted to achieve the objective.

Summarized below are the results of the archaeogeophysical investigation. Section 2 provides an historical review of the Fowler-Clark property, Section 3 provides a description of the land surveying that was performed to establish the grid for the geophysical surveys, Section 4 discusses the geophysical methodologies, and Section 5 presents geophysical interpretations and recommendations. Section 6 discusses the results of the shovel test pits that added ground truth to the geophysical interpretations. Relevant information and geophysical processing results are provided in the appendices along with archaeological results: Appendices A through C give brief overviews of archaeogeophysics, the GPR method, and the FDEM method, respectively; Appendix D contains two-dimensional (2-D) radargrams with annotated interpretations; Appendix E presents horizontal time-slice (depth) images of strong reflectors that were produced by combining the radargrams to produce a pseudo three-dimensional (3-D) dataset; Appendix F presents the color-contour FDEM data; and Appendix G contains a listing of the coordinates of significant features that were measured as part of the land surveying to establish the grid for the surveys. Appendix H lists units, levels, contexts and recovered archaeological artifacts.

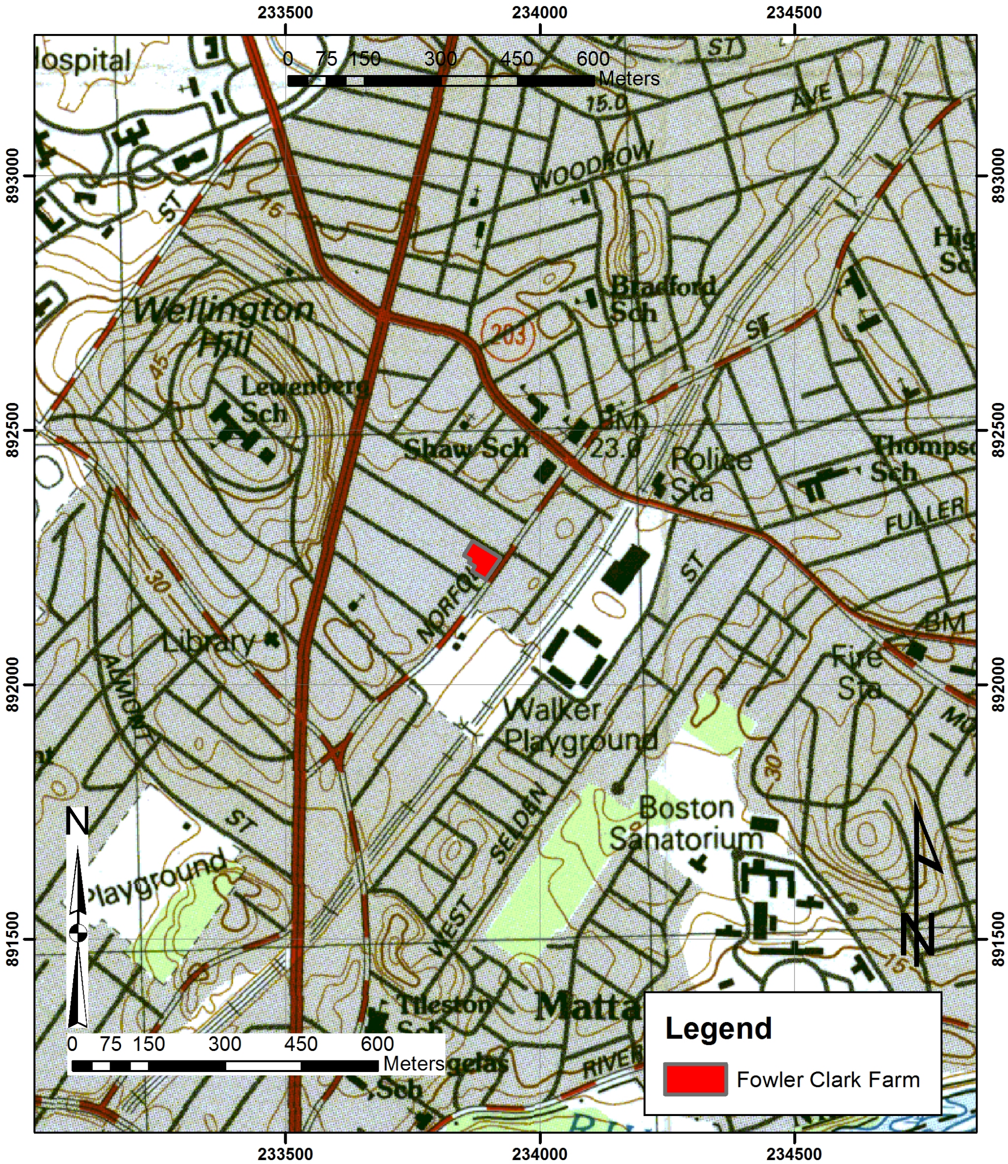

Figure 1. Index map showing present-day location of the Fowler-Clark property.

2.0 HISTORICAL REVIEW

Currently, three buildings are located on the Fowler-Clark property—a main house, a stable and an outbuilding. According to probate records, the main house was likely constructed sometime between 1786 and 1806. The standing stable dates to ca. 1860. However, documents reveal that the outbuilding may have been located on the property as early as the mid-18th century (Boston Landmarks Commission 2013). Historically, the economy of Dorchester was driven by agriculture, and outbuildings were central to the functioning of any farm. Subsurface remains of previous outbuildings would therefore be of significance to our understanding of the development of agriculture in Dorchester and the transformation of the landscape from rural to suburban in the 19th century. Summarized below and in Table 1 is the history of ownership of the Fowler-Clark property.

2.1 Early Historic Period (17th-18th Century)

Before European settlement, the region around the Neponset River was occupied by Algonquian-speaking Native American tribes. The property does not reside on any known prehistoric archaeological sites, although given its proximity to other known prehistoric sites and its location of less than a mile to the north of the Neponset River, the area holds some potential for pre-contact native material.

The town of Dorchester was settled by Puritans from the West Country of England in 1630 (Dorchester Antiquarian and Historical Society 1859:23). While the earliest settlers engaged in fishing, the region quickly became known for its agriculture. Various seventeenth-century accounts describe Dorchester as a fertile space for orchards, corn, and cattle (Birket 1916; Boston Landmarks Commission 2013:8; Hayward 1839; Winsor and Jewett 1880). An unfinished tracing of a map by John Oliver from 1661, which for the present study has been georeferenced to the Neponset River to a remarkable degree of accuracy, shows the location of the Fowler-Clark Farm as being within the boundary of the town of Dorchester, about one half of a mile to the south of the boundary between Dorchester and Roxbury, and three quarters of a mile to the north of the Neponset (Figure 2). The map shows a series of lots dividing the space between the Neponset and Roxbury, but no structures are depicted anywhere on the map.

At this time (17th century) the owner of the land containing the Fowler-Clark property is unknown. In later documents, the property inherited by Samuel Fowler in 1786 was termed “Stiles’s Place,” and “Stiles’s Lane” bounded the property on the east (Suffolk County Probate Records (Case# 18799, vol. 88 p.44, 1788 cited in Boston Landmarks Commission 2013:10). The Dorchester Town Records mention a Robert Stiles and his family throughout the seventeenth century. It is unconfirmed whether the place name of “Stiles’s Place” refers to the ownership of the property by Robert Stiles during this time. However, if “Stiles’s Place” was in fact Robert Stiles's twenty-acre lot that is mentioned in the town records of the seventeenth century, there may have been a house constructed somewhere on the property ca. 1677. At the meeting of the selectmen of Dorchester on September 12, 1677, "It was granted to Robt Stiles libertie to git some timber towards building him an house out of the 500 acrs" (Commissioners of the city of Boston 1883:222).

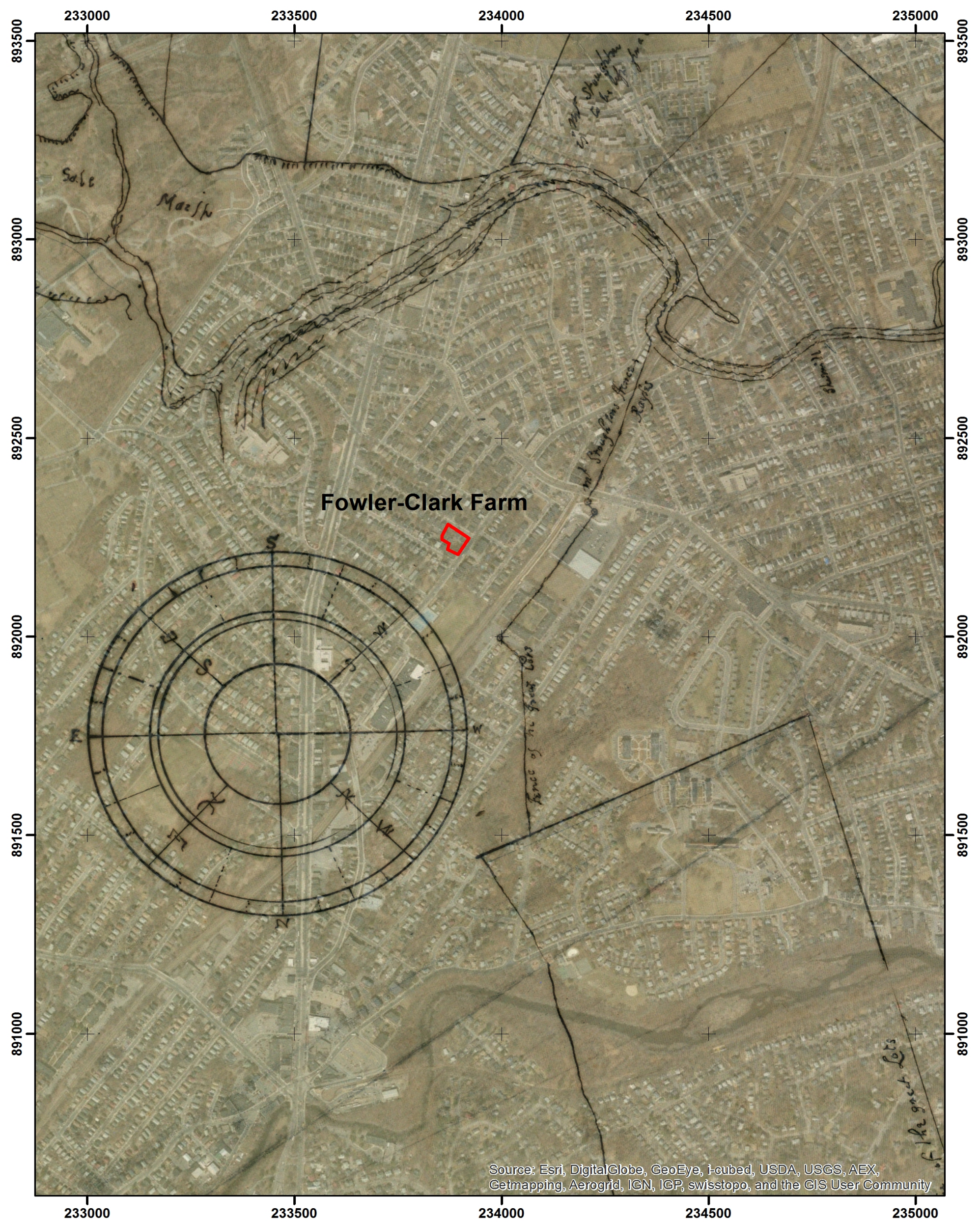

Figure 2. John Oliver's Dorchester 1661 map georeferenced with Fowler-Clark farm.

2.2 Fowler Period (18th Century-1837)

At some point, probably in the eighteenth century, the Fowler-Clark property came into the hands of Stephen Fowler. Stephen Fowler, a veteran of the revolutionary war, died in 1786. His 330 acre property was divided up amongst his children and grandchildren. In 1786, Samuel Fowler, Stephen Fowler's grandson, inherited 35 acres of land known as "Stiles's Place", bounded at some section on the east by "Stiles's Lane" and on the south by "the road"—possibly modern-day Norfolk Street. Samuel's inheritance mentions a barn but does not mention a house; when Samuel Fowler died in 1806, his probate records do mention a house (Norfolk County Probate Case #7292, Inventory of Sam'l Fowler's estate exhibited Feb. 3, 1807). This implies that Samuel Fowler built the current house on the property sometime between 1786 and 1806. Its architectural style is consistent with a late-eighteenth, early-nineteenth century construction date (Boston Landmarks Commission 2013:10).

Upon his death two thirds of the 35 acres was auctioned off with the last third being kept in the Fowler family (Norfolk County Probate Case #7292, vol.13, p.557, Dower of Samuel Fowler's Widow, March 9, 1807). Samuel Fowler's widow, Mary Fowler, inherited the eleven and one quarter acres of property from her husband. Mary Fowler in turn sold the property for five hundred dollars to her son Samuel Fowler Jr. in 1810 (Fowler to Fowler, Lib. 35 Fol. 255). At this point in time the property contained a house and a barn. After Samuel Fowler Jr.'s death in 1820, part of the property was sold at auction while the rest was divided among his siblings and their heirs. Despite this division, Samuel Baker eventually reconsolidated most of the property through various transactions (Pratt to Baker, Lib. 68 Fol.110, Withington to Baker, Lib. 69 Fol. 48). Daniel Sanderson then purchased the property in 1824 along with the final share of the original parcel that same year (Baker to Sanderson, Lib. 72 Fol. 227, Crane to Sanderson, Lib. 74 Fol. 81). Daniel Sanderson owned the property for a little more than a decade until selling the house, barn and eleven and one quarter acres to Mary B. Clark in 1837 (Sanderson to Clark, Lib. 114 Fol. 269).

Historic maps from this time period confirm the presence of a house at the location of the Fowler-Clark property. A map of Dorchester and Milton drawn in 1831 by Edmund James Baker, georeferenced relative to the Neponset River, depicts the house abutting present-day Norfolk Street (Figure 3).

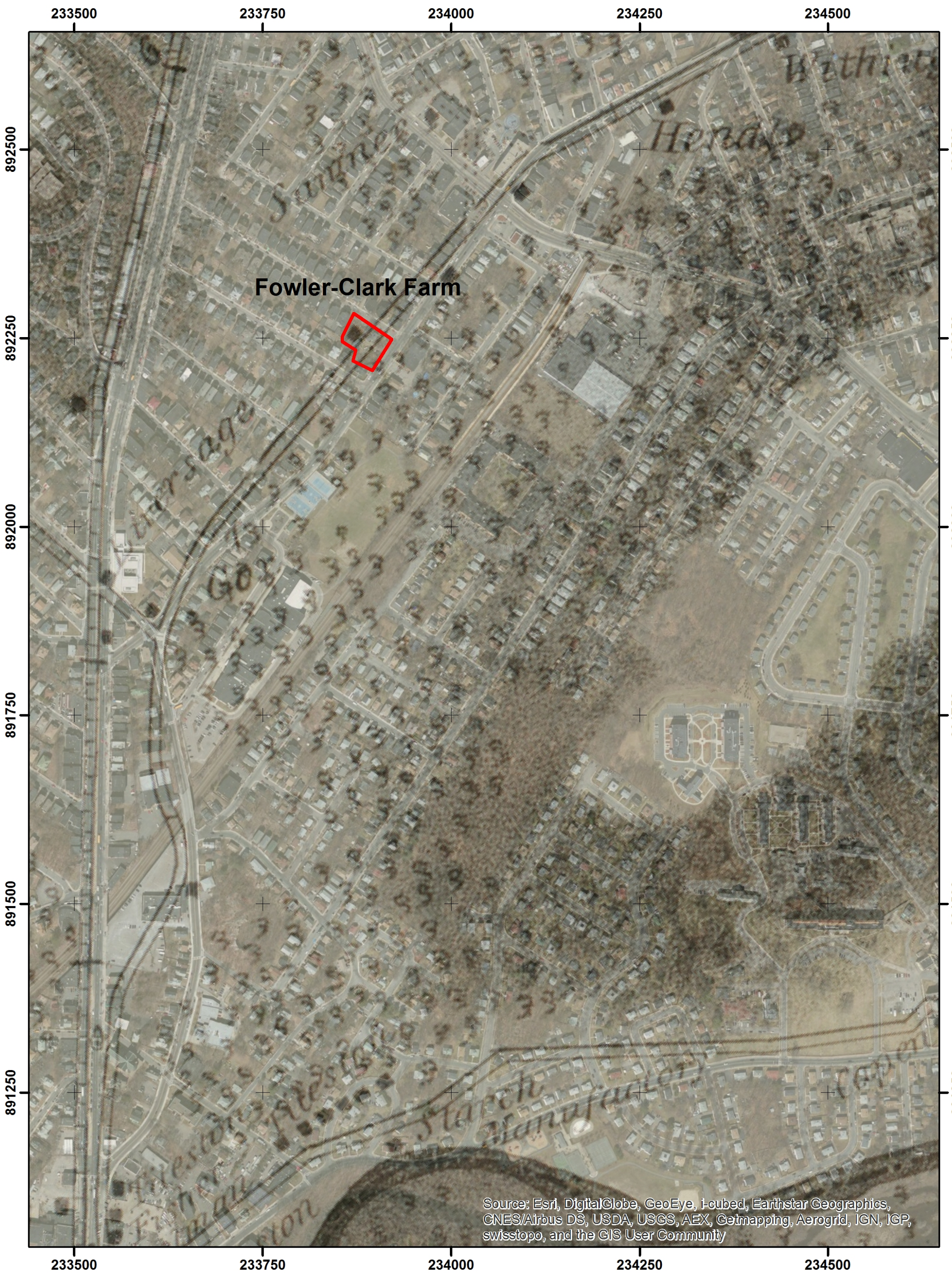

Figure 3. Edmund James Baker's Dorchester and Milton 1831 map georeferenced with Fowler-Clark farm.

2.3 Clark Period (1837-1940)

By 1855, tax records show that an additional barn had been constructed between that time and 1837 when the Clarks obtained the property (Boston Landmarks Commission 2013:11). At some time in the period of 1855 to 1860 a stable that is consistent with the contemporary outbuilding was constructed, bringing the possible total of outbuildings to three. When the property was included in the *Atlas of the county of Suffolk, Massachusetts* in 1874, only one outbuilding was shown to be standing which was presumably the stable (Figure 4). The implication of this seems to be that both of the barns were demolished between 1855 and 1874. A year later, the property passed to Mary B. Clark's daughter, Mary J. Clark, and her son, James Henry Clark. In 1895 the eleven and one quarter acre lot was subdivided into 61 lots at a time when Dorchester was becoming increasingly urbanized (BLC Report, 11). Approximately twenty years later a majority of the Fowler-Clark lots were sold. Mary J. Clark and James Henry Clark appeared on multiple real estate maps found in city atlases until 1933 (Bromley and Bromley 1898, 1904, 1918, 1933). In 1940 James Henry Clark sold the property, which was since reduced to a half acre, to Gertrude Miller and Grace Miller Hunt. A year later the Fowler-Clark property was sold to the most recent owners, Jorge and Ida Epstein (BLC Report, 12).

Since the Epstein's obtained the property a number of changes have been made to the half-acre that may inhibit the effectiveness of geophysical surveying in certain parts of the site. These include the addition of an ell and undocumented structures, which may be foundations (Application to erect one story addition to rear of dwelling, August, 1967). Several complaints resulting from city inspection were also filed about debris and unpermitted contracting supplies (Complaint against illegal materials, September, 1953, 1954). Much of this is apparently still on the property, with garbage such as disposed of metal, carpets, and slate architectural pieces—all of which have the potential to degrade the geophysical data quality and reduce potential archaeological preservation.

Figure 4. Griffith Morgan Hopkins' *Atlas of the county of Suffolk, Massachusetts* 1874 map georeferenced with Fowler-Clark farm.

Table 1. History of ownership of the Fowler-Clark property.

Robert Stiles??, *20 acres, 1 dwelling*	??? – ???
Fowler Family	**??? – 1822**
Stephen Fowler, *330 acres, multiple buildings*	??? – 1786
Samuel Fowler, *35 acres, inherits barn, builds a house*	1786-1806
Mary Fowler (widow of Samuel Fowler), *11 ¼ acres*	1806-1810
Samuel Fowler Jr., *11 ¼ acres*	1810-1820
House-lot sold at auction, rest of property divided among Samuel Fowler Jr.'s relatives and heirs	1820-1822
Samuel Baker, *~9.64 acres*	1822-1824
Daniel Sanderson, *11 ¼ acres*	1824-1837
Clark Family	**1837-1940**
Henry Clark & Mary B. Clark, *11 ¼ acres dwelling and outbuilding*	1837-1875
2 outbuildings (barns)	1850-1855
Modern stable constructed, up to three outbuildings now	1855-1860
Real-estate map shows *one house and one outbuilding on 11 ¼ acres*	1874
James Henry Clark & Mary J. Clark (mother), *11 ¼ to ½ acres*	1875-1932
Property subdivided in 61 lots. Most sold by 1918	1895-1918
James Henry Clark & Alice Clark (wife), *½ acre*	1932-1940
Gertrude Miller & Grace Miller Hunt, *½ acre*	1940-1941
Jorge Epstein and Ida Epstein, *½ acre*	1941-present?

3.0 LAND SURVEYING AND ESTABLISHMENT OF GRID

When performing archaeogeophysical surveys, quality control (QC) is critical and involves constant attention to calibration of instrumentation, consistency in field procedures, and accuracy in locating readings. The most important QC parameter is the accuracy in establishing the grid to be surveyed. Geophysical readings must be associated with a very specific location that is accurate and reproducible for the readings to be useful. Slight differences between the actual location of a geophysical reading and the coordinate assigned during survey can weaken or eliminate geophysical signatures. Inaccurate surveying can also create artificial anomalies.

For the present we employed two grids, the Massachusetts State Plan grid and a local geophysical grid. The Massachusetts State Plan was laid out with the southwest corner of the front yard having coordinates of E 233889.652 N892210.398. The geophysical survey grid used that same state plan grid location as N300 E300. In the northeastern area of the local geophysical grid, in the back yard, the coordinate N355 E340 had state plane coordinates of E233869.786 N892275.490. The grid encompassed about 2200 m^2 but much of the area in the center of the grid was not surveyed because of the standing structures.

Around the front, back, and east side of the yards, PVC flags were initially positioned by using fiberglass measuring tapes using the local geophysical survey grid. Their true locations were then measured with a Topcon GPT9005 total station (Appendix F). Along the northern and southern sides of the grid, a measuring tapeline was laid and colored PVC flags were placed at integer meter positions. Every even meter, odd meter, 5 m, and 10 m location had a specific color. These colored flags were then used as endpoints for the relative south-to-north transects that were traversed in the geophysical surveys.

Note that the location of significant features within the grid that could impact data quality or interpretations (e.g., trees, boulders and walls) were measured also with the total station. In addition, selected points were occupied at approximate 5-m intervals within the grid to provide topographic information. A tabulated listing of the coordinates of all land survey data is contained in Appendix F.

4.0 GEOPHYSICAL METHODOLOGIES

The use of geophysical methods in support of archaeological investigations is widely established (e.g., Gaffney and Gater 2003; Linford 2006). For the present study, GPR and FDEM surveys were conducted. Summarized below are the site conditions and methodologies that were employed.

4.1 Site Conditions

The soil in the Fowler-Clark property is classified as "Urban Land", which consists of excavated-and-filled material that is considered to be non-prime farmland (Map Unit Symbol 602, Soil Map MA616, Norfolk and Suffolk Counties, Massachusetts; www.websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx). The area is rated highly suited for GPR with anticipated minor attenuation of radar energy (Doolittle 2009). Within the grid that was surveyed, the ground surface is mainly grass but includes a partially stone-paved driveway. The presence of several trees was the main physical obstruction within the grid. Note that prior to surveying, an extensive amount of above-ground and partially exposed debris (e.g., branches, rocks, trash, metallic objects, etc.) was removed to facilitate data collection and to improve geophysical data quality. Some notable items of trash included recently shallow buried cans of pet food—detected with a metal detector—and scraps of carpets, both of which attest to the excavated-and-filled nature of the classified soil.

4.2 Ground-Penetrating Radar

4.2.1 Equipment and Field Procedures

The GPR survey was performed using a Malå X3M system that was equipped with a 500 MHz antenna (Figure 5). Data were collected at a vertical scan interval of approximately 0.02 m along parallel contiguous transects that were separated by 0.25 m. (10 inches). The data collection was guided by stretching a fiberglass measuring tape between the endpoints of 1-m spaced transects. However, the actual location along a given transect was determined by using a calibrated wheel attached to the antenna. The survey was conducted in a uni-directional manner (i.e., from southeast to northwest relative to the state-plane orientation). In total, 434 radar profiles were collected and 6,325 linear meters (20,750 linear feet) were traversed for the survey. Figure 6 shows the approximate locations of the radar profiles.

Figure 5. Photo of GPR surveying with the Mala X3 equipped with a 500 MHz antenna.

Figure 6. Map of gridded area showing the approximate location of radar profiles.

4.2.2 Data Processing

The data were processed using GPR-Slice software (see www.gpr-survey.com; Goodman, et al. 1995; Goodman, et al. 2008; Goodman, et al. 2007). The raw vertical scan data were gained, resampled and filtered (background removal and boxcar) to produce processed 2-D radargrams. On these radargrams, the presence of strong reflectors is indicated by a black-and-white banding pattern. Note that the raw data were collected in terms of the two-way travel time of reflected energy. To convert to a depth scale, a radar wave velocity of 0.087 m/ns (0.29 ft/ns) was assumed based on standard curve matching of a few hyperbolas that were identified in the data. The processed radargrams were next combined to produce a pseudo three-dimensional (3-D) data set. A total of twenty horizontal depth-slice images of approximately 0.12 m (4.7 inches) with 10% overlap were generated to provide detailed spatial information on the location and depth of reflectors. These depth-slice images were then incorporated into the GIS database. Appendices D and E contain the radargrams and the depth-slice images, respectively.

4.3 Frequency-Domain Electromagnetic Surveying

4.3.1 Equipment and Field Procedures

The FDEM survey was performed over the same grid using a GF Instruments CMD Mini-Explorer that operates at 30 kHz over three separate dipole lengths (0.32, 0.71, and 1.18 m [13, 28, and 46 inches]; Figure 7). Data were collected in the vertical dipole mode at a sampling rate of 10 Hz, which yielded a measurement spacing of approximately 0.06 m (2.4 inches) when walking at a normal pace. The instrument was oriented parallel to the transect direction with the sensors located a few centimeters above the ground surface. The survey was conducted in a uni-directional manner from southeast to northwest. Note that data collection was guided by PVC flags that were mostly placed at 3-m intervals (in the backyard 5m) along selected transects. The location of stations was determined by fiducial markers, which were placed into the data stream by the operator and assuming linear interpolation between markers. Both quadrature phase (bulk ground conductivity) and in-phase (proportional to bulk ground magnetic susceptibility) components were recorded for each of the three dipole lengths, resulting in more than 201,200 combined measurements for each of the two components.

4.3.2 Data Processing

The data were initially processed to properly adjust the starting and ending locations of transects which in some instances did not exactly fall on a 3-m interval. The data were then processed using Oasis Montaj mapping software to produce color-contoured maps (see Appendix F). These maps were then incorporated into the GIS database.

Figure 7. Photo of FDEM surveying with the CMD Mini-Explorer.

5.0 GEOPHYSICAL INTERPRETATIONS

The processed GPR and FDEM data were inspected to identify anomalous areas (see Appendix A for discussion of anomalies). Specifically, the 2-D radargrams were collated and analyzed in order to pick coherent and contiguous reflections—i.e., those reflections that are directly traceable from one radargram to adjacent radargrams which could be due to buried features. The annotated (interpreted) radargrams are presented in Appendix D; representative radargrams of interest and an overlay (composite) depth-slice image are presented in Figures 8 and 9, respectively. Note that the radargrams are color coded to facilitate comparisons between the appendix, table and figure. Additionally, Figures 10 and 11 depict color-contoured maps of bulk ground conductivity and in phase for the longest dipole from FDEM surveying. The major interpretations from geophysical surveying are summarized in Table 2.

The archaeogeophysical investigation was successful in identifying large areas that are interpreted to be without archaeological integrity. Specially, the backyard (north, centered on E325 N350) seems entirely disturbed in the upper layers and this conclusion is reinforced by deep compacted surfaces ridge like anomalies that are probably the result of substantial earth moving equipment activity (see Figures E3 and E4). That substantial change has occurred in the backyard is reinforced by the appearance of numerous small pieces of metal at various depths (e.g., Figure D14). The southwestern portion of the yard front yard (e.g., E315, N305) seems to have little coherence to the geophysical readings and therefore the area is most likely without much archaeological integrity. Finally, the small raised yard just to the north of the main house (centered on E335, N337) seems to have little coherence to the FDEM readings (no GPR survey was conducted) and is in all likelihood composed of disturbed fill.

The archaeogeophysical investigation was successful in identifying several anomalous areas that are due to the presence of below-ground features, two of which are archaeological. These features include TE#3, a northeasterly dipping compacted surface or boundary layer in the southeastern portion of the property (depth: 0.5 – 1.3 m [1.6 – 4.3 ft]; red outline), a strong but localized reflector (TE#2) that lies between the driveway and the stable (depth: 0.5 – 0.9 m [1.6 – 2.9 ft]; pink rectangle), a relatively recent trench-and-fill area (disturbed fill) in the northwestern portion of the property (black outline), compacted surfaces attributed to pathways from the entrance of the farm house and to vehicle parking adjacent to the present-day driveway (depth: near surface; brown lines and light blue rectangle, respectively), two buried pipes (most likely including a water line) that connects from Hosmer Street to the eastern corner of the farm house (depth: 1.0 – 1.3 m [3.3 – 4.3 ft]; black dashed lines), and a probable pipe that connects from Norfork Street to the southern corner of the farm house (depth: 1.4 – 1.5 m [4.6 – 4.9 ft]; black dashed line). TE#1 had such a substantial amount of metal that any archaeological features might be obscured a (depth: near surface; yellow rectangle, Figure 12). A second area with a smaller concentration of metal was also detected in the southwestern portion of the property (Figure 12 depth: near surface; purple rectangle at N303 E303) that does not need to be investigated prior to activity.

Table 2. Interpreted below-ground features associated with geophysical anomalies.

Interpreted Feature	Color Code(1)	Approximate Depth	Comments
Driveway/Stone Pavement	Blue	Near surface	
Parking Area on Grass	Light Blue	Near surface	
Driveway (unpaved)	Green	Near surface	
TE#3 - Surface or Boundary Layer (Shallow)	Red	0.5 – 1.3 m [1.6 – 4.3 ft]	
Surface or Boundary Layer (Deep)	Red	1.0 – 1.7 m [3.3 – 5.6 ft]	
Strong Reflector (TE#2)	Pink	0.5 – 0.9 m [1.6 – 2.9 ft]	
TW#1	Yellow	Near surface	GPR and In-phase data
Concentration of Metal	Purple	Near surface	In-phase data
Two Pipes	Black (Dashed)	1.0 – 1.3 m [3.3 – 4.3 ft]	Hosmer Street to eastern corner of farm house; profile perpendicular to pipe orientation
?Pipe?	Black (Dashed)	1.4 – 1.5 m [4.6 – 4.9 ft]	Norfolk Street to southern corner of farm house; profile parallel to pipe orientation
Pathway	Brown	Near surface	Front of farm house to driveway
Pathway	Brown	Near surface	Front of farm house to Norfolk Street

1 Figures 8, 9 and 12; and annotated radargrams in Appendix D

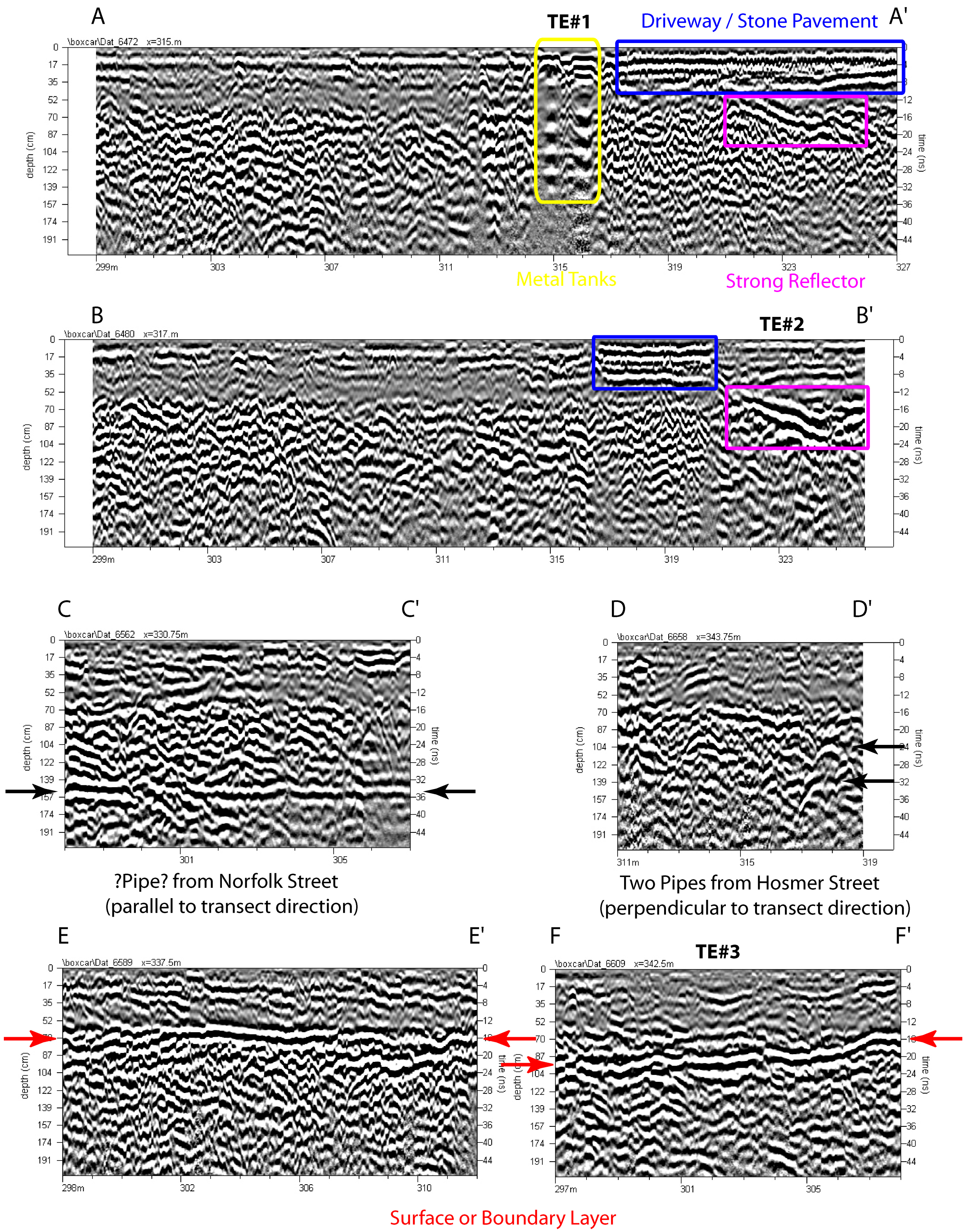

Figure 8. Representative annotated radargrams of interest. See Figure 9 for location of profiles.

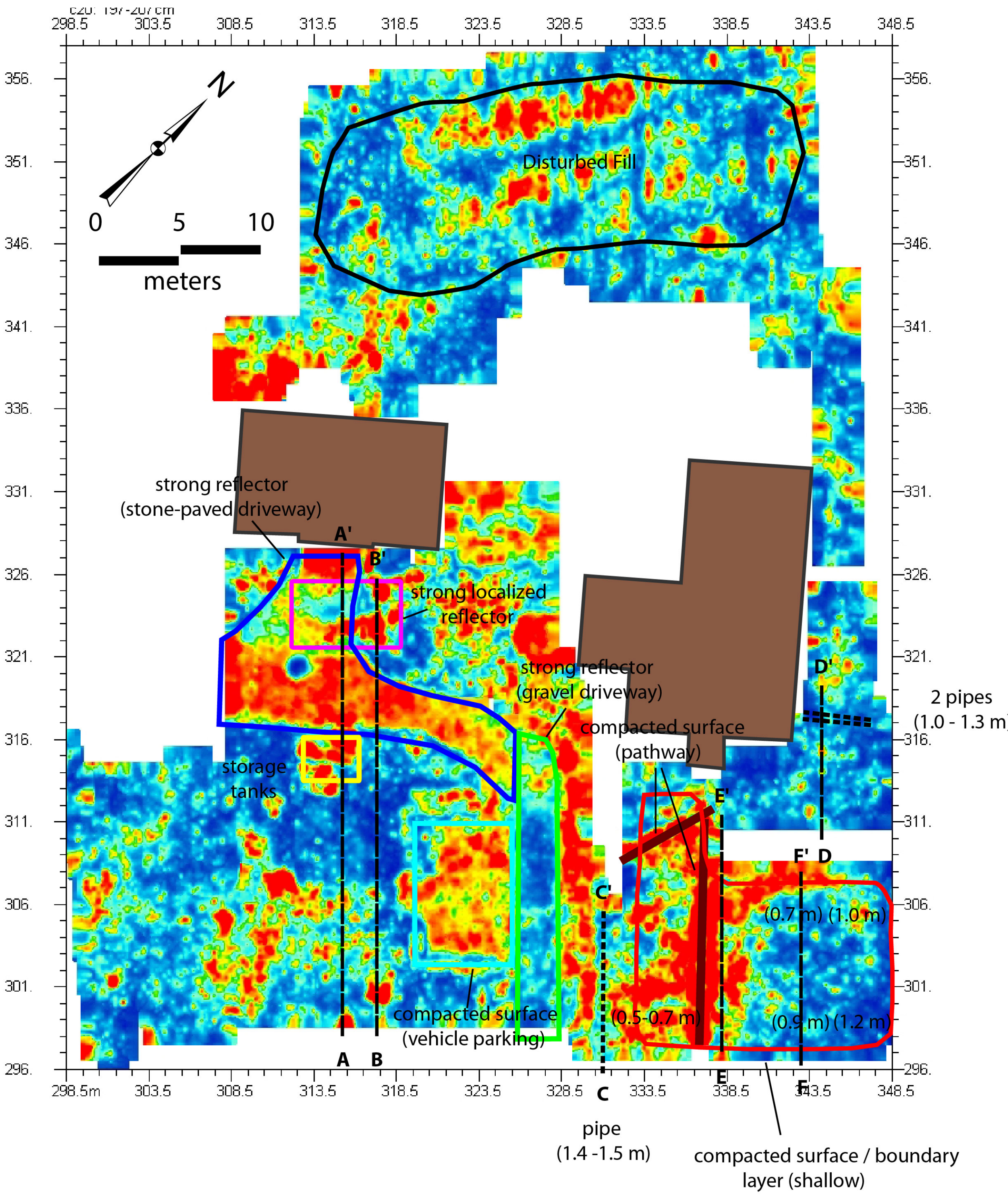

Figure 9. Overlay (composite) depth-slice image for the intervals 0.1 – 0.23 m (0.33 – 0.75 ft), 0.21 – 0.33 m (0.69 – 1.08 ft), 0.62 – 0.75 m (2.03 – 2.46 ft), and 1.97 – 2.07 m (6.46 – 6.79 ft). Strong reflectors are shown in red. The locations of various features are shown, as interpreted also on the radargrams presented in Appendix D.

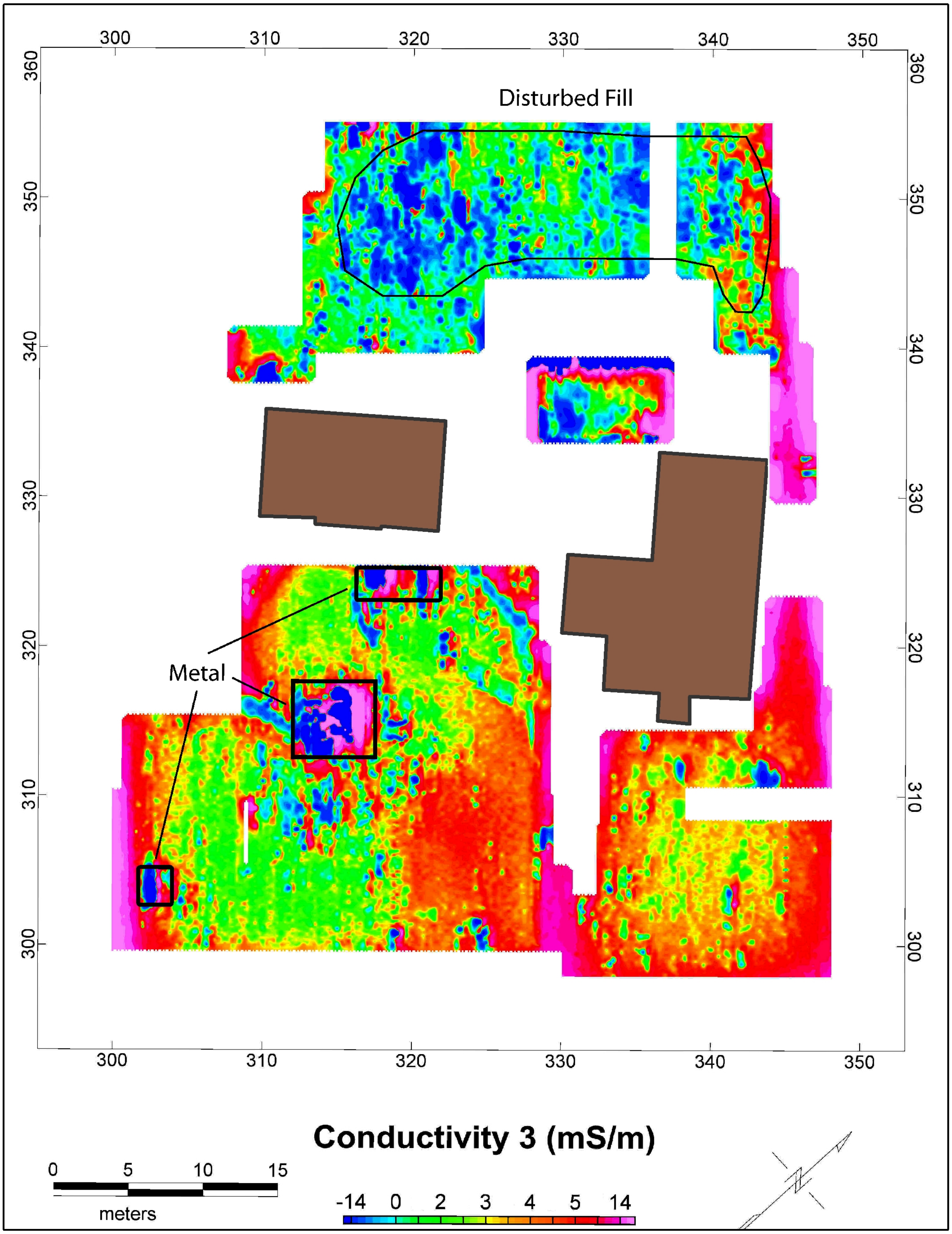

Figure 10. Color-contoured map of bulk ground conductivity for the longest dipole.

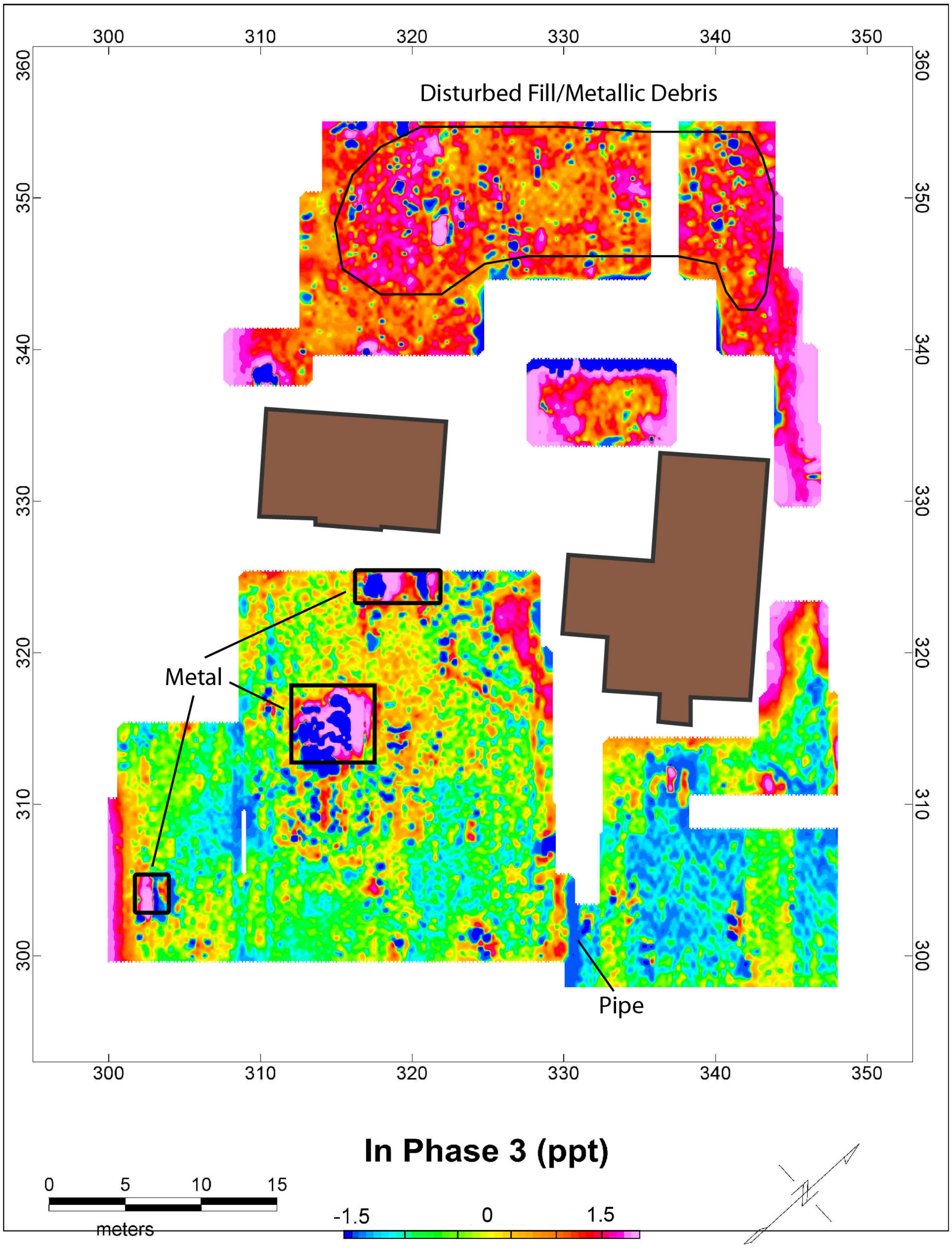

Figure 11. Color-contoured map of in phase for the longest dipole.

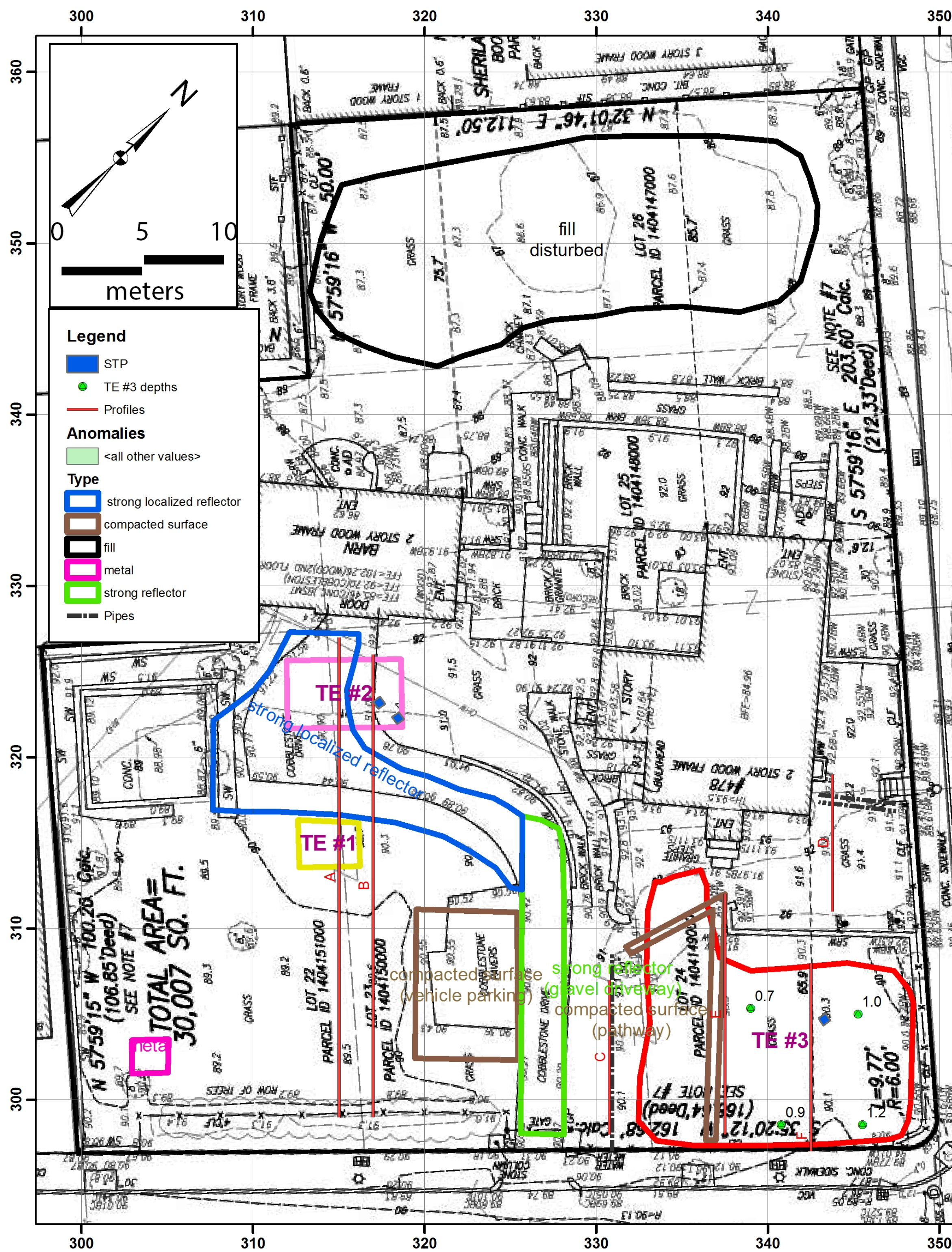

Figure 12. Summary of geophysical interpretations and recommendations for location of excavations for the intensive survey.

6.0 ARCHAEOLIGCAL RESULTS

The Geophysical survey was followed up in three areas with small excavations. These excavations took place under Massachusetts Historical Commission Permit Number 3555. The shovel test pits revealed that there are, in fact, two small, very deep layers that are preserved, potentially from the earliest occupations. The three areas that were investigated, are labeled in Figure 12 as TE#1, TE#2, & TE#3.

TE#1 was only partially explored. It was investigated because there was so much metal, any archaeological signatures would be overwhelmed. Upon investigation, the area consisted of two rebar reinforced cement rectangular boxes, 2 x 1.5 m each, that share a central long wall. The northwest bay was filled with modern trash, with a predominance of cat food cans, 8 track tapes, and turntables. It was mostly cleaned out during testing. The southeast bay was capped with a 7 cm think concrete slab and was not excavated. Small holes in the concrete slab suggested a void space under the southeast bay. There is no suggestion of preserved archaeological remains in TE#1.

TE #2 was explored with two test pits. The first one (STP#1 E203882.0, N892237.0) presented with a galvanized pipe at 40 cm bgs, which clearly had disturbed the entire deposit. The excavation was terminated at 40 cm. No artifacts were collected.

The second shovel test pit into TE#2 (STP#2, E233882.6, N892238.3), was placed 1 m northeast of STP 1. Level 1 (CXT 3, 0-20 cm bgs) was not screened, but a large modern metal rod was identified. Level 2 (CXT 4, 20-40 cm bgs) had brown soil, disturbed and poorly sorted rocks. The level contained nails and other non-descript artifacts. Level 3 (CXT 5, 40-60 cm bgs) was similar to level 2, except that it had more artifacts, including a few ceramics. Level 4 (CXT 6, 60-68 cm bgs) also had some ceramics, considering it was only an 8 cm layer. Level 4 was terminated because a distinct and dense layer of coal and coal ash was encountered (Figure 15). Level 5 (CXT 7, 68-75 cm bgs) had the highest number of artifacts collected (Table 3), but most of them were fuel residue. It was a dark black layer (Figure 16) that probably represents an ash dump. This layer 5, at 68-75 cm bgs, is almost surly the layer identified in the GPR as TE#2. Judging from the layers geometry, this is not an ash pit, but rather a preserved, layer. In fact, the driveway cobblestones go over this layer and may have helped to preserve it. Below that layer that was level 6 (CXT 8, 75-88 cm bgs) which may be an original ground surface, although it contained a fair amount of charcoal residue. There are likely preserved and significant archaeological deposits between 65 and 90 cm bgs over the TE#2 area. This archaeological deposit will not be affected by the planned farming/gardening regime proposed for the property.

TE#3 (E233915.2, N892249.7) was explored with one test pit (STP#3) that had a brown, mixed, rocky, poorly sorted, and low artifact density deposit for the top 60 cm (Levels 1-3, CXT 9, 10 & 11, Figure 17). Level 1 was not screened and no artifacts were recovered. Level 2 had some window glass, as well as plastic. Level three was similar, with some curved glass. Level 4 (CXT 12, 60-79 cm bgs) had relatively few artifacts but a pipe stem with a 4/64 in bore. While level 4 contained a number of rocks, it was better sorted than other layers. Under this layer, Level 5 (CXT 23, 79-90 cm bgs) is a potential preserved surface or early deposit. The rich organic black/brown layer was not overly greasy or thick (11 cm), but does seem to be a distinct layer (Figure 18), although it did not contain any artifacts. This layer 5, at 79-90, is almost surly the layer identified in the GPR as TE#3. There are likely preserved and significant archaeological deposits between 60 and 90 cm bgs over the TE#3. This archaeological deposit will not be affected by the planned farming/gardening regime proposed for the property.

Table 3. Artifact counts from with contexts and depths from the three shovel tests.

Unit	Levels	Depth (cm bgs)	Context	Total Artifacts
1	1	0-20	1	0
1	2	20-40	2	0
2	1	0-20	3	1
2	2	20-40	4	11
2	3	40-60	5	14
2	4	60-68	6	15
2	5	68-75	7	23
2	6	75-88	8	14
3	1	0-20	9	0
3	2	20-40	10	10
3	3	40-60	11	5
3	4	60-79	12	3
3	5	79-90	13	0

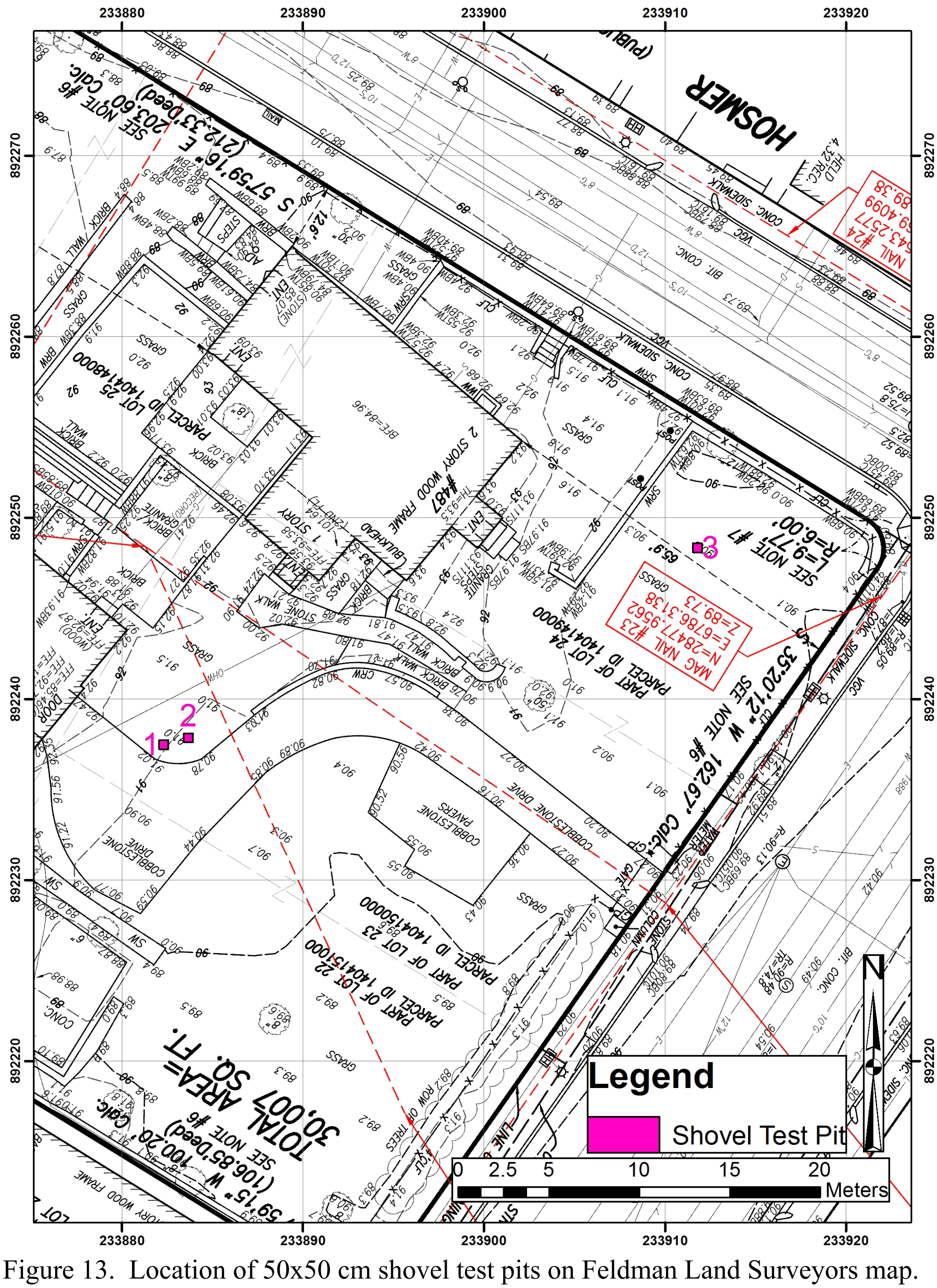

Figure 13. Location of 50x50 cm shovel test pits on Feldman Land Surveyors map.

Figure 14. Location of 50x50 cm shovel test pits on air photo.

Figure 15. Overehad photo (with north up) of the 50 cm in diameter STP#3 in TE#2 showing the surface at 70 cm (28 in) down, after cutting through the ash layer.

Figure 16. West wall ot STP #2 showing the 7 cm thikc ash layer, identified in the GPR as TP#2.

Figure 17. Photo, looking west, of 50 cm diameter STP #2, into the area labled TE#3, showing the organic layer identified in the GPR.

Figure 18. Photo of STP#3, looking west (20 cmn long knife pointing north) showing top of preserved surface (level 5) identified as TE#3 in the GPR.

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DISCLAIMER AND SIGNATORY OF REPORT

GPR and FDEM are geophysical methods that provide a means to interrogate structures and features that are buried in the shallow subsurface. The methods have been widely used in archaeological applications. These methods, like all geophysical methods, however, have their limitations. Specifically, existing (background) soils that contain a high percentage of silt and clay may significantly reduce the penetration of GPR energy and thus render the method ineffective. In addition, conditions can arise such that there is no measureable geophysical contrast to detect *even* when an archaeological feature is present. Although the equipment and data processing software that were used are the best available technology, and the field procedures that were used are typical for such investigations, the detection of buried features cannot be guaranteed.

Having the opportunities to collect, to process and to interpret the GPR and FDEM data, I believe that the subject work was properly and appropriately conducted in accordance with industry standards. Interpretations and conclusions provided in this report are supported by the data.

______________________________ Date: March 20, 2015

Brian N. Damiata, PhD

California Registered Geophysicist, #1069

APPENDIX A – ARCHAEOGEOPHYSICS PRIMER

In general, various well-established geophysical methods are available that can be used to interrogate the subsurface. Each method is designed to measure a specific property of the subsurface (e.g., electrical, electromagnetic, magnetic or seismic). Changes in measurements can occur if a given physical property of a buried feature or object is significantly different than its surroundings. The goal of geophysical surveying is to determine what lies in the subsurface by collecting non-invasive measurements along the ground surface. The usefulness of geophysical surveying is that large areas can be covered relatively quickly and inexpensively.

Archaeogeophysics is the application of geophysical methods to archaeological settings. More specifically, archaeogeophysics involves the interpretation of geophysical signatures (i.e., changes in measurements that are interpreted as “anomalies”) that may be due to buried archaeological sites and features. In some cases, archaeological features, artifacts and ecofacts can be located and partially analyzed based on their geophysical signatures. Geophysical surveying with specific emphasis on the shallow subsurface (i.e., upper few meters) has been particularly useful in understanding landscape features such as gardens (Cole, et al. 1997; Yentsch and Kratzer 1994) and cemeteries (Jones 2008; King, et al. 1993) that cover too large an area to be completely excavated.

Archaeogeophysics is not an exact science (Johnson 2006) as all geophysical methods have their limitations. The detectability of a feature depends on its size, geometry, depth, and geophysical contrast in relation to its surroundings. Small differences in the environment (e.g., soil moisture, surface cover, changes in ambient temperature) can affect geophysical measurements, and therefore change the nature and shape of the interpreted anomalies. Conditions can arise also such that there is no measureable contrast to detect, even when a distinct feature is present. Furthermore, the detection of an archaeological feature in one environment may not occur in another environment where the physical properties are different.

Note that a geophysical anomaly is a general term for any area that exhibits a significantly different change in measurement—and therefore a change in the physical property that is being measured—as compared to the surrounding environment. Defining an anomaly, however, is subjective. In addition, the causes of an anomaly can be either natural (such as a glacial erratic) or artificial (such as a wall or burial). By collecting a series of contiguous parallel profiles, an assessment can be made as to whether there is any geometry associated with an anomaly and then one can make an interpretation as to whether the cause is natural or man-made.

Archaeological interpretations based only on geophysical results have their limitations. While some anomalies are much more suggestive than others, there are no characteristic anomalies per se (i.e., different types of features can produce an identical geophysical signature). The most "accurate" interpretations are those that take into consideration the archaeological context, the geophysical context, any previous information from excavations, and comparisons with similar anomalies where those anomalies have been excavated at other sites with similar conditions. Whenever possible, interpretations should be ground truthed through archaeological excavations. Even small excavations of targeted geophysical anomalies can greatly enhance the overall accuracy of the interpretations. Similarly, the archaeogeophysical interpretations can help to guide the efficient placement of excavations.

APPENDIX B – BASIC PRINCIPLES OF GROUND-PENETRATING RADAR

GPR is an active non-destructive geophysical method that is used to image the shallow subsurface. In GPR, electromagnetic (EM) energy is pulsed through a transmitter antenna that is towed along the ground surface. As the energy travels through the ground and encounters distinct changes in electrical properties—specifically, the relative permittivity (E_R) which is a measure of a material's ability to store electrical energy—a portion is reflected back to the ground surface. It is the two-way travel time of the reflected energy that is recorded by a receiver antenna in the form of a single scan at the given location as schematically illustrated in Figure B1. A two-dimensional radargram is produced by combining all of the scans along a transect. The data from many radargrams can be further combined and horizontally sliced at specified time intervals to provide pseudo-three dimensional plan images that oftentimes are easier to interpret (see accompanying figures).

Of all the available geophysical methods, GPR provides the highest possible resolution for imaging the shallow subsurface. The ability to resolved buried features, however, depends partly on the center frequency of the transmitter antenna. Relatively higher frequencies (e.g., 800 MHz) have greater resolving capabilities but at the expense of less penetrating power as compared to lower frequencies (e.g., 500 MHz). The method works best in electrically resistive conditions such as dry sandy soils. In general, electrically conductive environments can severely attenuate the EM energy. The presence of water with high dissolved solids as well as water-retaining materials such as clay and silt, even in minor amounts, can severely limit the depth of penetration.

The use of GPR should be considered whenever the target of interest provides a distinct contrast in relative permittivity (air: $E_R = 1$, water: $E_R = 81$, dry soil: $E_R = 4\text{-}6$, wet soil: $E_R = 10\text{-}30$; rock/bedrock: $E_R = 5\text{-}8$) as compared to the surroundings and is sufficient in size to be detected. Typical targets include: buried stone walls and foundations, graves, site specific stratigraphy and soil thickness/depth to bedrock.

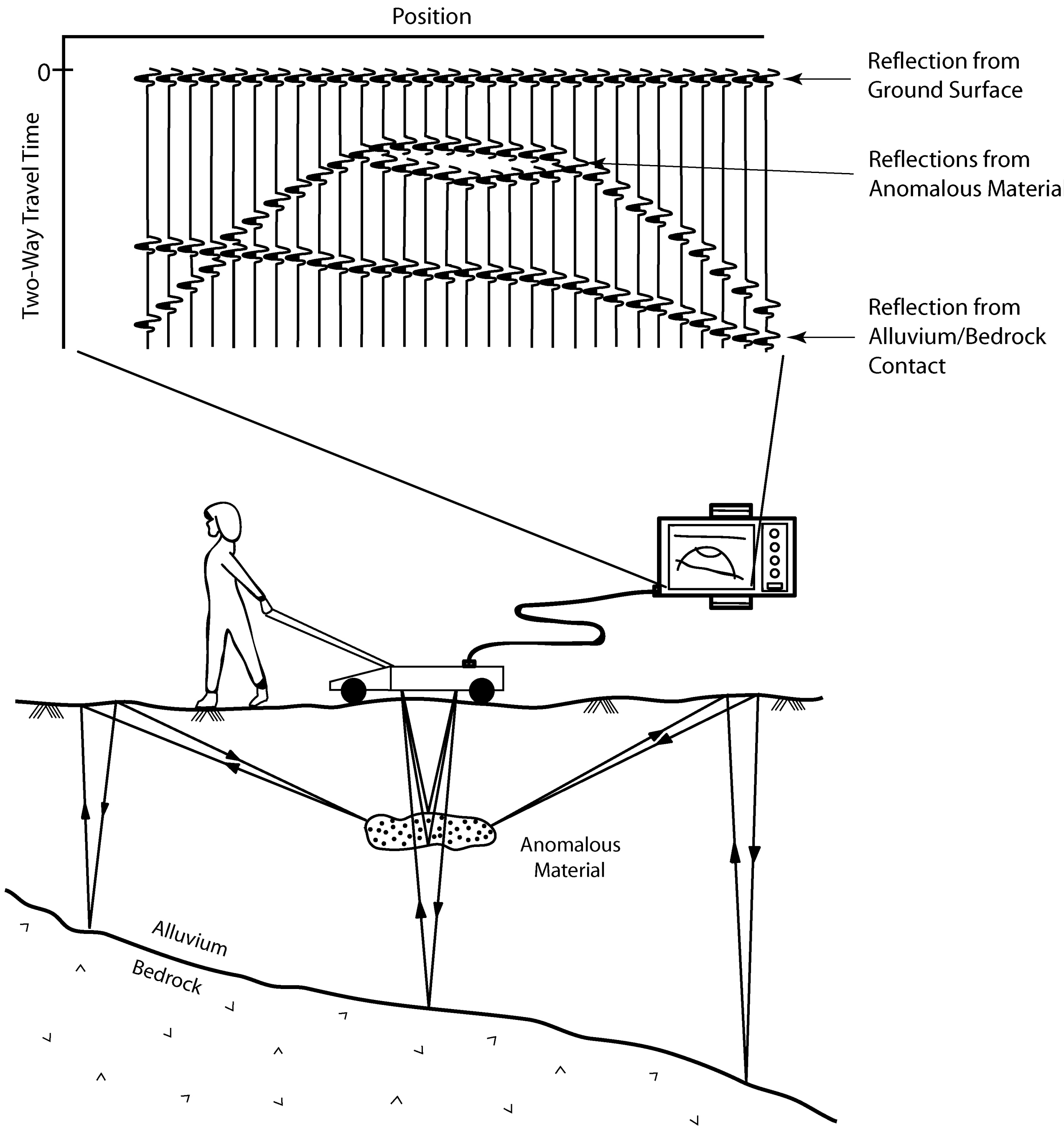


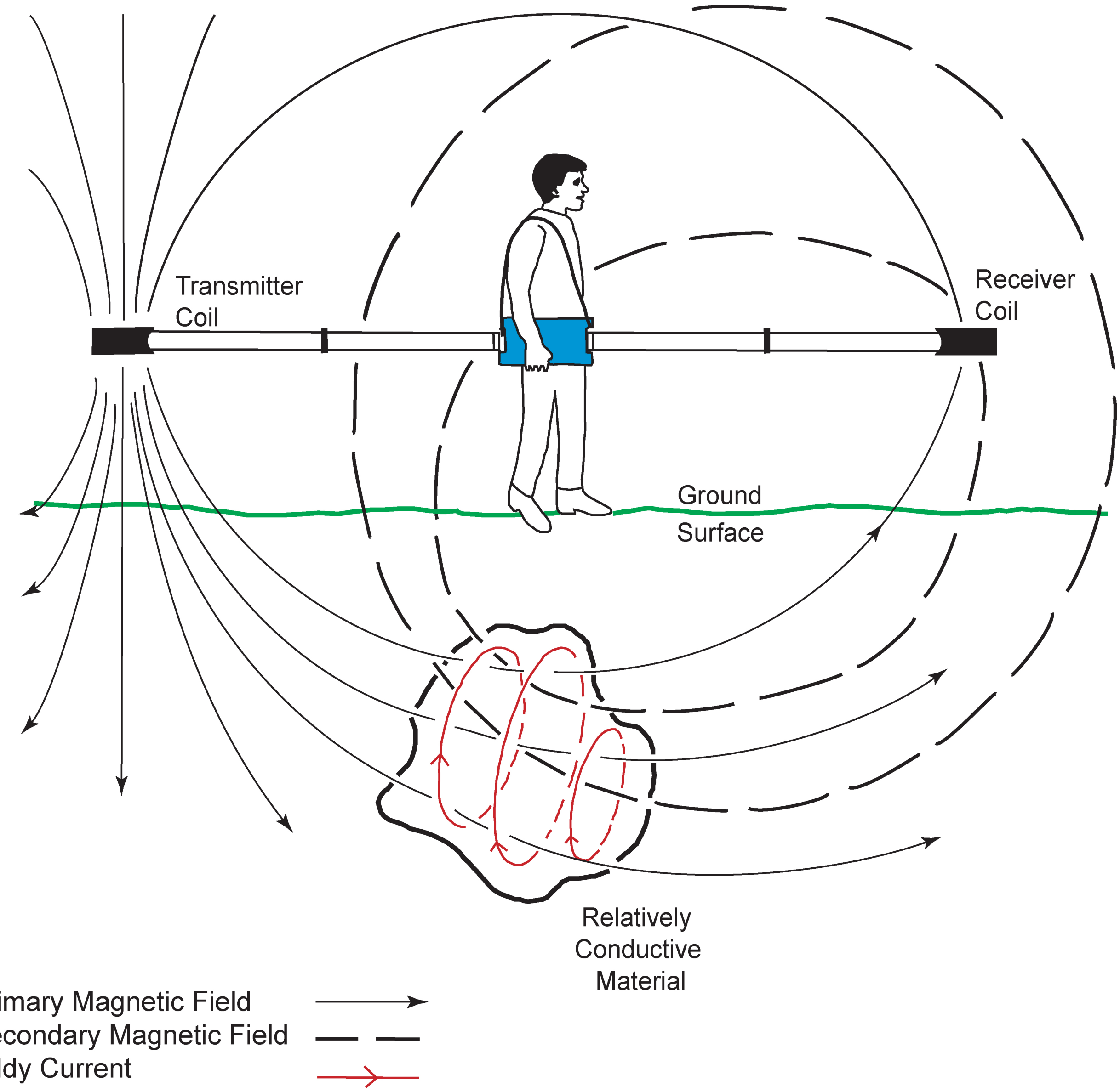
Figure B1. Schematic diagram illustrating the principles of GPR.

APPENDIX C – BASIC PRINCIPLES OF FREQUENCY-DOMAIN ELECTROMAGNETICS

The frequency-domain electromagnetic (FDEM) method is an active non-destructive geophysical method that is used to obtain shallow subsurface information. In the EM method, a time-varying magnetic field is generated by driving an alternating current through either a loop of wire or a straight wire that is grounded at both ends. Induced or eddy currents with flow within any conductive solid or fluid material that is present beneath the area of investigation. The eddy currents, in turn, generate their own magnetic fields such that at any point in space, the total magnetic field is the superposition of the primary field due to the source current and secondary fields due to the eddy currents, as schematically illustrated in Figure C1. By discriminating between primary and secondary fields, variations in the EM properties of the ground can be discerned.

EM instruments measure both out-of-phase (quadrature) and in-phase components of the induced magnetic fields. The former is a measure of the bulk apparent ground conductivity; the latter is related to magnetic susceptibility and is particularly sensitive to the presence of metallic objects. Bulk apparent ground conductivity reflects true conductivity when the subsurface is homogeneous and isotropic, which is rarely the case in practice. For heterogeneous conditions, it represents an integrated effect of the all the conductivity within the volume of ground being sensed. It does not, however, represent an average conductivity and in fact can be lower or higher than the lowest or highest subsurface conductivities, respectively. A lateral variation in the components is indicative of lateral changes in properties. The conductivity is particularly sensitive to fluid content and dissolved salts or ions. Accordingly, wet sands, clays and materials with high ion content generally have high bulk apparent ground conductivity; dry sands and crystalline rocks have low bulk apparent ground conductivity.

Ideally, EM surveys are conducted in archaeological investigations to find conductive targets in resistive environments such as middens and rammed-earthed walls. Although more subtle and difficult to detect, resistive targets such as buried stone walls and foundations can also be detected through EM surveying.



$$\sigma_a = \frac{2}{\pi f \mu l^2} \frac{H_s}{H_p} \qquad \text{(McNeill, 1980)}$$

σ_a = Apparent Ground Conductivity (mS/m)
f = Frequency
μ = Magnetic Permeability of Free Space
l = Intercoil Spacing
H_s = Secondary Magnetic Field
H_p = Primary Magnetic Field

Figure C1. Schematic diagram illustrating the principles of FDEM.

APPENDIX D – ANNOTATED PROCESSED RADARGRAMS

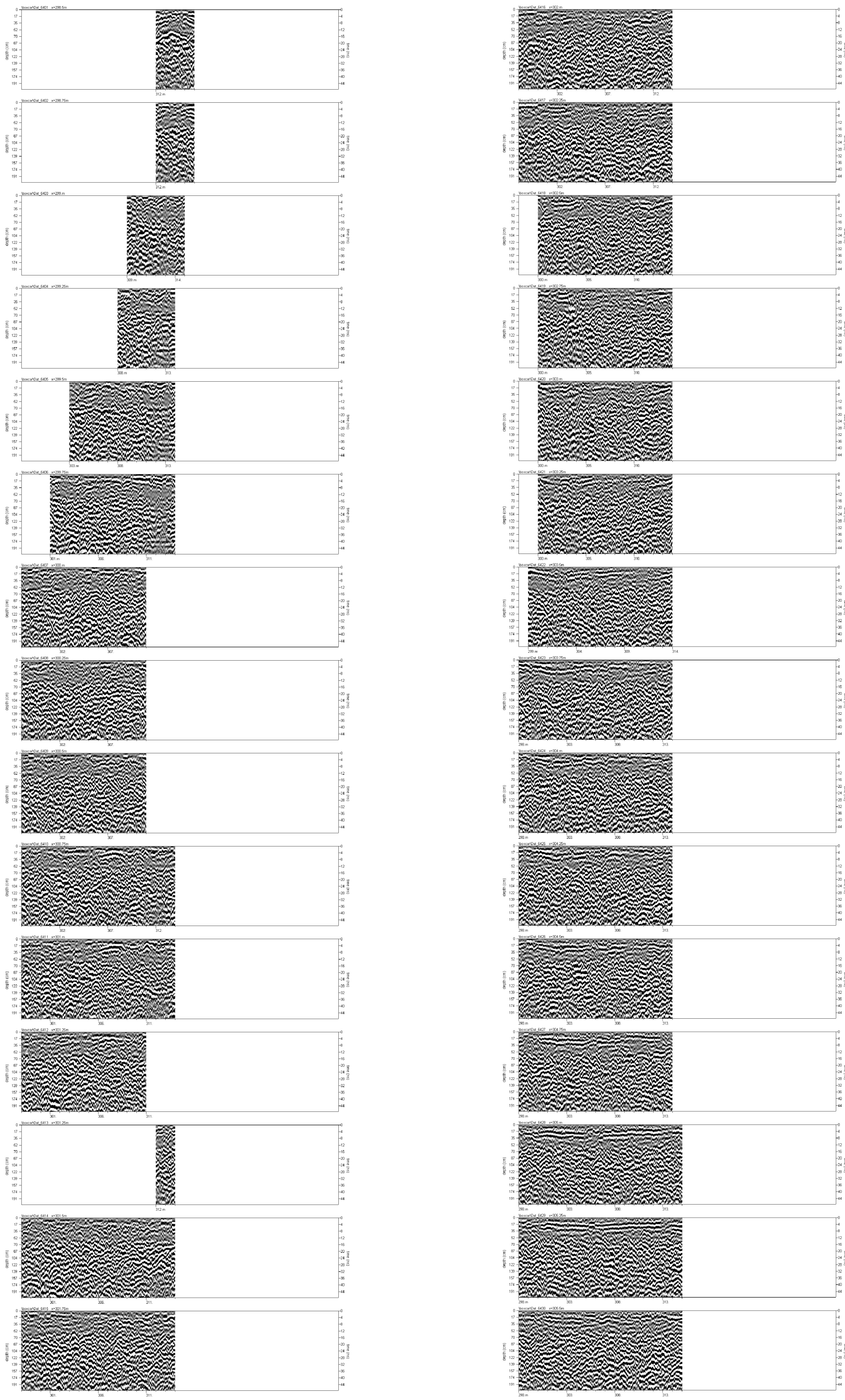


Figure D1. Annotated processed radargrams for front yard Transects X = 298.5 through X = 305.5 m.

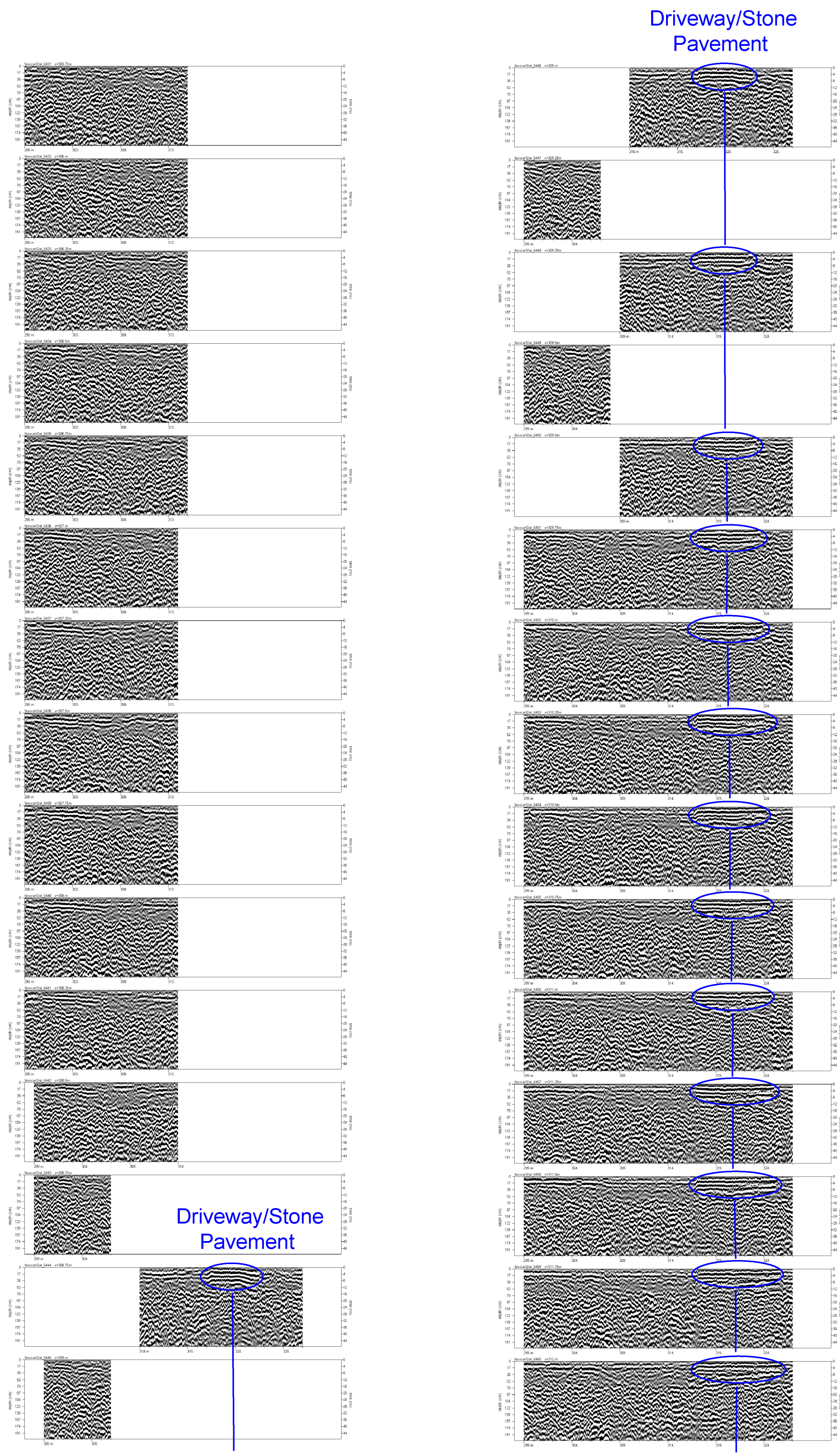


Figure D2. Annotated processed radargrams for front yard Transects X = 305.75 through X = 312 m.

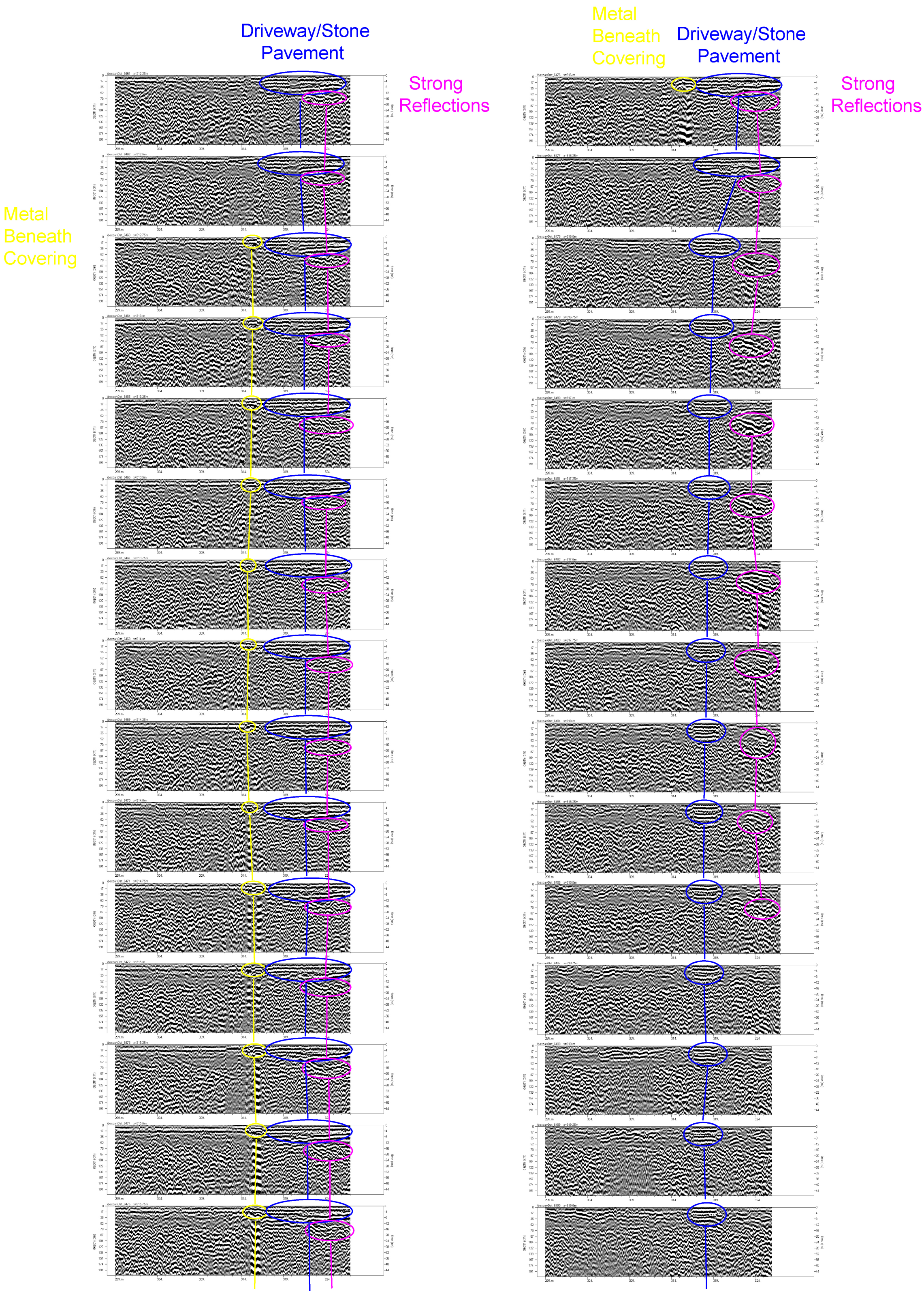


Figure D3. Annotated processed radargrams for front yard Transects X = 312.25 through X = 319.5 m.

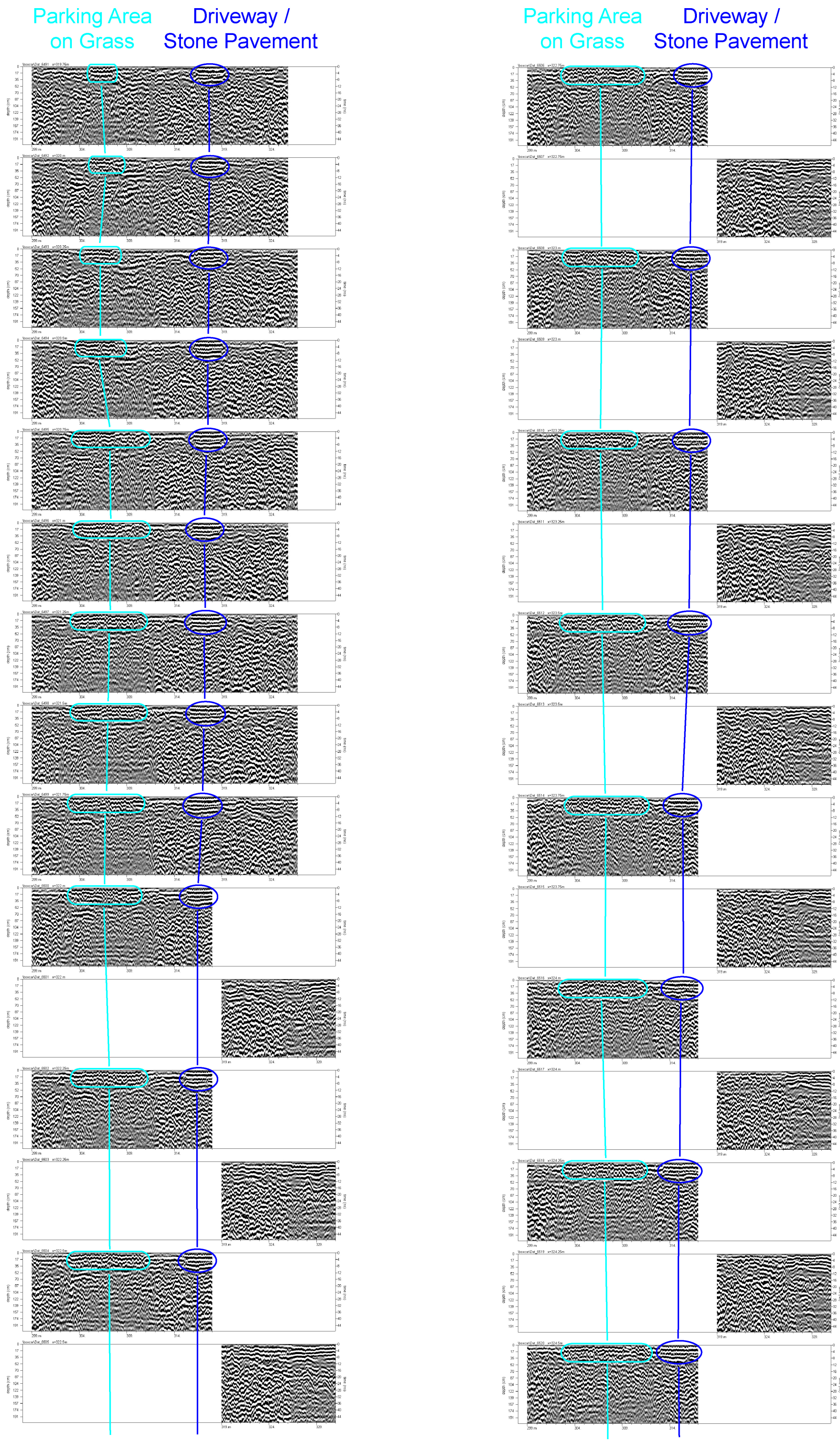


Figure D4. Annotated processed radargrams for front yard Transects X = 319.75 through X = 324.5 m.

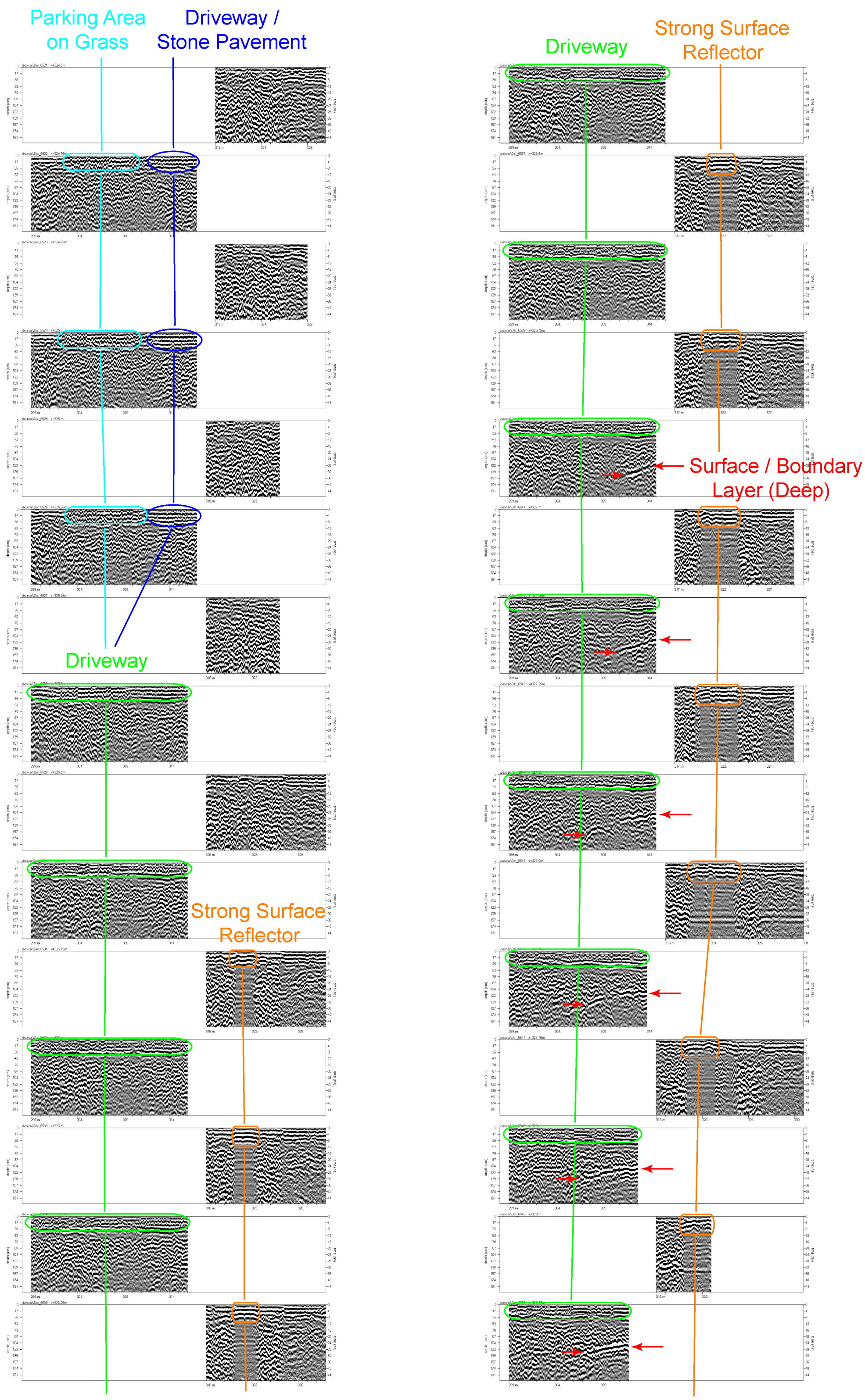


Figure D5. Annotated processed radargrams for front yard Transects X = 324.5 through X = 328.25 m.

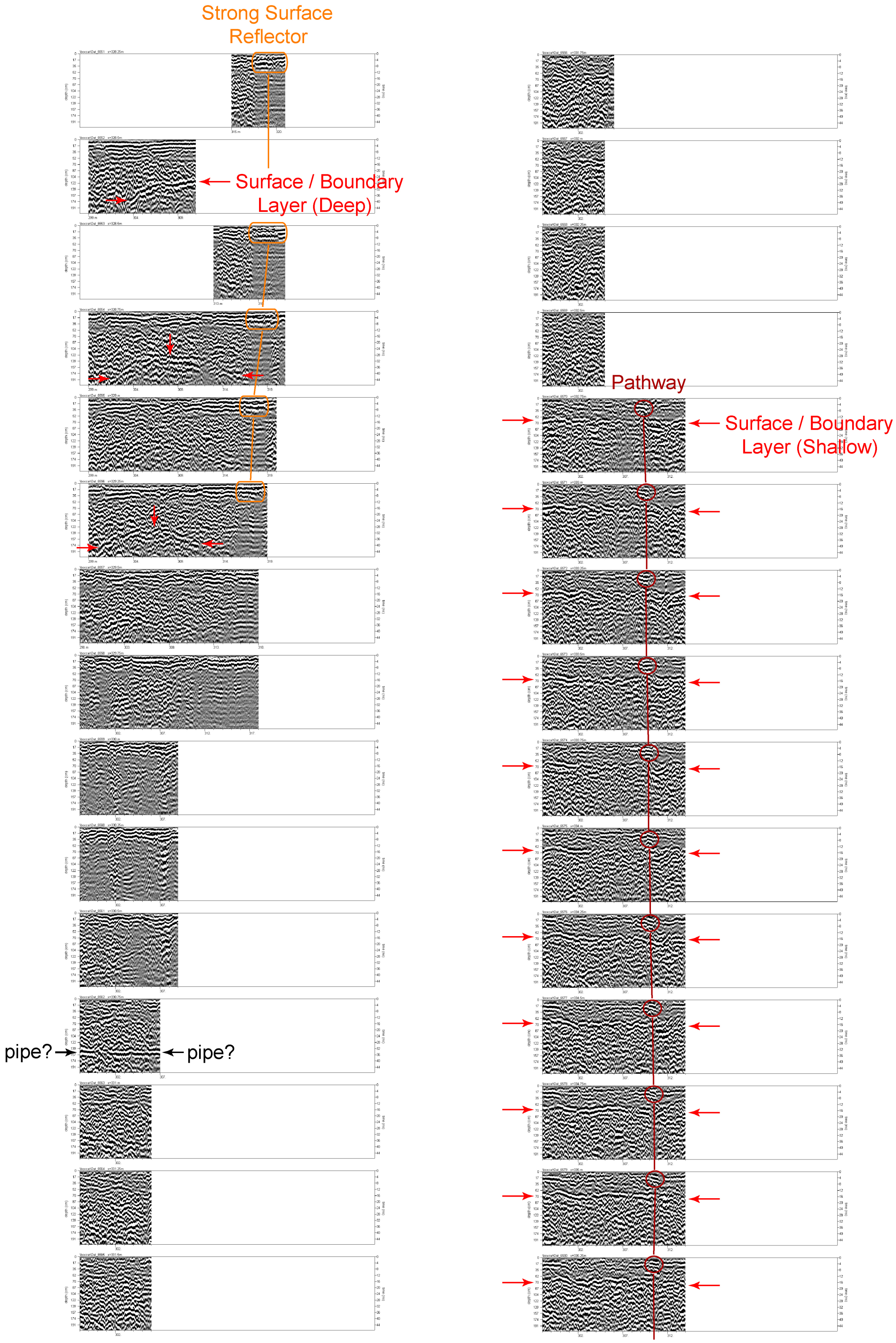


Figure D6. Annotated processed radargrams for front yard Transects X = 328.25 through X = 335.25 m.

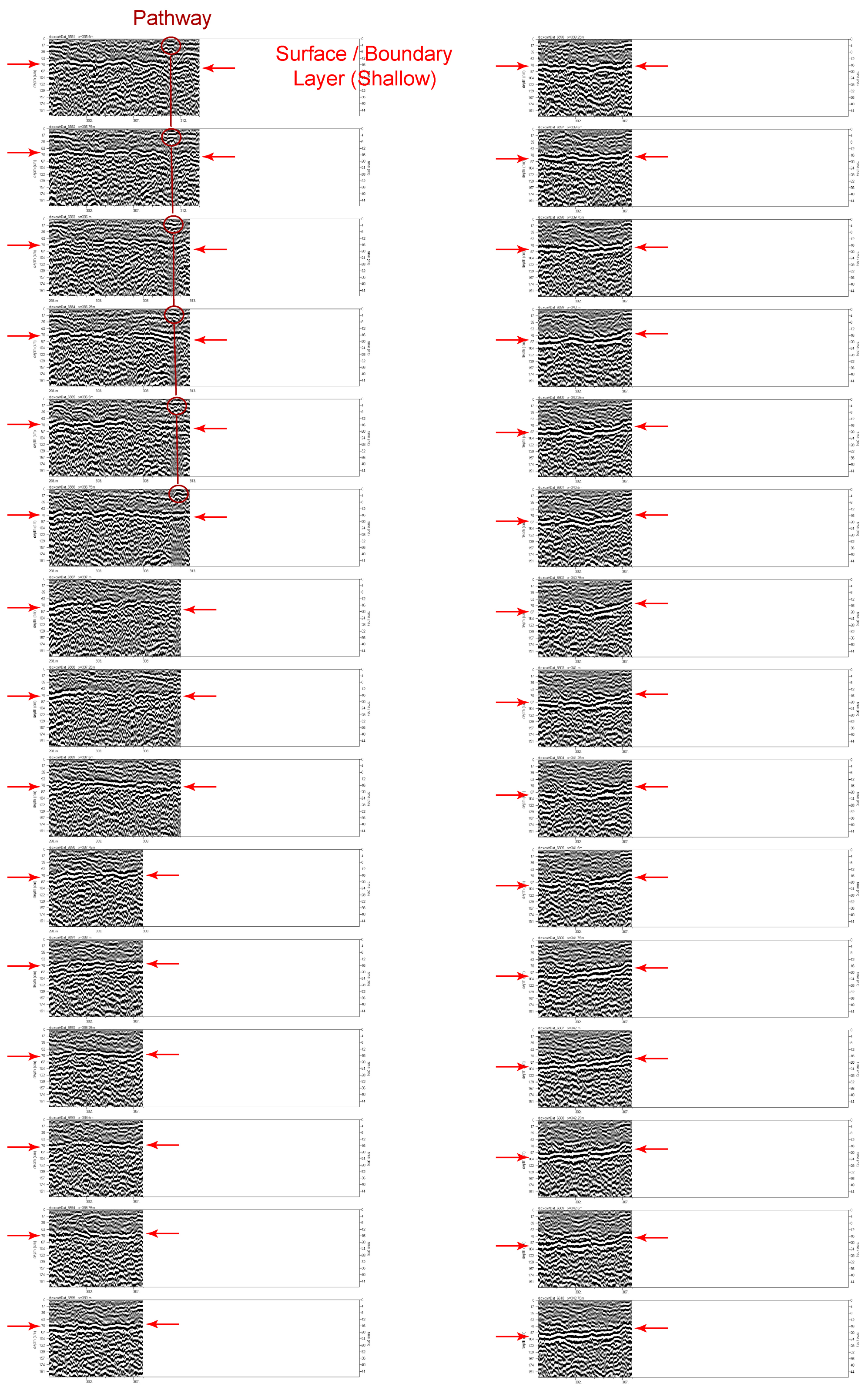


Figure D7. Annotated processed radargrams for front yard Transects X = 335.5 through X = 342.75 m.

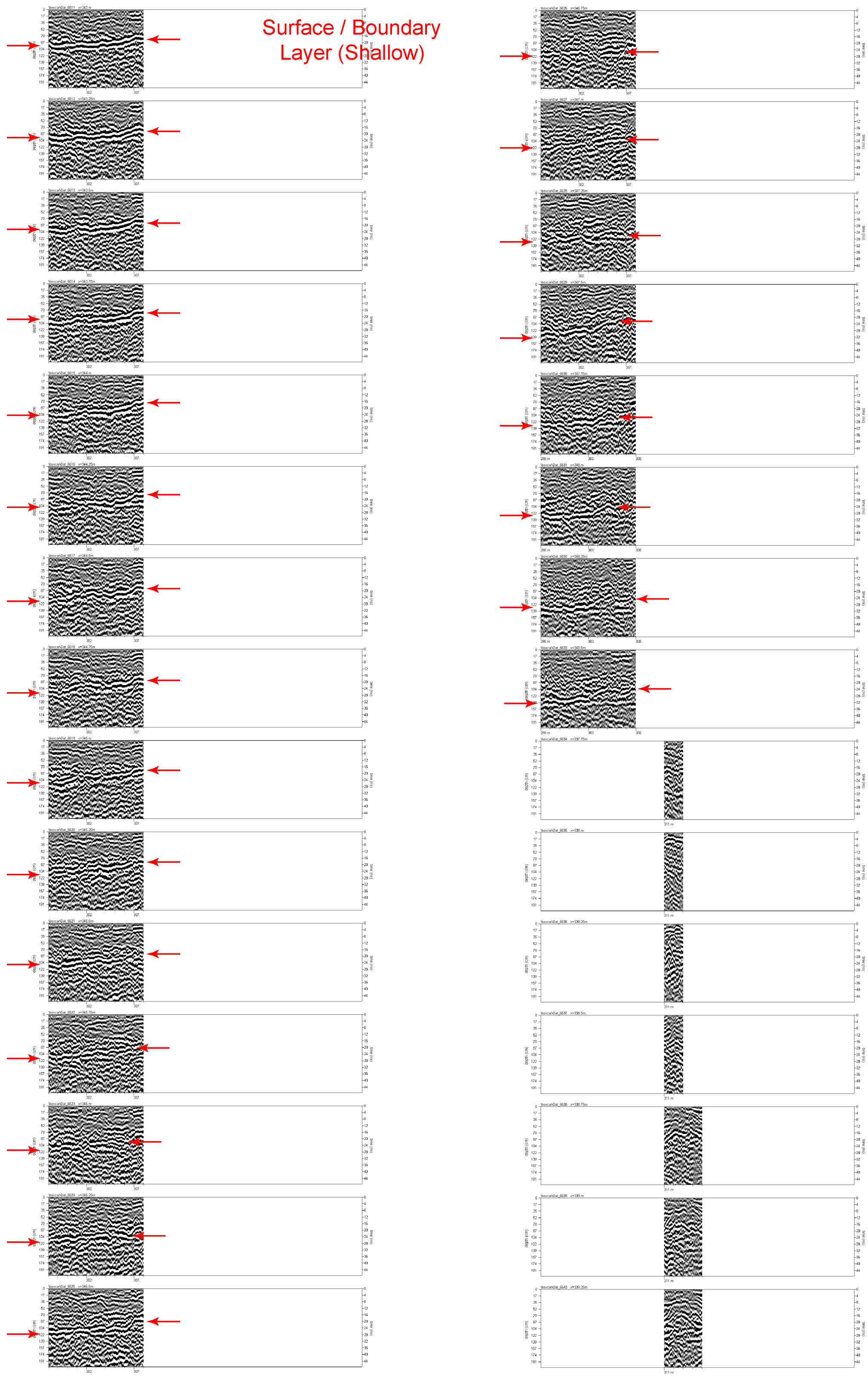


Figure D8. Annotated processed radargrams for front yard Transects X = 343 through X = 348.5 m and 337.75 through 339.25 m.

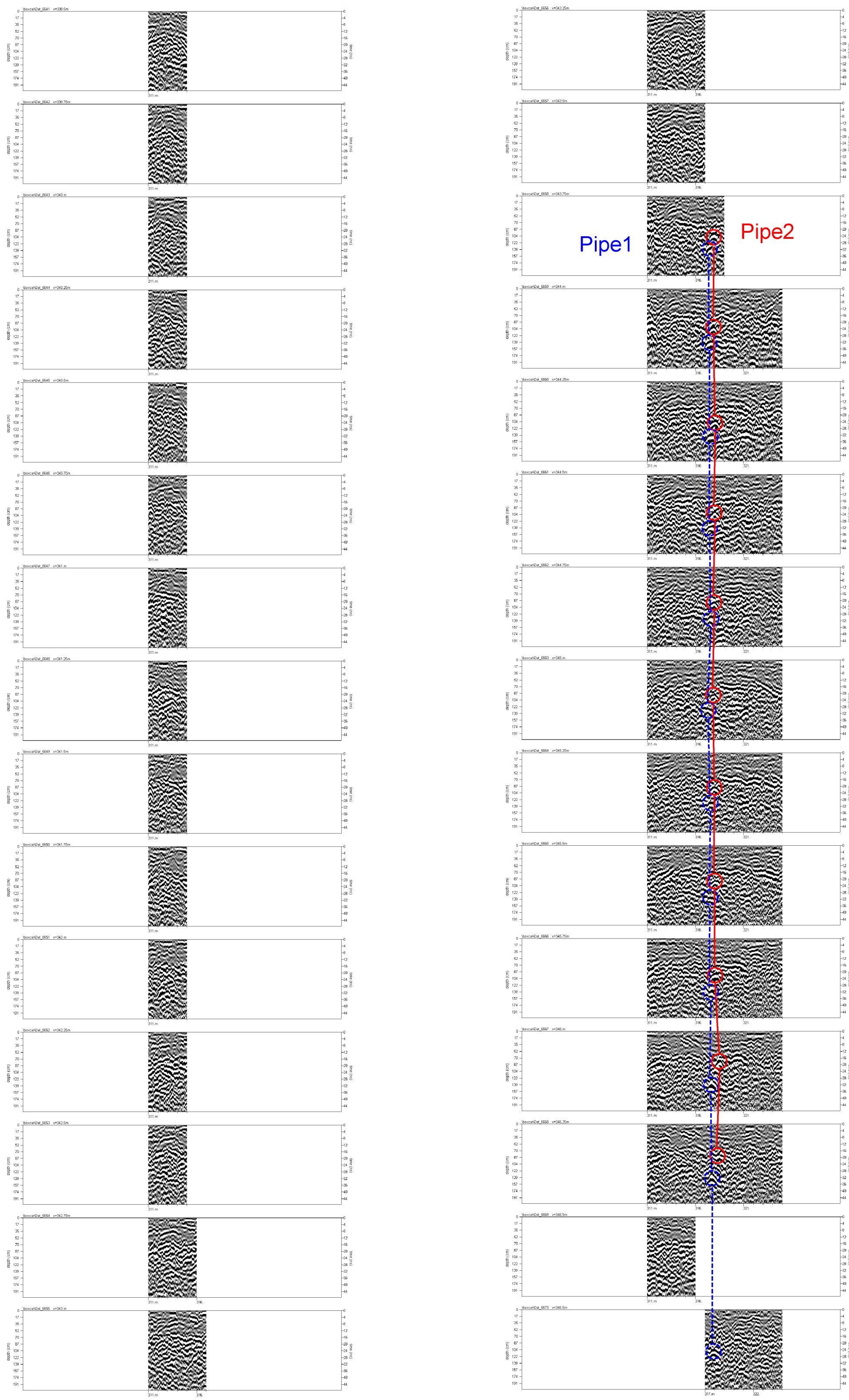


Figure D9. Annotated processed radargrams for front yard Transects X = 339.5 through X = 346.5 m.

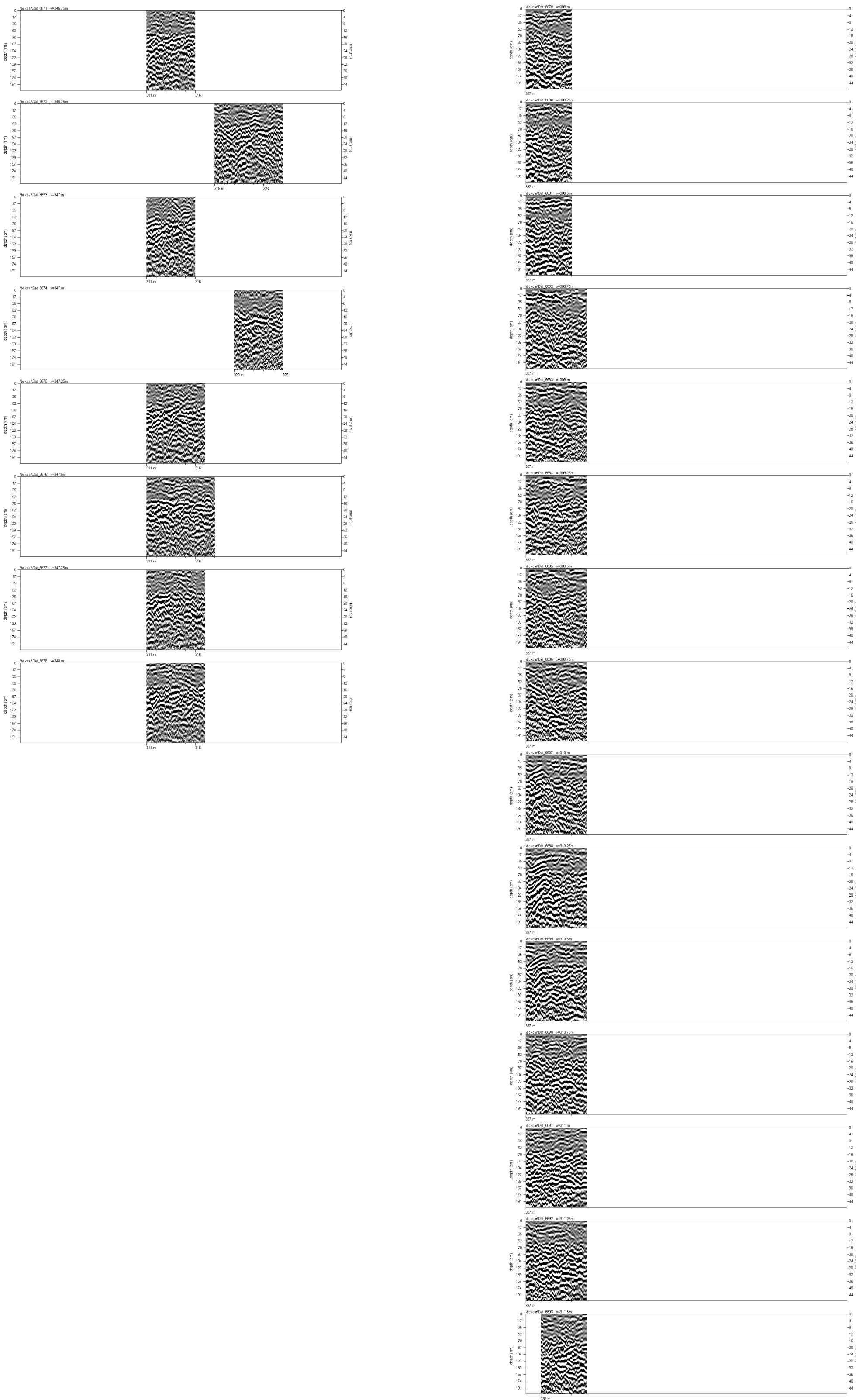


Figure D10. Annotated processed radargrams for front yard Transects X = 346.75 through X = 348 m and backyard X = 308 through X = 311.5 m.

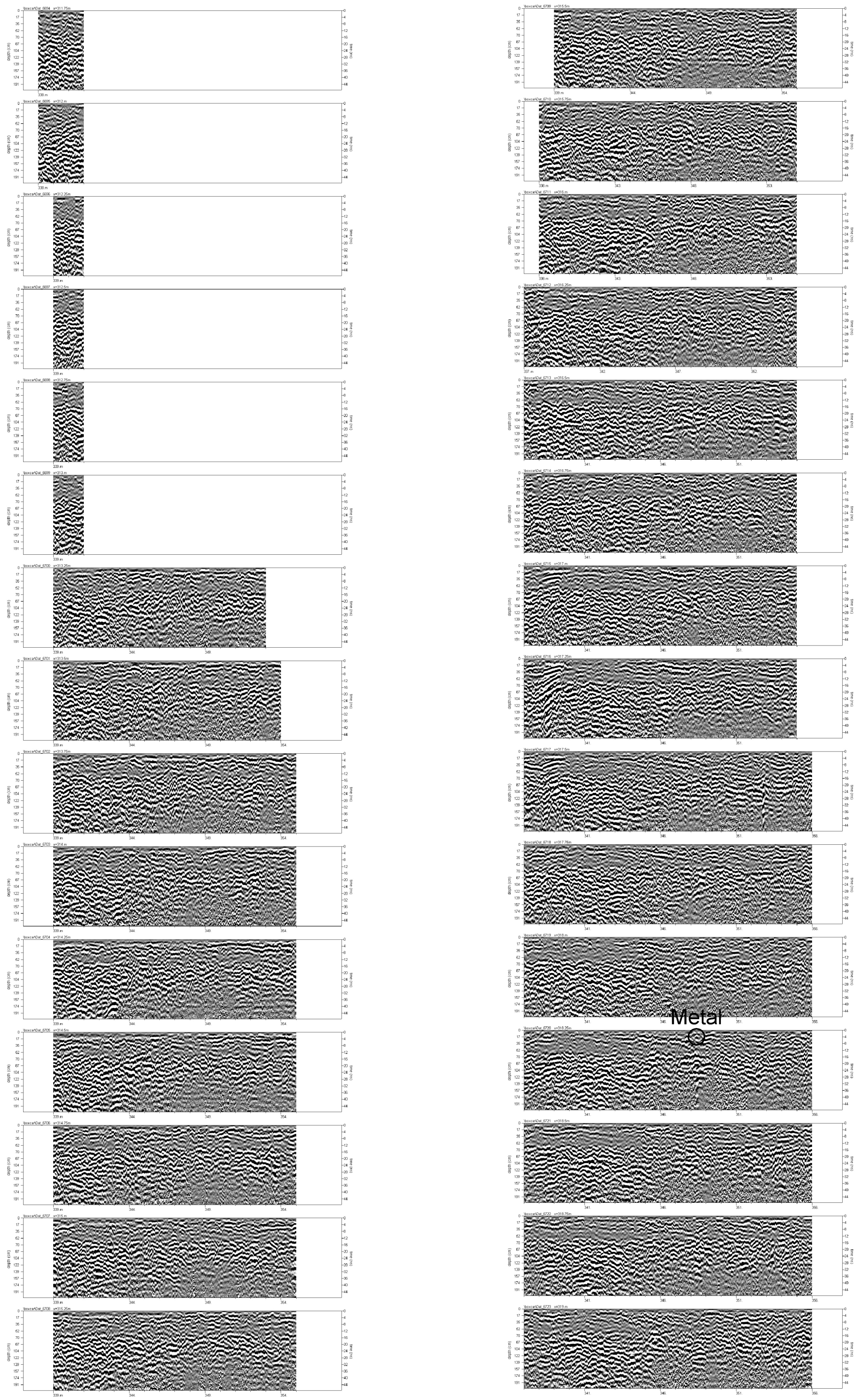


Figure D11. Annotated processed radargrams for backyard Transects X = 311.75 through X = 319 m.

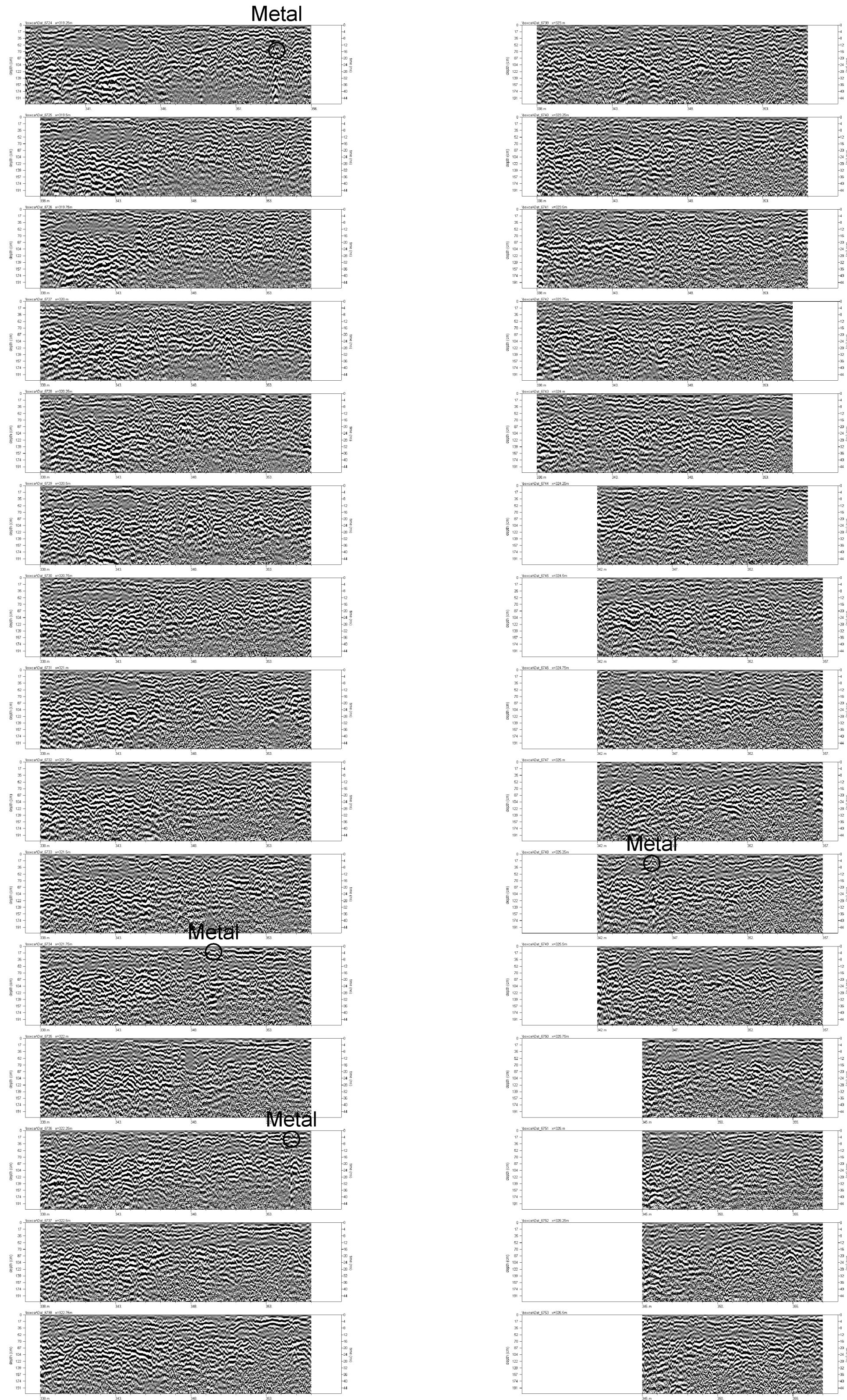


Figure D12. Annotated processed radargrams for backyard Transects X = 319.25 through X = 326.25 m.

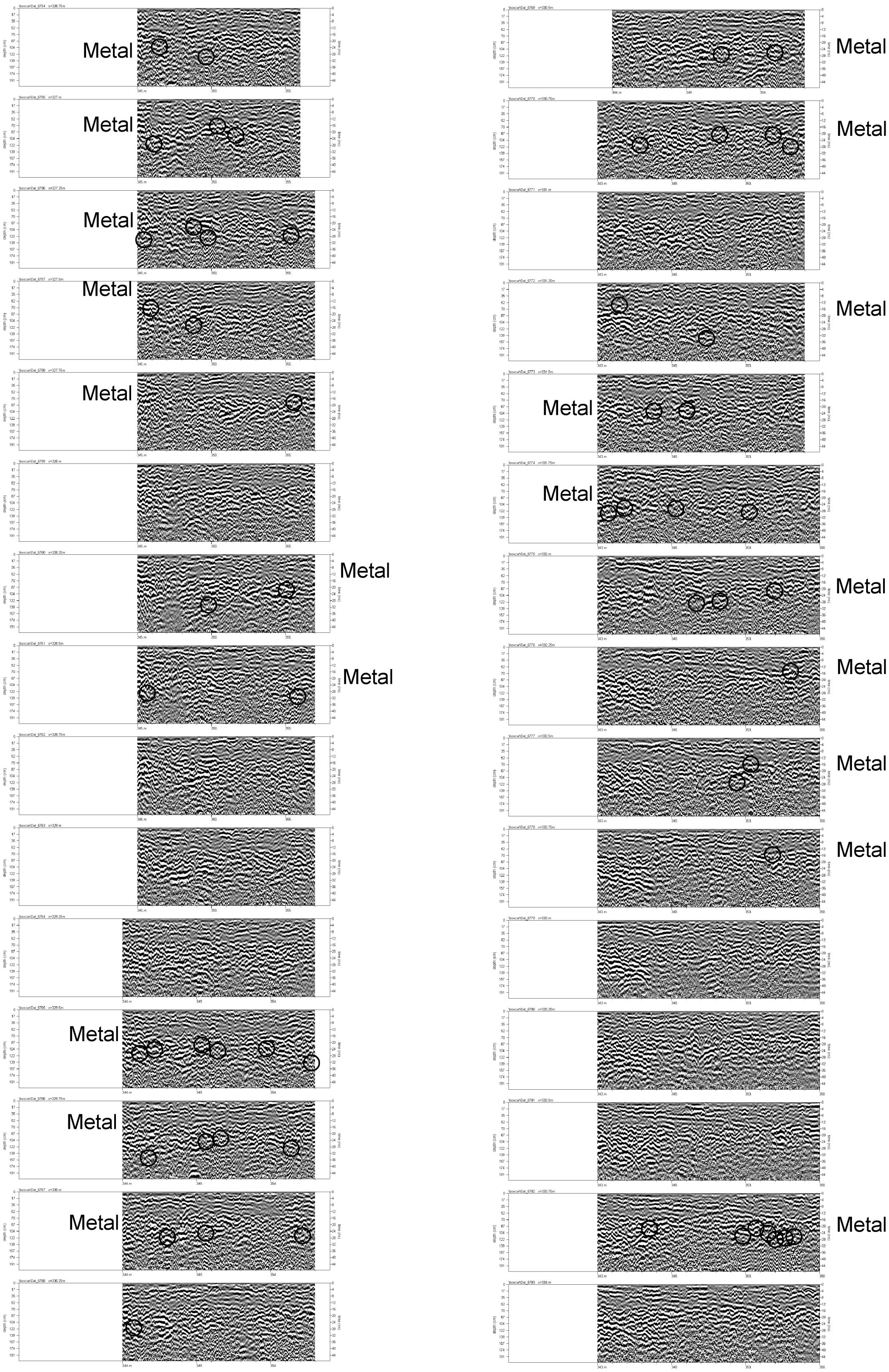


Figure D13. Annotated processed radargrams for backyard Transects X = 326.75 through X = 334 m.

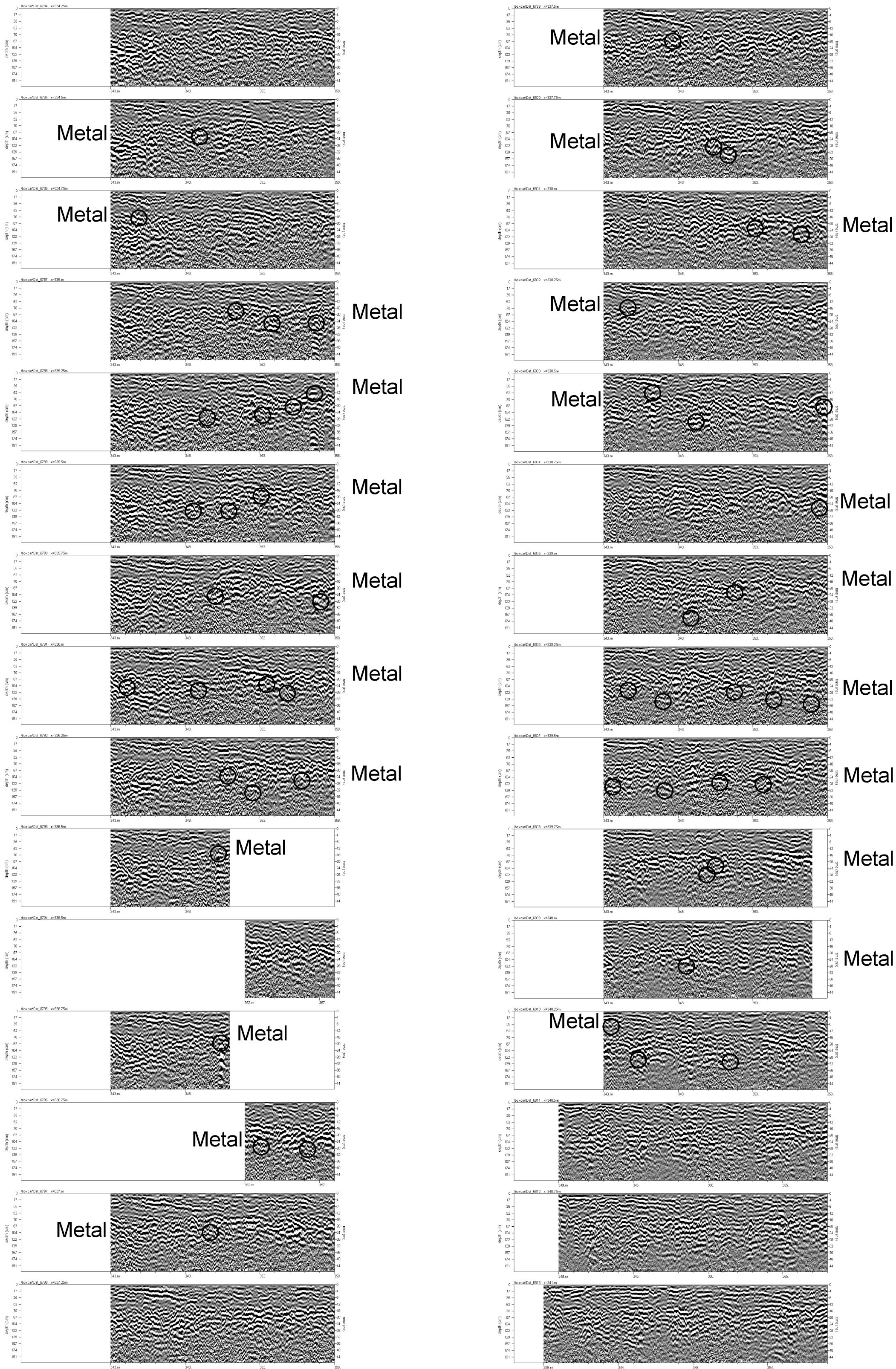


Figure D14. Annotated processed radargrams for backyard Transects X = 334.25 through X = 341 m.

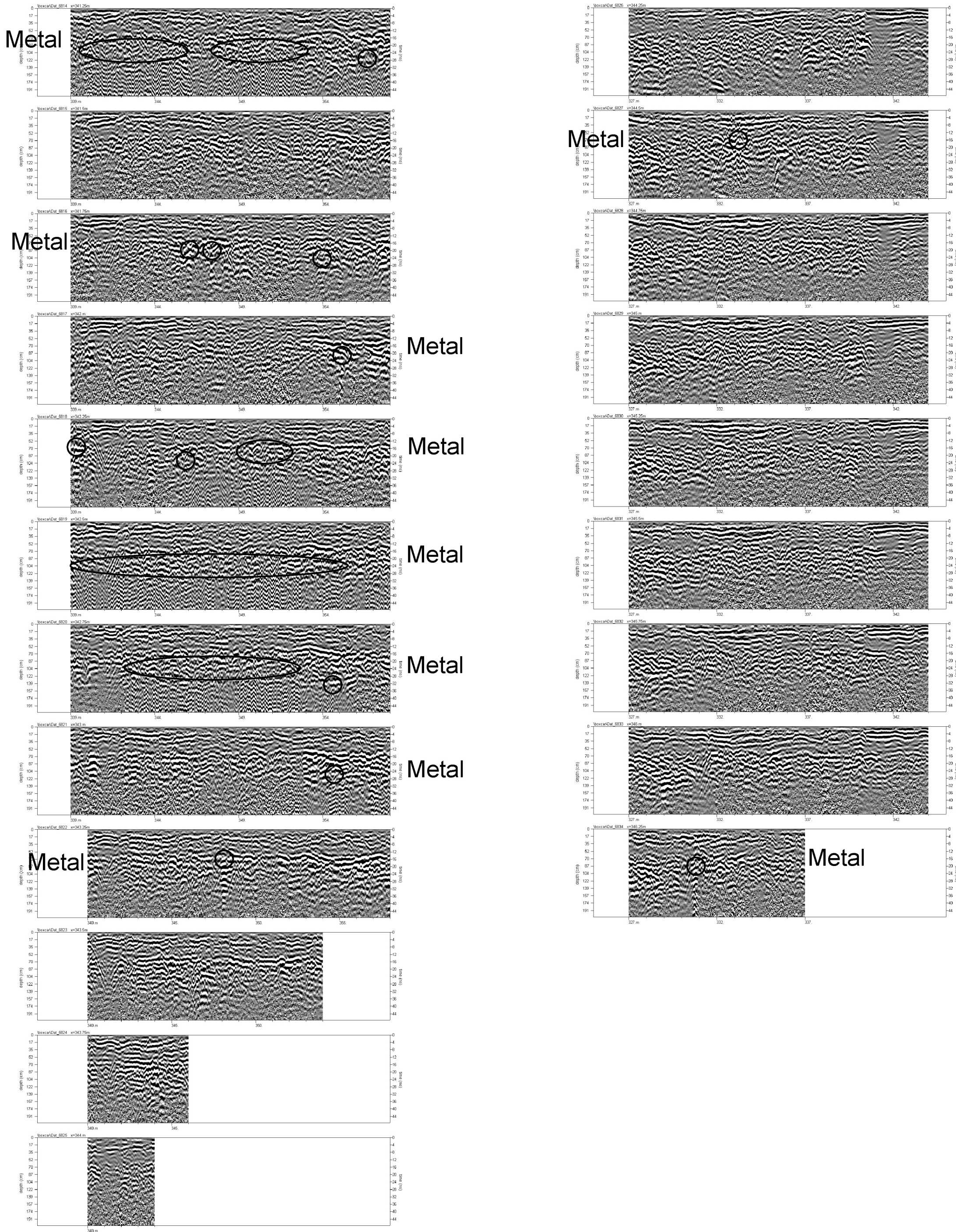
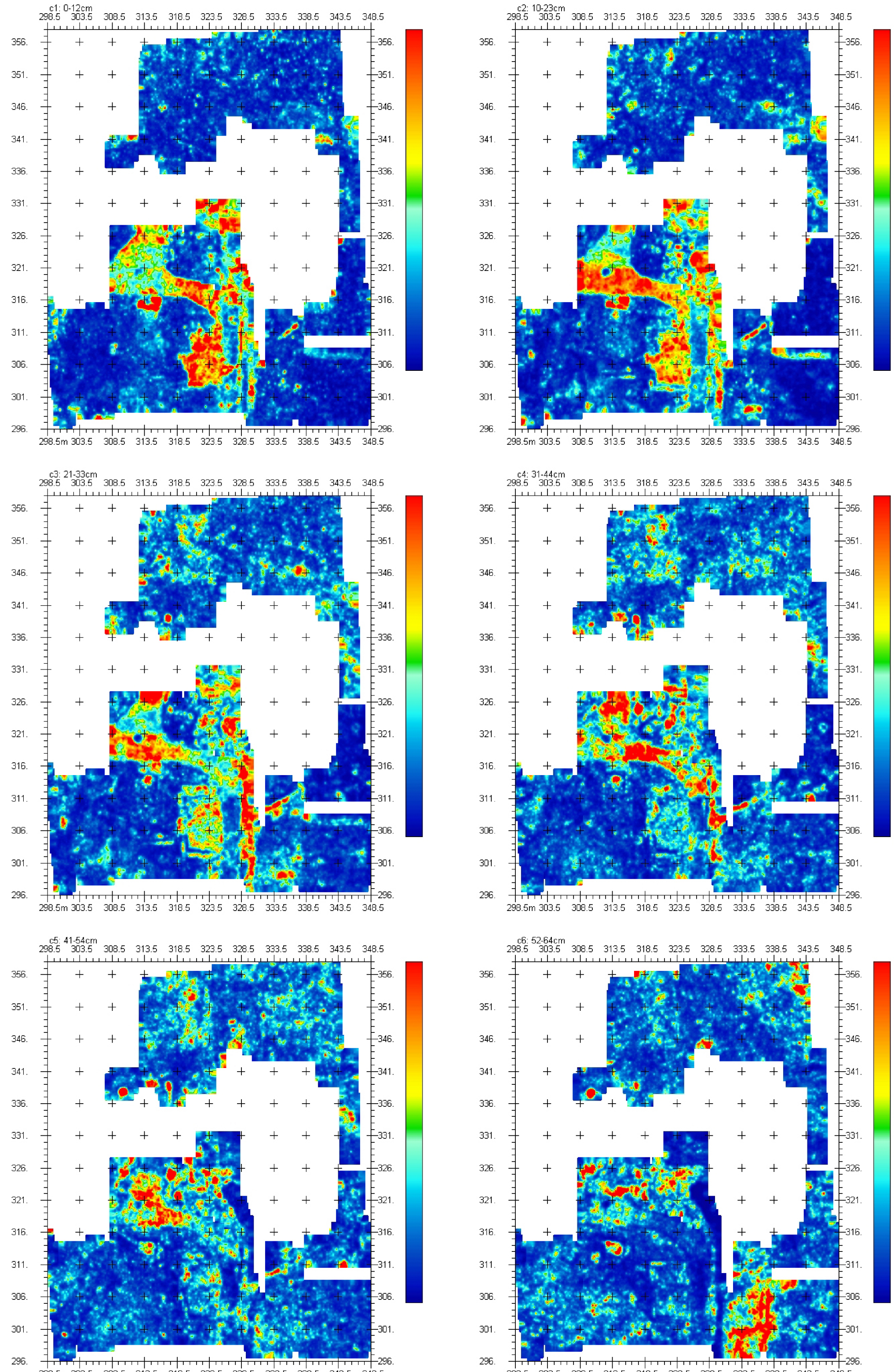


Figure D15. Annotated processed radargrams for backyard Transects X = 341.25 through X = 346.25 m.

APPENDIX E – HORIZONTAL TIME-SLICE IMAGES



d

Figure E1. Time-slice images for: Upper - 0 – 0.12 m and 0.10 – 0.23 m; Middle - 0.21 – 0.33 m and 0.31 – 0.44 m; and Lower - 0.41 – 0.54 m and 0.52 – 0.64 m.

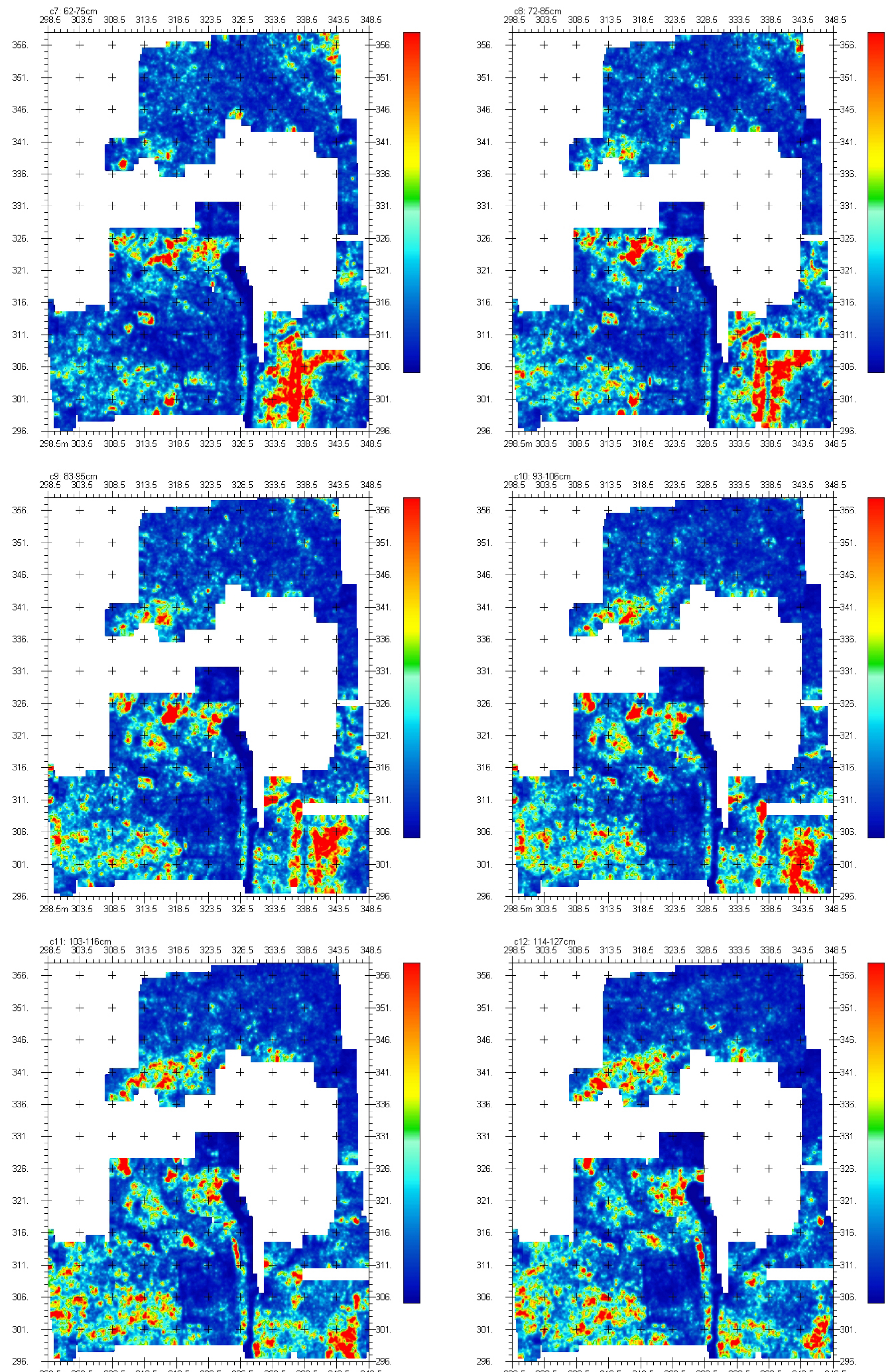


Figure E2. Time-slice images for: Upper - 0.62 – 0.75 m and 0.72 – 0.89 m; Middle - 0.83 – 0.95 m and 0.93 – 1.06 m; and Lower - 1.03 – 1.16 m and 1.14 – 1.27 m.

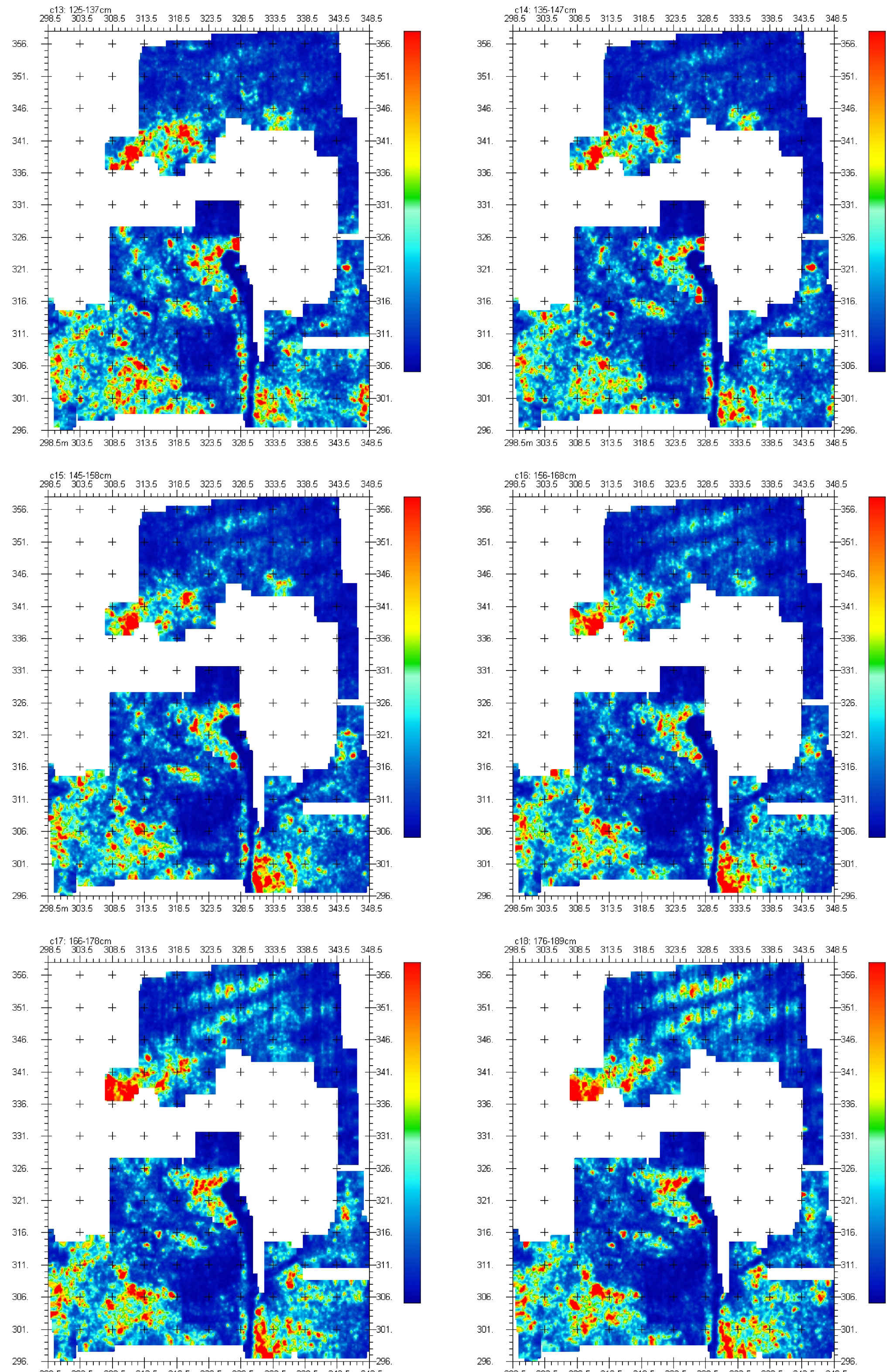


Figure E3. Time-slice images for: Upper - 1.25 – 1.37 m and 1.35 – 1.47 m; Middle – 1.45 – 1.58 m and 1.56 – 1.68 m; and Lower - 1.66 – 1.78 m and 1.76 – 1.89 m.

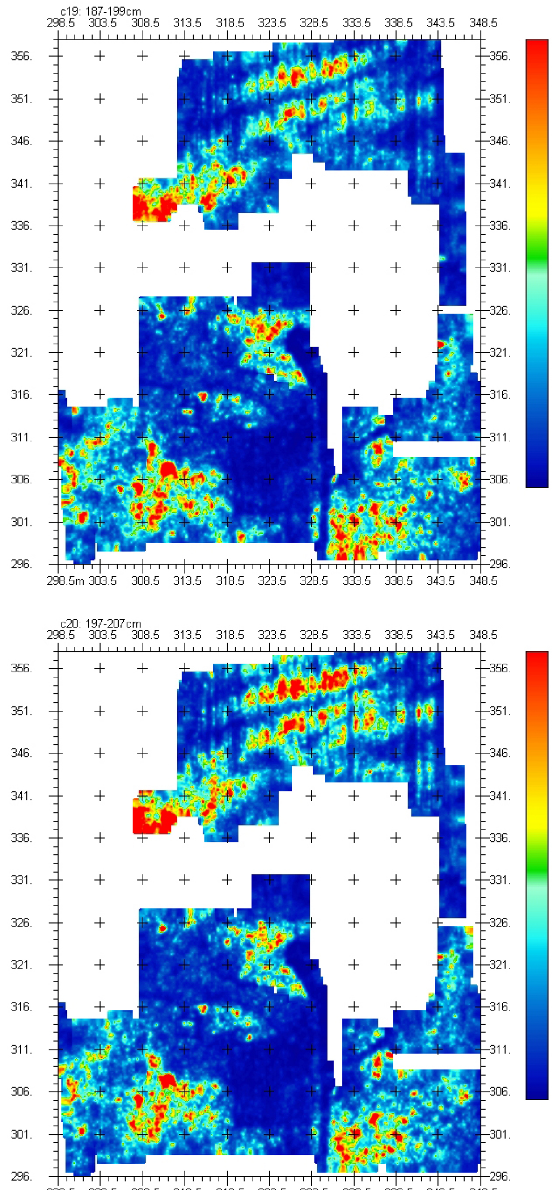


Figure E4. Time-slice images for: Upper - 1.87 – 1.95 m and Lower - 1.97 – 2.07 m.

APPENDIX F – COLOR-CONTOURED FDEM DATA

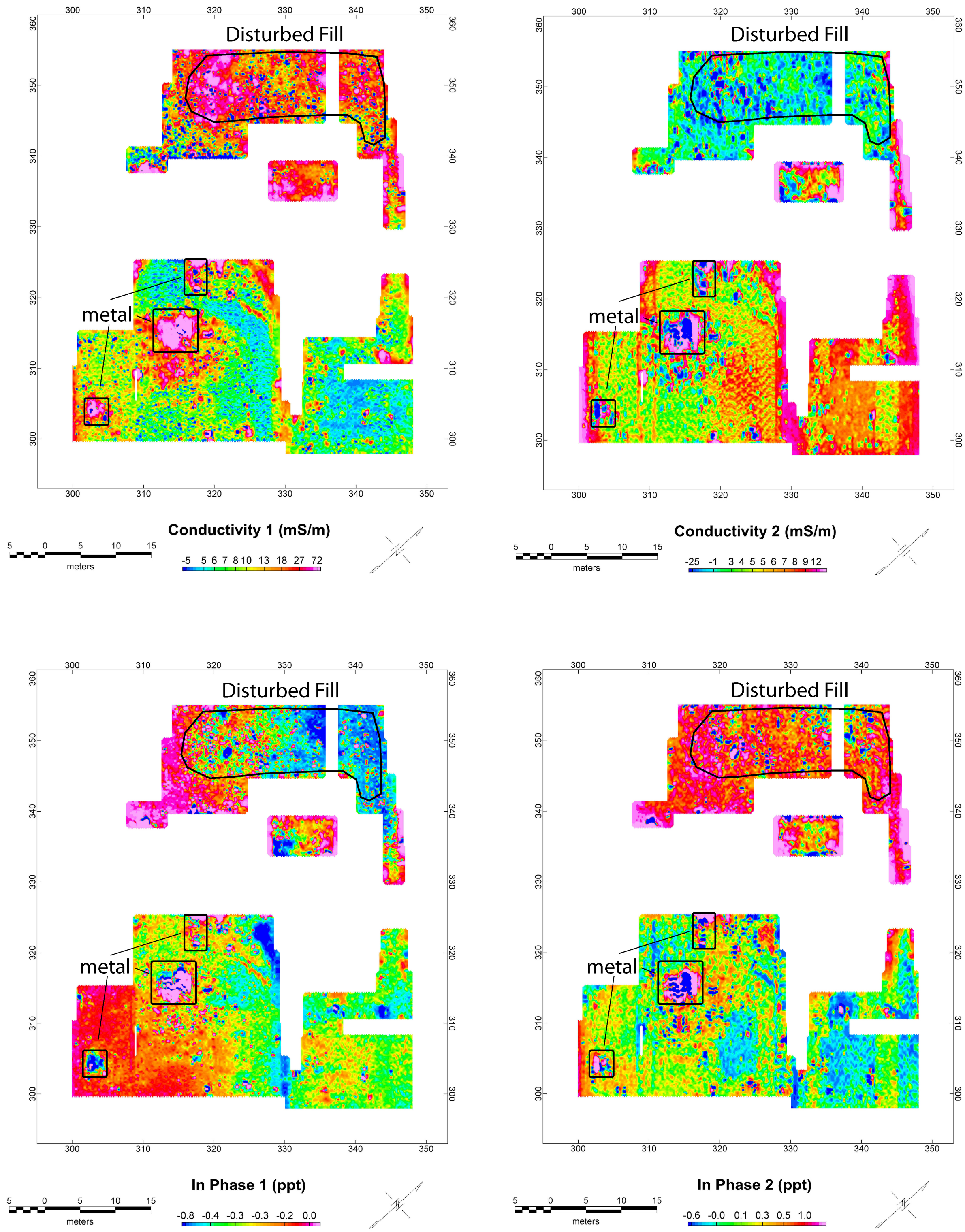


Figure F1. Upper: Apparent Ground Conductivity for vertical dipole spacings of 0.32 m (13 inches, left) and 0.71 m (28 inches, right), respectively. Lower: Corresponding In Phase for same spacings.

APPENDIX G – TOTAL STATION DATA

Table G1. Survey points taken from total station in Massassustts State Plane (m). Points with N3xx E3xx are in the survey grid coordinate system.

Point Name	East	North	Elevation	Code	Shot
Elizabeth Spray GPS	233958.373	892259.835	24.057	GPS_BENCH	1
Gate Nail GPS	233910.027	892228.721	24.299	GPS_BENCH	2
Hosmer Nail GPS	233876.310	892290.517	23.897	GPS_BENCH	3
Norfolk Nail GPS	233922.008	892245.658	24.139	GPS_BENCH	4
494 Norfolk Spray Paint GPS	233911.260	892204.294	24.301	GPS_BENCH	5
112514 BASE1	233883.885	892228.823	25.823	OCCUPIED	6
HOSMER NAIL	233876.316	892290.497	23.832	BENCH	7
ELIZABETH NAIL	233958.385	892259.852	24.089	BENCH	8
NORFOLK NAIL	233922.013	892245.664	24.147	BENCH	9
GATE NAIL	233910.044	892228.732	24.296	BENCH	10
494 NORFOLK SPRAY	233911.274	892204.265	24.305	BENCH	11
TREE WALK NAIL	233899.951	892214.434	24.358	2DRY_BENCH	12
FLS 101	233895.623	892217.147	23.937	2DRY_BENCH	13
BLUESTONE	233884.539	892257.099	25.111	2DRY_BENCH	14
CINDERBLOCK	233878.470	892254.185	24.899	2DRY_BENCH	15
WALKWAY	233886.548	892244.843	24.800	2DRY_BENCH	16
DRIVEWAY	233882.547	892270.591	23.895	2DRY_BENCH	17
GRID2_stk	233879.988	892240.001	24.719	GRID	18
GRID3_stk	233879.998	892219.994	24.091	GRID	19
GRID4_stk	233879.990	892229.994	24.408	GRID	20
GRID5_stk	233889.993	892240.003	24.466	GRID	21
GRID6_stk	233889.999	892230.004	24.284	GRID	22
GRID7_stk	233889.994	892220.008	23.949	GRID	23
GRID8_stk	233889.998	892210.005	24.087	GRID	24
GRID9_stk	233900.002	892230.007	24.327	GRID	25
GRID10_stk	233899.998	892239.995	24.404	GRID	26
GRID11_stk	233909.999	892239.996	24.277	GRID	27
GRID12_stk	233910.002	892250.002	24.234	GRID	28
GRID13_stk	233894.993	892220.004	23.903	GRID	29
GRID14_stk	233895.008	892214.991	23.929	GRID	30
GRID15_stk	233900.010	892225.005	24.086	GRID	31
GRID16_stk	233905.001	892230.002	24.252	GRID	32
GRID17_stk	233909.992	892235.005	24.230	GRID	34
GRID18_stk	233914.993	892240.004	24.274	GRID	36
GRID19_stk	233914.991	892244.997	24.205	GRID	38
GRID20_stk	233915.001	892249.997	24.225	GRID	40
GRID21_stk	233920.010	892244.996	24.171	GRID	42

Point Name	East	North	Elevation	Code	Shot
GRID22_stk	233874.994	892234.999	24.725	GRID	44
GRID23_stk	233885.009	892245.001	24.769	GRID	46
GRID24_stk	233890.007	892244.992	24.881	GRID	48
GRID25X_stk	233885.007	892214.997	23.947	GRID	50
112514 BASE2	233857.145	892252.564	24.952	OCCUPIED	51
GRID51_stk	233859.999	892249.998	23.272	GRID	54
GRID52_stk	233860.000	892259.993	23.388	GRID	56
GRID53_stk	233860.010	892264.996	23.351	GRID	58
GRID54_stk	233869.993	892250.012	23.538	GRID	60
GRID55_stk	233870.002	892260.004	23.457	GRID	62
GRID56_stk	233870.001	892269.999	23.487	GRID	64
GRID57_stk	233869.989	892279.995	23.884	GRID	66
GRID58_stk	233879.993	892270.002	23.689	GRID	68
GRID59_stk	233880.002	892275.009	23.925	GRID	70
GRID60_stk	233865.001	892244.992	23.400	GRID	72
GRID61_stk	233870.003	892244.997	23.673	GRID	74
GRID62_stk	233870.003	892255.002	23.417	GRID	76
GRID63_stk	233875.000	892265.008	23.468	GRID	78
GRID64_stk	233885.001	892269.990	23.905	GRID	80
GRID65_stk	233864.993	892275.001	23.587	GRID	82
GRID66_stk	233864.993	892270.001	23.429	GRID	84
GRID67_stk	233855.004	892254.996	23.343	GRID	86
GRID68_stk	233855.000	892259.992	23.366	GRID	88
GRID69_stk	233875.001	892275.006	23.617	GRID	90
CHECK1	233878.471	892254.181	24.899	CHECKPTS	91
TREE1-1	233856.323	892262.917	23.949	TREE	92
TREE1-2	233856.747	892262.590	23.768	TREE	93
TREE1-3	233857.330	892263.070	23.788	TREE	94
TREE2-1	233867.933	892281.069	24.230	TREE	95
TREE2-2	233868.550	892281.678	24.207	TREE	96
TREE3-1	233869.880	892281.233	24.080	TREE	97
TREE3-2	233870.062	892280.985	24.021	TREE	98
TREE4-1	233871.768	892278.970	24.051	TREE	99
TREE4-2	233871.773	892278.493	23.895	TREE	100
TREE4-3	233872.880	892278.502	23.968	TREE	101
TREE5-1	233875.941	892276.977	23.954	TREE	102
TREE5-2	233876.215	892276.894	24.115	TREE	103
TREE6-1	233876.767	892276.647	24.203	TREE	104
TREE6-2	233877.229	892276.324	24.006	TREE	105
OCC6	233915.601	892243.269	25.921	OCCUPIED	106

Point Name	East	North	Elevation	Code	Shot
N300 E348	233918.397	892248.812	24.244	RS_GRID	107
N308 E348	233911.931	892253.599	24.134	RS_GRID	108
N314 E333	233898.175	892245.184	24.931	RS_GRID	109
N314 E348	233907.286	892257.163	24.524	RS_GRID	110
N311 E349	233909.819	892255.291	24.869	RS_GRID	111
N325 E347	233897.735	892262.845	24.787	RS_GRID	112
N325 E344	233895.852	892260.534	24.944	RS_GRID	113
N300 E300	233889.652	892210.398	24.075	RS_GRID	114
N300 E301	233890.199	892211.209	24.097	RS_GRID	115
N300 E302	233890.816	892212.017	24.145	RS_GRID	116
N300 E303	233891.445	892212.810	24.135	RS_GRID	117
N300 E304	233892.018	892213.622	24.047	RS_GRID	118
N300 E305	233892.573	892214.383	24.011	RS_GRID	119
N300 E306	233893.198	892215.206	23.981	RS_GRID	120
N300 E307	233893.791	892216.020	23.959	RS_GRID	121
N300 E308	233894.428	892216.808	23.946	RS_GRID	122
N300 E309	233895.011	892217.609	23.912	RS_GRID	123
N300 E310	233895.592	892218.389	23.895	RS_GRID	124
N300 E311	233896.218	892219.198	23.932	RS_GRID	125
N300 E312	233896.817	892219.984	23.937	RS_GRID	126
N300 E313	233897.401	892220.779	23.950	RS_GRID	127
N300 E314	233898.069	892221.583	23.960	RS_GRID	128
N300 E315	233898.611	892222.374	23.988	RS_GRID	129
N300 E316	233899.243	892223.200	24.016	RS_GRID	130
N300 E317	233899.818	892223.988	24.094	RS_GRID	131
N300 E318	233900.413	892224.802	24.125	RS_GRID	132
N300 E319	233901.023	892225.599	24.164	RS_GRID	133
N300 E320	233901.585	892226.392	24.164	RS_GRID	134
N300 E321	233902.180	892227.199	24.150	RS_GRID	135
N300 E322	233902.763	892228.010	24.179	RS_GRID	136
N300 E323	233903.388	892228.821	24.219	RS_GRID	137
N300 E324	233903.965	892229.636	24.266	RS_GRID	138
N300 E325	233904.612	892230.443	24.256	RS_GRID	139
OCC7	233887.801	892227.862	25.931	OCCUPIED	140
N325 E328	233886.427	892247.785	24.858	RS_GRID	141
N325 E325	233884.597	892245.400	24.805	RS_GRID	142
N325 E320	233881.661	892241.411	24.694	RS_GRID	143
N325 E315	233878.585	892237.386	24.714	RS_GRID	144
N325 E310	233875.545	892233.350	24.655	RS_GRID	145
N325 E309	233874.892	892232.421	24.753	RS_GRID	146

Point Name	East	North	Elevation	Code	Shot
N35 E298	233876.403	892217.733	24.576	RS_GRID	147
N315 E30	233877.635	892219.314	24.468	RS_GRID	148
N315 E300	233877.620	892219.314	24.468	RS_GRID	149
N315 E305	233880.611	892223.358	23.961	RS_GRID	150
N315 E310	233883.534	892227.343	24.176	RS_GRID	151
OCC12	233876.044	892256.296	26.390	OCCUPIED	152
FLS 102	233863.218	892240.175	23.693	2DRY_BENCH	153
N338 E308	233864.607	892239.427	23.685	RS_GRID	154
N338 E309	233865.157	892240.261	23.682	RS_GRID	155
N338 E310	233865.700	892241.092	23.627	RS_GRID	156
N338 E311	233866.211	892241.981	23.617	RS_GRID	157
N340 E308	233862.964	892240.487	23.616	RS_GRID	158
N341 E308	233862.163	892241.022	23.767	RS_GRID	159
N341 E309	233862.686	892241.879	23.692	RS_GRID	160
N341 E310	233863.220	892242.673	23.636	RS_GRID	161
N341 E311	233863.704	892243.556	23.590	RS_GRID	162
N341 E312	233864.322	892244.393	23.508	RS_GRID	163
N341 E313	233864.776	892245.154	23.430	RS_GRID	164
N340 E313	233865.677	892244.722	23.432	RS_GRID	165
N340 E314	233866.194	892245.496	23.394	RS_GRID	166
N340 E315	233866.742	892246.340	23.372	RS_GRID	167
N340 E316	233867.389	892247.117	23.385	RS_GRID	168
N340 E317	233867.968	892247.924	23.416	RS_GRID	169
N340 E318	233868.548	892248.717	23.422	RS_GRID	170
N336 E318	233871.673	892246.249	23.818	RS_GRID	171
N336 E319	233872.266	892246.996	23.867	RS_GRID	172
N338 E320	233871.243	892249.151	23.750	RS_GRID	173
N338 E321	233871.861	892249.958	23.792	RS_GRID	174
N338 E322	233872.596	892250.862	23.844	RS_GRID	175
N338 E323	233873.078	892251.585	23.824	RS_GRID	176
N338 E324	233873.696	892252.383	23.896	RS_GRID	177
N340 E319	233869.146	892249.530	23.539	RS_GRID	178
N340 E320	233869.757	892250.367	23.498	RS_GRID	179
N340 E321	233870.325	892251.136	23.491	RS_GRID	180
N340 E322	233870.906	892251.969	23.593	RS_GRID	181
N340 E323	233871.533	892252.753	23.641	RS_GRID	182
N340 E324	233872.124	892253.572	23.698	RS_GRID	183
N345 E313	233861.507	892247.717	23.377	RS_GRID	184
N345 E314	233862.137	892248.479	23.257	RS_GRID	185
N345 E315	233862.745	892249.280	23.294	RS_GRID	186

Point Name	East	North	Elevation	Code	Shot
N345 E316	233863.304	892250.111	23.287	RS_GRID	187
N345 E317	233863.887	892250.920	23.369	RS_GRID	188
N345 E318	233864.487	892251.734	23.386	RS_GRID	189
N345 E319	233865.068	892252.506	23.380	RS_GRID	190
N345 E320	233865.688	892253.337	23.428	RS_GRID	191
N345 E321	233866.278	892254.151	23.372	RS_GRID	192
N345 E322	233866.864	892254.927	23.322	RS_GRID	193
N345 E329	233871.043	892260.480	23.388	RS_GRID	194
N345 E330	233871.610	892261.344	23.397	RS_GRID	195
N345 E331	233872.204	892262.128	23.373	RS_GRID	196
N345 E332	233872.842	892262.910	23.360	RS_GRID	197
N345 E333	233873.427	892263.705	23.383	RS_GRID	198
N345 E334	233874.063	892264.521	23.442	RS_GRID	199
N345 E335	233874.647	892265.304	23.465	RS_GRID	200
N345 E336	233875.271	892266.127	23.483	RS_GRID	201
N345 E337	233875.817	892266.939	23.523	RS_GRID	202
N345 E338	233876.389	892267.735	23.544	RS_GRID	203
N345 E339	233877.052	892268.526	23.586	RS_GRID	204
N345 E340	233877.613	892269.336	23.560	RS_GRID	205
N345 E341	233878.183	892270.113	23.588	RS_GRID	206
N345 E328	233870.356	892259.784	23.450	RS_GRID	207
N345 E342	233878.783	892270.937	23.658	RS_GRID	208
N345 E343	233879.346	892271.770	23.739	RS_GRID	209
N345 E344	233879.952	892272.576	23.766	RS_GRID	210
N345 E345	233880.505	892273.423	23.822	RS_GRID	211
N340 E341	233881.984	892267.158	23.733	RS_GRID	212
N340 E342	233882.661	892267.876	23.764	RS_GRID	213
N340 E343	233883.273	892268.767	23.781	RS_GRID	214
N340 E344	233883.866	892269.475	23.821	RS_GRID	215
N340 E345	233884.611	892270.271	23.921	RS_GRID	216
N340 E346	233885.121	892271.099	23.922	RS_GRID	217
N3435 E345	233888.400	892267.470	24.103	RS_GRID	218
N350 E345	233876.614	892276.337	23.944	RS_GRID	219
N334 E328	233879.287	892253.266	24.820	RS_GRID	220
N334 E329	233879.861	892254.050	24.757	RS_GRID	221
N334 E330	233880.496	892254.790	24.808	RS_GRID	222
N334 E335	233883.635	892258.662	24.858	RS_GRID	223
N334 E336	233884.210	892259.516	24.885	RS_GRID	224
N334 E337	233884.814	892260.270	24.861	RS_GRID	225
N339 E331	233877.228	892258.665	24.720	RS_GRID	226

Point Name	East	North	Elevation	Code	Shot
N339 E332	233877.860	892259.469	24.800	RS_GRID	227
N339 E333	233878.502	892260.214	24.756	RS_GRID	228
N339 E334	233879.110	892261.042	24.754	RS_GRID	229
N339 E335	233879.727	892261.804	24.773	RS_GRID	230
N339 E336	233880.368	892262.599	24.813	RS_GRID	231
N339 E337	233880.987	892263.335	24.880	RS_GRID	232
N355 E315	233857.812	892259.366	23.496	RS_GRID	233
N355 E320	233857.809	892259.362	23.491	RS_GRID	234
N355 E321	233858.413	892260.177	23.451	RS_GRID	235
N355 E322	233859.009	892261.011	23.405	RS_GRID	236
N355 E323	233859.615	892261.804	23.318	RS_GRID	237
N355 E324	233860.254	892262.600	23.181	RS_GRID	238
N355 E325	233860.717	892263.381	23.182	RS_GRID	239
N355 E326	233861.402	892264.182	23.211	RS_GRID	240
N355 E327	233861.970	892265.058	23.204	RS_GRID	241
N355 E328	233862.626	892265.787	23.221	RS_GRID	242
N355 E329	233863.193	892266.570	23.248	RS_GRID	243
N355 E330	233863.812	892267.399	23.265	RS_GRID	244
N355 E335	233866.786	892271.465	23.487	RS_GRID	245
N355 E336	233867.387	892272.255	23.590	RS_GRID	246
N355 E337	233867.979	892273.065	23.597	RS_GRID	247
N355 E338	233868.598	892273.852	23.588	RS_GRID	248
N358 E339	233866.826	892276.518	23.673	RS_GRID	249
N358 E340	233867.387	892277.341	23.727	RS_GRID	250
N358 E341	233867.790	892278.184	23.762	RS_GRID	251
N358 E342	233868.366	892278.895	23.727	RS_GRID	252
N358 E343	233868.943	892279.642	23.813	RS_GRID	253
N355 E340	233869.786	892275.490	23.539	RS_GRID	254
N355 E341	233870.375	892276.265	23.573	RS_GRID	255
occ13	233916.827	892244.906	25.799	OCCUPIED	256
N308 E335	233904.198	892243.134	24.511	RS_GRID	257
N308 E333	233902.977	892241.531	24.644	RS_GRID	258
N308 E334	233903.541	892242.313	24.585	RS_GRID	259
N308 E340	233907.138	892247.136	24.350	RS_GRID	260
N308 E345	233910.086	892251.175	24.262	RS_GRID	261
N308 E346	233910.726	892251.779	24.221	RS_GRID	262
N308 E347	233911.373	892252.743	24.281	RS_GRID	263
N308 E349	233911.929	892253.613	24.146	RS_GRID	264
N308 E348.5	233912.258	892254.046	24.231	RS_GRID	265
N311 E339	233904.152	892248.163	24.741	RS_GRID	266

Point Name	East	North	Elevation	Code	Shot
N311 E340	233904.803	892248.909	24.719	RS_GRID	267
N311 E341	233905.408	892249.773	24.717	RS_GRID	268
N311 E342	233905.952	892250.561	24.768	RS_GRID	269
N311 E343	233906.601	892251.396	24.757	RS_GRID	270
N311 E344	233907.185	892252.188	24.751	RS_GRID	271
N311 E345	233907.798	892253.026	24.747	RS_GRID	272
N311 E346	233908.365	892253.787	24.724	RS_GRID	273
N311 E347	233908.987	892254.533	24.700	RS_GRID	274
N311 E348	233909.835	892255.281	24.860	RS_GRID	275
N314 E345	233905.352	892255.019	24.681	RS_GRID	276
N314 E346	233905.904	892255.624	24.651	RS_GRID	277
N314 E347	233906.651	892256.443	24.611	RS_GRID	278
N317 E345	233902.971	892256.683	24.825	RS_GRID	279
N320 E345	233900.544	892258.401	24.860	RS_GRID	280
N323 E345	233898.128	892260.160	24.826	RS_GRID	281
N325 E345	233896.487	892261.297	24.879	RS_GRID	282
N325 E346	233897.160	892262.087	24.786	RS_GRID	283
N326 E344	233895.055	892261.116	24.380	RS_GRID	284
N326 E345	233895.658	892261.702	24.412	RS_GRID	285
N326 E346	233896.327	892262.599	24.338	RS_GRID	286
N330 E345	233892.502	892264.198	24.220	RS_GRID	287
N335 E345	233888.469	892267.489	24.131	RS_GRID	288
N314 E337	233900.619	892248.364	24.981	RS_GRID	289
N314 E338	233901.213	892249.150	24.986	RS_GRID	290
N314 E339	233901.799	892249.965	24.933	RS_GRID	291
N314 E340	233902.391	892250.785	24.915	RS_GRID	292
N314 E341	233903.021	892251.572	24.908	RS_GRID	293
N314 E342	233903.622	892252.395	24.869	RS_GRID	294
N314 E343	233904.223	892253.194	24.802	RS_GRID	295
N314 E344	233904.812	892253.956	24.757	RS_GRID	296
WALL TOP 1	233903.940	892247.215	24.963	TOPO	297
WALL TOP 2	233905.174	892246.480	24.942	TOPO	298
WALL TOP 3	233906.101	892247.714	24.915	TOPO	299
WALL TOP 4	233906.929	892248.932	24.920	TOPO	300
WALL TOP 5	233907.858	892250.509	25.026	TOPO	301
WALL TOP 6	233908.601	892251.628	25.037	TOPO	302
WALL TOP 7	233909.822	892253.183	25.027	TOPO	303
WALL TOP 8	233910.586	892254.172	25.082	TOPO	304
WALL TOP 9	233911.285	892254.822	25.003	TOPO	305
WALL BOT 10	233904.062	892246.631	24.684	TOPO	306

Point Name	East	North	Elevation	Code	Shot
WALL BOT 11	233904.941	892245.994	24.581	TOPO	307
WALL BOT 12	233905.764	892246.461	24.481	TOPO	308
WALL BOT 13	233906.393	892247.518	24.475	TOPO	309
WALL BOT 14	233907.196	892248.605	24.391	TOPO	310
WALL BOT 15	233908.113	892249.793	24.360	TOPO	311
WALL BOT 16	233908.852	892250.944	24.330	TOPO	312
WALL BOT 17	233909.790	892252.149	24.290	TOPO	313
WALL BOT 18	233910.695	892253.406	24.271	TOPO	314
WALL BOT 19	233911.616	892254.162	24.170	TOPO	315
WALL BOT 20	233911.560	892254.698	24.449	TOPO	316
N314 E334	233898.804	892245.978	24.930	RS_GRID	317
N314 E335	233899.398	892246.786	24.921	RS_GRID	318
N314 E336	233899.994	892247.577	24.938	RS_GRID	319
N300 E335	233910.598	892238.411	24.278	RS_GRID	320
N298 E335	233912.254	892237.200	24.294	RS_GRID	321
N298 E336	233912.843	892237.972	24.310	RS_GRID	322
N298 E337	233913.454	892238.828	24.284	RS_GRID	323
N298 E338	233914.044	892239.609	24.282	RS_GRID	324
N298 E339	233914.681	892240.390	24.264	RS_GRID	325
N298 E340	233915.270	892241.236	24.266	RS_GRID	326
N298 E341	233915.868	892242.040	24.281	RS_GRID	327
N298 E342	233916.475	892242.791	24.266	RS_GRID	328
N298 E347	233919.411	892246.860	24.255	RS_GRID	329
N298 E348	233920.013	892247.634	24.280	RS_GRID	330
N298 E348.5	233920.361	892248.019	24.320	RS_GRID	331
N00 E340	233913.574	892242.428	24.213	RS_GRID	332
N300 E341	233914.183	892243.201	24.236	RS_GRID	333
N300 E342	233914.761	892244.036	24.248	RS_GRID	334

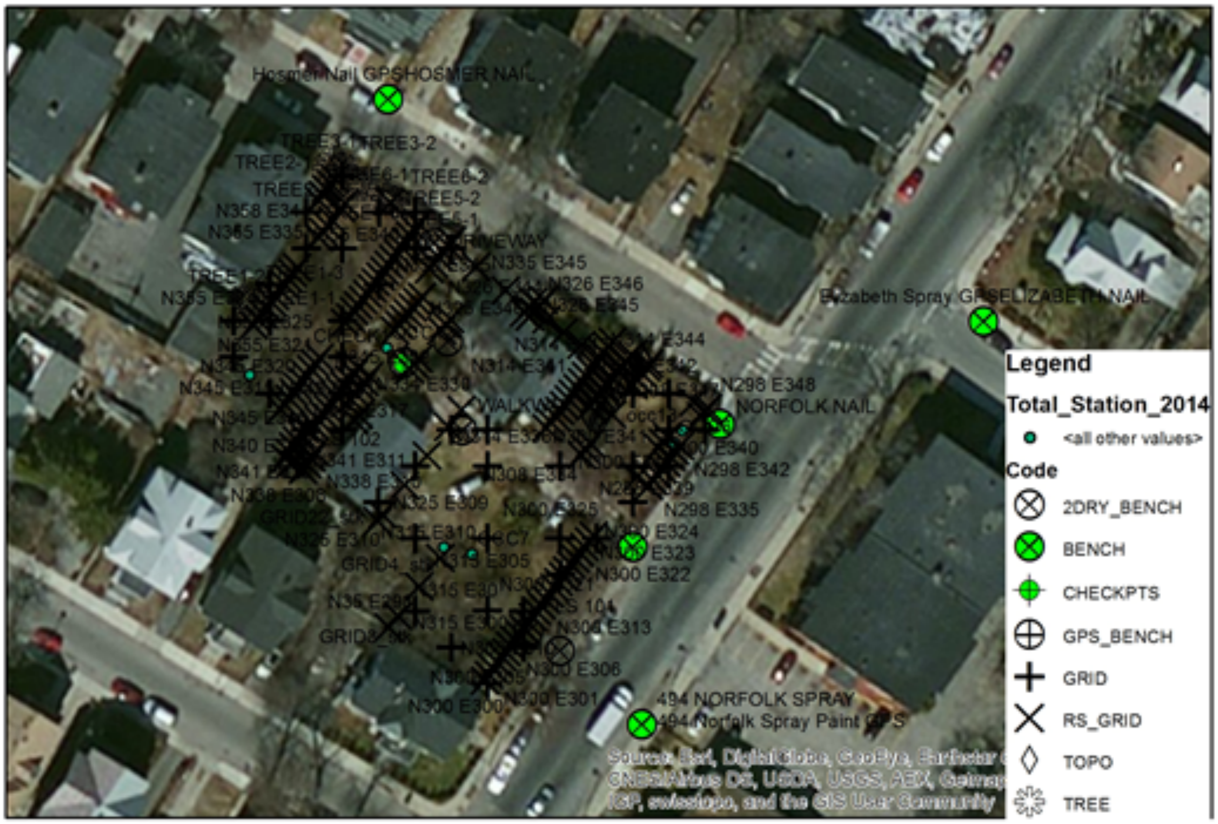


Figure G2. Location of total station points at the Fowler-Clark property.

APPENDIX H – ARTIFACTS RECEOVERED

Context 1 **Unit_Number** 1 **Unit_Level** 1

Ceramics

Glass

Nails Pipes

Other Materials

Bone and Shell

Context 2 **Unit_Number** 1 **Unit_Level** 2

Ceramics

Glass

Nails Pipes

Other Materials

Bone and Shell

Context 3 **Unit_Number** 2 **Unit_Level** 1

Ceramics

Glass

Nails Pipes

Other Materials

1	Metal ferrous other

Bone and Shell

Context 4 **Unit_Number** 2 **Unit_Level** 2

Ceramics

Glass

1	flat, undetermined

Nails Pipes

4	Nails

Other Materials

1	Architectural brick
1	Architectural mortar
4	Fuel and furnace coal

Bone and Shell

Context 5 **Unit_Number** 2 **Unit_Level** 3

Ceramics

1	Earthenware, coarse, Redware
3	Earthenware, refined, Indeterminate earthenware

Glass

Nails Pipes

3	Nails
1	Screw

Other Materials

2	Metal ferrous other
1	Fuel and furnace slag
3	Fuel and furnace coal and furnace products, unseparated

Bone and Shell

Context 6 **Unit_Number** 2 **Unit_Level** 4

Ceramics

3	Earthenware, coarse, Redware
2	Earthenware, refined, Indeterminate earthenware

Glass

1	curved, indet.
1	flat, undetermined

Nails Pipes

Other Materials

5	Architectural brick
2	Fuel and furnace slag
1	Fuel and furnace coal and furnace products, unseparated

Bone and Shell

Context 7 **Unit_Number** 2 **Unit_Level** 5

Ceramics

Glass

Nails Pipes

2	Nails

Other Materials

2	Architectural brick
19	Fuel and furnace coal and furnace products, unseparated

Bone and Shell

Context 8 **Unit_Number** 2 **Unit_Level** 6

Ceramics

Glass

Nails

Pipes

Other Materials

1	Architectural brick
1	Fuel and furnace slag
12	Fuel and furnace coal and furnace products, unseparated

Bone and Shell

Context 9 **Unit_Number** 3 **Unit_Level** 1

Ceramics

Glass

Nails

Pipes

Other Materials

Bone and Shell

Context 10 **Unit_Number** 3 **Unit_Level** 2

Ceramics

Glass

2	curved, undetermined
4	flat, undetermined

Nails

Pipes

Other Materials

1	Metal ferrous object
1	Synthetic plastic
2	Fuel and furnace coal and furnace products, unseparated

Bone and Shell

Context 11 **Unit_Number** 3 **Unit_Level** 3

Ceramics

Glass

2	curved, undetermined

Nails

Pipes

Other Materials

3	Architectural brick

Bone and Shell

Context 12 **Unit_Number** 3 **Unit_Level** 4

Ceramics

Glass

Nails

Pipes

1 stem

Other Materials

1 Fuel and furnace charcoal
1 Metal ferrous other

Bone and Shell

Context 13 **Unit_Number** 3 **Unit_Level** 5

Ceramics

Glass

Nails

Pipes

Other Materials

Bone and Shell