Geophysical Survey Report

Metro North
Bellinstown to St Stephens Green, Dublin

Licence No. 08R0117

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Executive Summary

Survey Objectives

This report outlines the results of a geophysical survey undertaken for the Railway Procurement Agency in advance of the development of the Metro North light rail service from Bellinstown to St Stephens Green, Dublin..

The aims of the geophysical survey were to identify and map any significant archaeological responses which may be present within the survey areas. The results of the geophysical survey will be followed by a programme of invasive archaeological test trenching and will inform the archaeological strategy for the proposed scheme.

Survey Location, Soils and Geology

The route of the Proposed Metro North will run along a proposed 18km corridor, from Bellinsown in North County Dublin, through Dublin Airport, to the city centre at St Stephen's Green. It will have stops at Belinstown (where its depot will be located), Lissenhall (provisional), Estuary (provisional), Seatown, Swords, Fosterstown, Dublin Airport, Dardistown, Northwood, Ballymun, Dublin City University, Griffith Avenue, Drumcondra, Mater Hospital, Parnell Square, O' Connell Bridge and St Stephen's Green.

Track construction will occur on a generally narrow development corridor where it passes through outer city suburbs and green-field locations. However, larger development sites are proposed at the depot site in Bellinstown, the park and ride facilities, the tunnel portal locations at Dublin Airport and at Albert College Park. The city centre section will be tunnelled and associated with a series of station-specific and shaft-specific construction locations. The geophysical survey areas are displayed within the site location figures (Figures 1-6).

Magnetic gradiometry has yielded consistently good results in the drift geology of north County Dublin and in the north Leinster region. Soils of the locality are mainly dry mineral soils and include predominantly grey brown podzolics with associated gleys (soil association 38). The underlying geology comprises till of Irish Sea origin with limestone and shale (National Soil Survey of Ireland, 1980). These conditions are generally considered to be favourable for geophysical survey.

Archaeological Background *(after MGL and Co. Ltd, 2008)*

Evidence for prehistoric activity in north county Dublin is recorded in a variety of sources, including the Record of Monuments and Places (RMP), previous development-led investigations and surveys and from stray finds. In the early historical period the area through which the route is aligned formed part of the geographical region of Brega with a range of sites dating to this period including ringforts, dispersed settlement sites and Early Christian ecclesiastical sites. There are relatively few surviving ringforts in north County Dublin due to the intensive cultivation and agricultural activity in this part of the county, which levelled many earthwork sites.

After the conquest by Anglo-Normans in the 12th century social structures, agrarian development and settlement centres of religious and secular origin followed. Throughout the medieval period monastic foundations and individual lordships held large tracts of lands in north Dublin. A period of great flux occasioned by warfare, confiscation and transfer of ownership occurred during the Tudor, Comwellian and Jacobite wars. These factors and the subsequent development of demesne properties all influenced the character and layout of rural north Dublin in their own ways, but also as part of a continuum in a landscape that was influenced by and changed over time in equal measure by economic and associated agricultural development.

The city-centre underground section, from St Stephen's Green to Parnell Square, passes through the designated zone of Archaeological Constraint for Recorded Monument DU018-020 (the historic city). The city centre portion of the route does not pass through the medieval walled city and lies to the east of the important medieval suburb of Oxmantown that developed on the north side of the River Liffey, following the Anglo-Norman invasion in the 12th and early 13th century. It also lies to the east of the precinct of the important and large land-holding or the 12th-century St Mary's Abbey.

Lying outside the walled medieval city, the material archaeology along the city centre route is not overly complex and is not composed of deep stratigraphic sequences of archaeological occupation deposits. However, the route from St Stephen's Green to Parnell Square and some distance north of Parnell Square toward the Mater does cross through the footprint of the developed 18th-century city, the most potent graphic evocation of which is Rocque's map of

1756. 18th-century suburban expansion reached North Circular Road and Phibsborough with later north city expansion taking place rapidly after the 1830s.

A number of recorded archaeological monuments (RMPs) will be directly impacted by the proposed development. These include the joint archaeological constraint zone for DU008-056 (Archaeological Complex – Earthworks site), DU012-086 (Barrow – Unclassified), DU007-036 (Archaeological Complex – Earthworks site), DU012-001 (Archaeological Complex – ringforts site), DU011-00701 (Castle Site) and DU011-00702 (Earthworks Site) within Belinstown Townland, DU011-081 (Bridge) within Balheary Demesne, DU011-046 (ringfort – unclassified) within Cloghran (Coolock By) and finally DU018-020334 (Park) which is within the overall constraint zone for Dublin city (DU018-020).

In addition, numerous recorded archaeological monuments (RMPs) are known within a 1km radius of the proposed scheme. These are detailed within Table 1.

Table 1 - RMPs located within 1km radius

RMP Ref	Site Type	NGR	Townland	Distance
DU 007-036001	Archaeological Complex (earthworks site)	318970 250350	Belinstown (Nethercross By)	Direct impact
DU 008-056001	Archaeological Complex (earthworks site)	318840 250670	Belinstown (Nethercross By)	320m to the N
DU 011-007	Archaeological Complex	318640 250440	Belinstown (Nethercross By)	160m to the N
DU 011-007001	Castle site	318570 250370	Belinstown (Nethercross By)	120m to the N
DU 011-007002	Earthworks site	318650 250400	Belinstown (Nethercross By)	120m to the N
DU 012-001001	Archaeological Complex (ringforts site)	319020 250230	Belinstown (Nethercross By)	Direct impact
DU 012-002	Enclosure	319434 249943	Lissenhall Little	300m to the E
DU 012-003	Ring-ditch	319167 249681	Lissenhall Little	110m to the E
DU 012-011	Ritual Site/Holy Well	319050 248880	Lissenhall Little	450m to the E
DU 012-012001/002	Enclosure + Field system	319430 248520	Lissenhall Great	450m to the E
DU 012-015	Enclosure	319240 248080	Lissenhall Great	450m to the E
DU 012-086	Barrow Unclassified	319250 250439	Belinstown (Balrothery West By)	200m to the N
DU 011-081	Bridge	318750 248290	Balheary Demesne	Direct impact
DU 011-017	Enclosure	317780 249000	Newtown (Nethercross By)	600m to the W
DU 011-078	Enclosure	317680 248720	Newtown (Balrothery East By)	700m to the W
DU 011-080	Ring-ditch	317790 248290	Holybanks	750m to the W
DU 011-036	Earthwork	318760	Seatown West	140m to the N

RMP Ref	Site Type	NGR	Townland	Distance
		247290		
DU 011-070	Font (Present Location)	318460 246800	Swords Demesne	170m to the W
DU 011-034001-018	Ecclesiastical Site + Castle	318030 246740	Swords Glebe/Townparks (Nethercross By)	160m to the W
DU 011-037	Ritual Site/Holy Well	317920 246360	Forrestfields	400m to the NW
DU 012-022	Ritual Site/Holy Well	318970 246030	Commons East	330m to the SE
DU 011-045	Ritual Site/Holy Well	318490 245810	Crowscastle	200m to the S
DU 011-047	Ring-ditch	317930 244910	Nevinstown West	120m to the E
DU 011-046	Ringfort	317360 244240	Cloghran (Coolock By)	Direct impact
DU 014-010	Ritual Site/Holy Well	318070 243830	Cloghran (Coolock By)	800m to the SE
DU 014-022	Ringfort Unclassified	314570 240970	Balcurris	790m to the W
DU 014-061001-002	Ringfort + Enclosure	314420 240640	Balcurris	750m to the W
DU 014-065	Well possible	314350 240010	Jamestown Great	960m to the W
DU 014-030	House 18th/19th century	316440 240410	Santry Demesne	930m to the E
DU 014-072	Barrow/Mound Barrow	315130 238180	Claremont	200m to the W
DU 014-078	Enclosure	315090 237810	Claremont	560m to the W
DU 018-005001-009	Church/Ecclesiastical site	315330 237650	Dublin North City	400m to the SW
DU 018-004	Earthwork	315030 237500	Dublin North City	680m to the SW
DU 018-009	House	315210 237080	Dublin North City	830m to the SW
DU 018-010	Ritual Site/Holy Well	315400 236860	Daneswell	900m to the S
DU 018-011	Ritual Site/Holy Well	315830 236940	Dublin North City	730m to the S
DU 018-012001	House 16th/17th century	316200 237100	Drishoge (Newcastle By)	560m to the SE
DU 018-013001-002	Church + Graveyard	316520 237070	Dublin North City	820m to the SE
DU 018-014002	Building	316580 237060	Dublin North City	970m to the SE
DU 018-020036-991	Various	315998 233380	Dublin South City	Direct impact
DU 018-051	Inn	315650 232850	Dublin South City	470m to the SW
DU 018-120	Building	315629 232858	Dublin South City	470m to the SW

Summary of Results

This summary should be read in conjunction with the results of the detailed geophysical survey (Section 5)

Responses representing two sub-circular ditched enclosures have been identified within Belinstown Townland, Area AS1 (G8 & G16). The enclosures are located upon a gentle south-facing slope, approximately 187m apart and are within the joint constraint zone for DU008-056 (Archaeological Complex – Earthworks site), DU012-086 (Barrow – Unclassified), DU007-036 (Archaeological Complex – Earthworks site), DU012-001 (Archaeological Complex – ringforts site), DU011-00701 (Castle Site) and DU011-00702 (Earthworks Site). The easternmost enclosure (G8), measures 50m from north to south and 43m from east to west. Numerous internal responses suggestive of occupation have been identified and possible annexes are indicated radiating to the east of the enclosure. The second sub-circular enclosure within the northwest of Area AS1 (G16) measures 49m in diameter. A web of broken linear responses, thought to represent annexes can be identified radiating from the enclosure to the east, west and north.

South of Swords, within the townland of Fosterstown South (AS19 & AS20), a possible archaeological complex has been identified including at least two possible ditched enclosures (A/1 & B/2). Several curvilinear responses (C/3) have been identified which may indicate further archaeological ditches.

To the north of Swords (AS10 & AS11/G50), ground penetrating radar (GPR) has identified responses which may represent the presence of an earlier continuous structure between Lissenhall Bridge (RMP DU011-081; RPS 341 Fingal) and Balheary Bridge (RPS 340 Fingal) spanning both the Broadmeadow and the Ward rivers.

Elsewhere, numerous responses of archaeological potential have been identified throughout the geophysical survey application areas. These responses may represent ephemeral archaeological remains such as pits or burnt spreads or, in some cases, plough-damaged archaeological remains. However, no clear archaeological patterns are visible in these instances and these responses may be modern in origin or may represent localised variations within the subsoil. Nonetheless, an archaeological interpretation cannot be dismissed and further investigation in the form of test trench excavation is recommended to clarify the nature of these responses.

1 Areas of Investigation

1.1 Figures 1-6 show the site location, survey location, location of recorded archaeological monuments (RMP) and location of scanned anomalies (Fig. 1-5 at a scale of 1:8000 and Fig 6 at 1:2500). Also detailed within the location drawings are those areas deemed to be unsuitable for survey and those which were inaccessible at the time of survey.

1.2 For the purposes of design and construction the route has been divided into 7 areas (MN101 - MN107). These areas are referred to throughout the report, and are displayed on the location and summary drawings (Fig 1-30):

- MN101 – Belinstown to Swords Stop
- MN102 – Swords Stop to Airport North Portal
- MN103 – Dublin Airport (No geophysical survey)
- MN104 – Dublin Airport South Portal to Santry Avenue
- MN105 – Santry Avenue to Albert College Park
- MN106 – Albert College Park to Mater Stop
- MN107 – Mater Stop to St Stephens Green (No geophysical survey)

1.3 A total of 50 pre-defined greenfield sites (AS1-AS14, AS16-AS23, AS34-AS39, AS41, AS43-AS50 and AS52-AS64) measuring 103.76ha were initially chosen for geophysical investigation. However, following an initial site visit, several areas were considered to be unsuitable for geophysical survey. Areas AS4 & AS5 contained crops at the time of survey and could not be accessed whilst Areas AS14, AS47 – AS48, AS17-18, AS56 – AS62 & AS64 were considered unsuitable for survey due to modern landscaping and ground disturbance. Ground conditions are displayed within the site location drawings (Fig 1 – 6) and are summarised within Appendix 3

1.4 In total, an area measuring 90.94ha was subject to gradiometer scanning. This area was complimented by 34.95ha of detailed gradiometer survey which is divided into areas G1-G84. Ground penetrating radar (GPR) survey was conducted within Areas AS10 & AS11 (G50) between Lissenhall Bridge (RMP DU011-081 Bridge; RPS 341 Fingal) and Balheary Bridge (RPS 340 Fingal), Swords. This survey is detailed within Appendix 2.

Resistance survey was conducted within Areas AS19 & AS20 (G52 & G35) to help locate the extent of archaeological responses identified here. The detailed gradiometer survey was conducted with a sample interval of 0.25m and a traverse interval of 1m using a Bartington GRAD 601-2 dual sensor instrument. The resistance survey was conducted with the Geoscan research RM15 instrument with a sample interval of 1m and a traverse interval of 1m. (*See Summary Technical Information* section, attached to this report).

1.5 The fieldwork was undertaken on various dates between the 6th May 2008 and 7th April 2009 by David Harrison and Benjamin Thébaudeau under licence to the National Monuments Section of the Department of The Environment, Heritage and Local Government (DoEHLG) and the National Museum of Ireland (Licence No. 08R0117).

1.6 GPR survey was conducted by Murphy Surveys Ltd, on behalf of Margaret Gowen & Co Ltd. Survey was conducted on Thursday 2nd April 2009. Details of this survey can be found within Appendix 2.

1.7 The geophysical survey was conducted in accordance with the latest English Heritage Guidelines (David et al, 2008). The survey areas were set out and tied in to the Irish National Grid with a DGPS system. Tie-in information is available upon request.

2 Data Display

2.1 Figures 7-30 present summary greyscale drawings and accompanying interpretation drawings of the results at a scale of 1:2000.

2.2 Survey data in the form of archive plots is presented within an archive section as a series of XY-trace and dot density plots with accompanying interpretation diagrams (A1.1-A1.86). These are displayed at 1:625.

2.3 Resistance data recorded in Areas AS19 & AS20 (G52 & G35) is presented in A1.47 – A1.49 and A1.53 – A1.55 as raw data and processed data with an accompanying interpretation diagram, all at a scale of 1:1000.

2.4 Letters in parentheses within the text of the report refer to specific areas or responses highlighted within the summary diagrams (Figures 7-30).

2.5 The display formats referred to above are discussed in the *Summary Technical Information* section, attached to this report.

3 Ground Conditions and Further Information

3.1 Ground conditions throughout the scheme varied and also determined when geophysical works could be conducted. Ground conditions are displayed within the site location drawings (Fig 1 – 6) and are summarised within Appendix 3.

3.2 The extent of the survey was limited in some areas by the presence of disturbed ground, power lines, pylons, metal fences, gates, farm buildings and field boundaries. Disturbance from these obstacles is visible within some of the data and can mask or obscure responses produced by any archaeological features that might be present within the affected areas.

3.3 Numerous isolated ferrous-type responses are apparent throughout the data sets. These anomalies are usually caused by the presence of modern ferrous debris within the topsoil and are not referred to in the text unless considered relevant.

4 Results of Gradiometer Scanning *(Figures 1-6)*

4.1 Gradiometer scanning is a fast and effective way of detecting potential archaeological anomalies requiring further investigation with detailed gradiometer survey. The instruments are set in scanning mode and 10m traverses of the application area are made. Information regarding the magnetic background variation and any anomalies of archaeological potential are noted and marked for targeted detailed survey. A concentration of scanned anomalies is suggestive of archaeology. The scanning technique provides a general overview of areas which may be of archaeological interest, and require follow up targeted detailed survey to investigate the true archaeological potential of responses noted.

MN101

Area AS1/ G1-G37 (Figure 1)

4.2 A generally low level of background response (<±0.5nT) was noted throughout the area of the gradiometer scan which proved beneficial to the overall scanning procedure. Anomalies of potential interest were identified across Area AS1, and these were subsequently targeted for further investigation with detailed gradiometer survey.

4.3 A strong and broad anomaly (±5.0nT) was noted within the northeast of Area AS1. Detailed gradiometer survey (G2) was positioned to investigate this anomaly and an isolated anomaly (±2.0nT) which was observed a short distance to the south.

4.4 Within the northwest of Area AS1, two broad anomalies (±3.0nT) were noted. These anomalies were subject to further investigation in the form of detailed gradiometer survey (G16).

4.5 A short distance to the east of (G16), an isolated anomaly (±2.0nT) was noted. Detailed gradiometer survey (G6) was positioned to target and investigate the nature of the anomaly.

4.6 An area of high archaeological potential was observed towards the eastern boundary of Area AS1. Here, a cluster of strong anomalies (±10.0nT) appeared to demonstrate a circular form. Detailed gradiometer survey (G8) was positioned to investigate.

4.7 Immediately south of this area (G8) a broad area of increased background response (±1.0nT) was observed and an isolated anomaly (±3.0nT) was also noted. Detailed survey (G11) was positioned to investigate.

4.8 Two isolated anomalies (±3.5nT) of indeterminate shape were observed within the easternmost field of Area AS1 adjacent to the M1 motorway. Detailed survey areas (G9 and G10) were positioned for clarification.

4.9 A strong and broad anomaly (±15nT) was observed towards the south of Area AS1. Detailed gradiometer survey (G12) was positioned to investigate the source of the anomaly.

4.10 Two isolated anomalies (±1.0nT) were observed towards the centre of Area AS1 adjacent to the Belinstown/Lissenhall townland boundary. Detailed gradiometer survey (G21) was located so as to target and investigate the nature of the anomalies.

4.11 Two isolated anomalies (±3.0nT) were observed towards the west of Area AS1. These anomalies were targeted for further investigation with detailed gradiometer survey (G31 & G32).

4.12 Within the southwest of Area AS1 two further isolated anomalies (±2.0nT) were identified. Detailed gradiometer survey (G36) was positioned to investigate.

4.13 Detailed gradiometer survey (G1, G2, G4 & G5) was located within the north of Area AS1 to investigate the potential for responses of archaeological potential within the vicinity of RMPs DU007-036 (Archaeological Complex – Earthworks Site) and DU012-001 (Archaeological Complex – Ringforts Site). Elsewhere, detailed survey areas (G3,

G7, G13-G15, G17-G20, G22-G30, G33-35 & G37) were positioned to investigate the generally low level of background fluctuation and as a scientific control to test the results of the gradiometer scanning.

Area AS2 & AS3/G38-G43 (Figure 1)

4.14 Minimal background response (±0.5nT) was observed throughout the area of the gradiometer scan. Occasional anomalies of archaeological potential were identified, however, and detailed gradiometer survey was positioned to investigate.

4.15 An area of increased background response (±2.0nT) was observed towards the north of Area AS2. Whilst it was thought likely that the increase in response was associated within the adjacent field boundary, detailed gradiometer survey (G38) was positioned for clarification.

4.16 Elsewhere, four isolated anomalies (±2.0nT) were noted throughout Area AS2 & AS3. Detailed gradiometer survey (G38, G39, and G41) was positioned to further investigate their archaeological potential.

4.17 Minimal background fluctuation was observed through Areas AS2 & AS3 and detailed survey areas (G40, G42 & G43) were positioned to further test the results of the gradiometer scan.

Area AS5 – AS14, AS54 & AS55/G44-G50 (Figures 1 & 2)

4.18 Generally a low level of background fluctuation (±1.0nT) was observed throughout Area AS5 & AS6 which was beneficial to the scanning procedure. Scanning within Area AS9-AS14, AS54 and AS55, however, was more problematic, with frequent ferrous material littering the topsoil contributing to a broad background response (±2.5nT).

4.19 Three isolated anomalies (±2.0nT) were identified within the east of Area AS6. Detailed gradiometer survey areas (G45-G47) were positioned to investigate.

4.20 Detailed gradiometer survey areas (G44, G48 & G49) were positioned to investigate the generally low background fluctuations observed within the gradiometer scan.

MN102

Area AS16/G51 (Figure 3)

4.21 Minimal background fluctuation (±0.5nT) was noted throughout much of the area of the gradiometer scan, although magnetic interference from adjacent buildings resulted in increased background responses towards the south and west of Area AS16.

4.22 An isolated anomaly (±1.5nT) was noted at the top of a prominent rise within Area AS16. Detailed gradiometer survey (G51) was positioned to investigate the source of the anomaly.

Area AS19-AS23/G52-G56 (Figure 3)

4.23 A broad level of background response (±1.0nT) was noted throughout Area AS19 – AS23. Frequent dense clusters of ferrous anomalies were observed, probably resulting from ferrous material scattered within the topsoil. These conditions provided complications for gradiometer scanning although occasional anomalies were identified for further investigation.

4.24 An isolated anomaly (±3.0nT) was observed towards the northwest of Area AS19. Detailed gradiometer survey (G52) was located to investigate.

4.25 A broad area of increased background response (±3.0nT) was observed within the southeast of Area AS19. Whilst it was suspected that this increase in response related to ferrous material within the adjacent boundary, detailed gradiometer survey (G52) was extended to investigate this area.

4.26 Isolated responses (±4.0nT) were noted within the overall broad background response at Area AS20. Detailed gradiometer survey (G53 and G54) was positioned to investigate.

4.27 Two broad areas of increased background response (±2.0nT) were identified for further investigation within the north of Area AS21. Detailed survey (G55) was positioned to investigate.

4.28 Within the south of Area AS22 three positive responses (±2.0nT) and a broad area of increased background response (±1.5nT) were observed adjacent to a small stream. Detailed gradiometer survey (G56) was positioned here to investigate.

MN104

Area AS34-AS41 & AS63/ G62-G78 (Figure 4)

4.29 A broad level of background response (±1.5nT) was noted throughout Area AS34 – AS41, AS43 – AS46 & AS63. Frequent dense clusters of ferrous anomalies were observed, probably resulting from ferrous material scattered within the topsoil. These conditions provided complications for gradiometer scanning. Nevertheless, an area of increased background response was highlighted for further investigation.

4.30 Within the north of area AS34 two broad positive responses (±3.0nT) were identified. Detailed gradiometer survey (G62 & G63) was positioned to investigate.

4.31 Towards the south of Area AS41, a broad area of increased background response (±3.0nT) was observed. The origins of this increase in response were thought to be modern in origin, but detailed gradiometer survey (G78) was positioned to confirm the nature of the response.

4.32 Detailed survey (G57-G61 & G64-G77) was positioned to provide a representative sample of the background response observed.

MN106

Area AS49 & AS50/G79-G82 (Figure 5)

4.33 A broad level of background response (±1.5nT) was observed throughout Areas AS49 and AS50. Frequent areas of magnetic disturbance and clusters of ferrous anomalies were thought to be the result of modern landscaping. No anomalies of archaeological potential

were identified and detailed survey (G79-G82) was positioned to investigate the nature of the background response.

Area AS52/G83-G84 (Figure 5)

4.34 A generally low level of background fluctuation (±0.5nT) was observed throughout Area AS52. This was of overall benefit to the scanning procedure in this area.

4.35 Two strong anomalies (±4.0nT) were observed towards the centre of Area AS52. The anomalies seemed to be linear in form. Detailed gradiometer survey (G84) was positioned to investigate.

4.36 Detailed gradiometer survey (G83) was positioned to investigate the generally low level of background fluctuation which was observed towards the north of Area AS52.

5 Results of Detailed Geophysical Survey

MN101

Area AS1/G1-G15 (Figures 7 & 8)

5.1 No clear archaeological responses have been identified within the vicinity of RMPs DU007-036 (archaeological complex – earthworks site; G1 & G2) or DU012-001 (archaeological complex – ringforts site; G2, G4 & G5). However, occasional pit-type responses and short curvilinear trends have been identified within areas (G1-G5) which may be archaeological in origin, perhaps representing ephemeral archaeological remains. Test trench excavation is recommended to investigate.

5.2 A clear area of archaeological potential has been identified within the east of Area AS1 (G8). Here, a fragmented curvilinear response forms a sub-circular enclosure measuring 50m from north to south and 43m from east to west. Several linear responses, short curvilinear trends and pit-type responses have been identified within the interior of the enclosure. These are thought to indicate occupational features such as small ditches or gullies, pits and postholes. A number of curvilinear trends and responses radiating from the east of the enclosure are thought to represent annexes. The responses appear weaker and less well defined towards the west of the enclosure. This may be the result of increased plough damage within this area or perhaps a lower concentration of magnetically enhanced or burnt material. Archaeological test trench excavation is recommended to assess the nature and full extent of the archaeological remains.

5.3 Several isolated pit-type responses have been identified within areas (G1-G4 and G6-G13) which may be archaeological in origin, perhaps relating to isolated archaeological pits. It is likely, however, that some of these responses relate to either localised variations within the subsoil or ferrous material, buried more deeply within the topsoil. Test trench excavation is required to confirm the nature of these responses.

5.4 Towards the east of Area AS1 (G11) a broad area of increased background response has been identified corresponding with a notable rise in the topography. This increase in response may be of archaeological interest and three pit-type responses have been identified within it. However, no clear archaeological pattern is discernable and it is plausible that near surface geological variation is displayed here. Test trench excavation is recommended to clarify.

5.5 Numerous trends are apparent throughout the east of Area AS1 (G1 – G4 & G6 – G14) which may be of archaeological interest, perhaps relating to ephemeral archaeological remains. Generally, however, these are weak and ill-defined and are thought likely to relate to localised variations within the subsoil. An archaeological origin cannot be dismissed however, and, in particular, rectilinear trends within the north of (G10) and curvilinear trends within the north of (G13) should be targeted for further investigation with testing.

5.6 Former field boundaries have been identified in the form of linear alignments of ferrous responses (G2 & G7). These responses correspond closely to former boundaries depicted on the first edition Ordnance Survey map (1843). Archaeological significance is thought to be minimal.

5.7 Towards the southeast of Area AS1 several broad and amorphous positive responses have been identified (G11-G15). These are thought to relate to localised variations within the subsoil and are not thought to be of any archaeological interest. However, test trench excavation of these responses is recommended for confirmation.

5.8 Several broad areas of magnetic disturbance have been recorded throughout the area. Areas of magnetic disturbance within (G6, G7, G10 and G13) result from the close proximity of adjacent electricity pylons whilst magnetic disturbance within (G2, G4 and G5) relates to a farm building at the site of RMP DU012-001 (Archaeological Complex – Ringforts site). Magnetic disturbance of this nature may mask or obscure any responses of archaeological potential, if present, within the affected area.

MN101

Area AS1/G16-G27 (Figures 9 & 10)

5.9 A clear area of archaeological potential has been identified within the northwest of Area AS1 (G16). A fragmented sub-circular response, thought to represent an enclosure, has been identified, measuring 49m in diameter. Internally, numerous linear responses are thought to indicate ditches and gullies, perhaps forming internal divisions, and several short curvilinear trends and pit-type responses may represent occupational features such as pits and postholes. A web of broken linear responses and trends can be identified

radiating from the enclosure to the east, west and north. These responses are thought to represent annexes formed by ditches, perhaps functioning as areas of differing land use. Overall, the complex measures 78m from east to west and 95m from north to south. Test trench excavation is recommended to confirm the nature and extent of the responses.

5.10 Elsewhere, occasional pit-type responses have been identified (G17, G18, G20-G24) which may be archaeological in origin, perhaps indicating isolated pits. In these instances, however, no clear archaeological patterns are evident and it is possible that these responses relate to localised variations within the subsoil. Test trench excavation is required to establish the nature of these responses.

5.11 A notable broad area of increased background response can be seen throughout the west of Area AS1 (G17-G20). This increase in background response is thought to relate to dense scatters of modern ferrous material within the topsoil and is not thought to be of any archaeological significance.

5.12 A broad area of increased background response has been identified within the south of (G21). This area may be of archaeological interest, perhaps representing a spread of burnt material. However, no clear archaeological patterns are visible and it is possible that this increase in background response relates to ground disturbance associated with the adjacent boundary. Test trench excavation is recommended for clarification.

5.13 Several linear trends are apparent throughout areas (G17 – G18, G21 – G23 and G26 - G27) which may be of archaeological interest, perhaps relating to ephemeral archaeological remains. However, generally these trends are weak and ill-defined and are thought to relate to localised variations within the subsoil. Linear trends displaying a clearer form within the east of (G22) and the south of (G23) are thought typical of field drains and are unlikely to be of any archaeological interest.

5.14 Former field boundaries have been identified in the form of linear alignments of ferrous responses (G16 & G18). These responses correspond closely to former boundaries depicted on the first edition Ordnance Survey map (1843). Archaeological significance is thought to be minimal.

5.15 Within the south of Area AS1 (G20 and G22 – G26), several broad and amorphous positive responses have been identified. These are interpreted as being natural in origin and are thought to relate to localised variations within the subsoil. Archaeological potential is thought to be minimal.

5.16 A broad area of magnetic disturbance within the west of (G16) originates from an electricity pylon at this location and is of no archaeological interest.

MN101

Area AS1/G28-G37 (Figures 11 & 12)

5.17 Several isolated pit-type responses have been identified within (G28, G29, G35 and G36) which may represent plough-damaged or ephemeral archaeological remains. However, no clear archaeological patterns are visible within the datasets and it is possible that these responses relate to ferrous material buried more deeply within the topsoil. Test trench excavation is recommended for clarification.

5.18 Occasional short and curvilinear trends have been recorded throughout the west of Area AS1. Whilst these trends may be of interest, they are generally weak and ill-defined and are thought likely to represent localised variations within the subsoil. Test trench excavation is recommended for clarification.

5.19 Broad and amorphous positive responses have been identified within (G30, G31 and G36). These are interpreted as being natural in origin and are thought to relate to localised variations within the subsoil. Archaeological potential is thought to be minimal.

5.20 Series of parallel linear trends throughout (G28, G30, G32 and G36) are thought to relate to recent ploughing activity and are not thought to be of any archaeological interest.

5.21 A broad linear area of magnetic disturbance within the south of (G28) and an alignment of ferrous responses within (G34) correspond closely to former boundaries depicted on the first edition Ordnance survey map (1843) and are not thought to be of any archaeological interest. Elsewhere, a ferrous alignment towards the south of (G28) and

longer linear trends within (G33, G35 and G37) may also relate to former boundaries or field drains. Archaeological interest is thought to be minimal.

5.22 Areas of magnetic disturbance within (G29, G31, G32 and G37) correspond to the locations of electricity pylons and are of no archaeological interest.

MN101

Area AS2-AS3/G38-G43 (Figures 13 & 14)

5.23 Isolated pit-type responses and short curvilinear trends have been identified within Areas AS2-AS3 (G39 & G41-G43). These responses may be of interest, perhaps indicating isolated pits or ephemeral archaeological remains. However, no archaeological patterns can be seen within the datasets and it is probable that these responses relate to localised variations within the subsoil. Test trench excavation is recommended to clarify.

5.24 A linear trend within the north of (G43) may be of interest, perhaps representing a ditch. However, no clear archaeological pattern is discernable and it is possible that this trend relates to a field drain. Test trench excavation is recommended to clarify.

5.25 Occasional amorphous positive responses have been noted throughout (G38, G40, G41 and G42). These responses are ill-defined and are thought to represent localised pedological variations. Archaeological potential is negligible.

5.26 An area of magnetic disturbance within the southwest of (G38) is thought to relate to ferrous material within the topsoil and is of no archaeological interest.

MN101

Area AS5-AS7 & AS9/G44-G50 (Figures 15 & 16)

5.27 Several pit-type responses and short curvilinear trends have been identified within (G44-G49). These responses may be of interest, perhaps relating to isolated pits or plough damaged archaeological remains. However, they form no clear archaeological patterns and it is thought likely that localised pedological variations may be represented here. Test trench excavation is recommended to investigate the source of the responses.

5.28 Areas of magnetic disturbance within the east and north of (G47) relates to ferrous material within the adjacent boundaries. Disturbance within the south of (G48) is thought to originate from an adjacent house whilst broad areas of magnetic disturbance within (G49) are thought to relate to modern ground disturbance. No archaeological interpretation of these areas can be offered.

5.29 Based upon the recommendations of the EIS, Ground penetrating radar (GPR) survey was conducted within (G50) between Lissenhall Bridge (RMP DU011-081 Bridge; RPS 341 Fingal) and Balheary Bridge (RPS 340), Swords (Areas AS10 & AS11) to establish the structural relationship between the two bridges and to determine whether the two bridges are, in fact, one continuous structure. GPR survey identified one clear arch as well as a linear anomaly which is interpreted as the response from an older road. This survey is detailed within Appendix 2.

MN102

Area AS16/G51 (Figures 17 & 18)

5.30 A linear trend within the centre of Area AS16 (G51) may be of interest, perhaps representing the site of a ditch or former boundary. The trend, however, is ill-defined and it is equally viable that natural variations within the subsoil are represented here. Test trench excavation is recommended to clarify.

5.31 Elsewhere, three plough trends running perpendicular to a linear negative trend are thought to relate to agricultural activity and are unlikely to be of any archaeological interest.

5.32 Broad magnetic disturbance has been recorded within the northwest of Area AS16. This originates from metal fencing at this location and is of no archaeological interest.

MN102

Area AS19-AS23/G52-G56 (Figures 19 & 20)

5.33 An area of considerable archaeological potential has been identified within Area AS19 and within the north of Area AS20. Several curvilinear trends and responses are thought

to represent at least two ditched enclosures (A & B) whilst several further curvilinear responses (C) may indicate further concentrations of archaeological activity. Interpretation of the data is hampered, however, by frequent ferrous responses caused by ferrous debris within the topsoil and contributing to a broad background response.

5.34 A broad rectilinear response within (G52) is thought to represent part of an enclosing ditch, the remainder of which is only visible as weak and ill-defined curving trends to the west. The full extents of this sub-square enclosure (A) are unclear. However, we may postulate that it measures 32m from north to south and 36m from east to west. A cluster of positive responses within the interior of the possible enclosure may represent occupational activity such as pits and postholes. No entranceway is visible within the gradiometer data.

5.35 Approximately 140m south-southwest of the possible enclosure (A), a possible D-shaped enclosure (B) has been identified within Area AS20 (G53). The possible enclosure (B) is formed by faint curvilinear responses and trends and measures 30m from northwest to southeast and 33m from northeast to southwest. Three weak linear trends can be identified within the interior of (B), perhaps representing ephemeral or plough-damaged archaeological remains. Test trench excavation is recommended to confirm the nature and extents of the possible enclosure.

5.36 Within the north of Area AS20 (G53) several linear and curvilinear trends and responses (C) have been identified. These are thought to represent curving ditches and gullies. No clear archaeological form is discernable, but given the close proximity of possible enclosures (A) and (B) an archaeological origin is likely. Test trench excavation is recommended for clarification.

5.37 A strong linear response (D) is visible within (G52 & G53). This response is thought to represent a ditch and corresponds closely to a former field boundary as depicted on the first edition Ordnance Survey map (1843). The response runs south of the sub-square response (A) and north of responses (B) and (C) and its location may have been influenced by earthworks which are no longer visible on the ground surface. Given the curvilinear nature of this probable former boundary, archaeological interpretation is tentative and test trench excavation is recommended to clarify.

5.38 A clear linear response (E), thought to indicate a ditch, has been identified within the south of Area AS20 (G54). The response is equal in form to the linear response (D) (G52 & G53) although it does not correspond to any field boundary depicted on first edition (1843) or second edition (1871-5) Ordnance Survey mapping and, therefore, its origins are unclear. Test trench excavation is recommended to clarify.

5.39 Elsewhere, occasional pit-type responses and short curvilinear trends have been identified throughout (G54, G55 & G56) which may be archaeological in origin and a cluster of positive responses within the south of (G42) may represent plough-damaged archaeological remains. No clear archaeological patterns are visible, however, and it is possible that these responses relate to localised variations within the subsoil. Test trench excavation of these responses is recommended to confirm their origins.

5.40 Two broad areas of increased background response are visible adjacent to streams within the north of (G55) and the south of (G56). These areas may be of interest, perhaps representing spreads of burnt material. However, no clear archaeological form can be seen within the datasets and it is thought possible that these increases in background response relate to ground disturbance associated with the adjacent streams. Test trench excavation is recommended to clarify.

5.41 A curvilinear response within the south of Area AS22 (G56) may be of interest, perhaps representing a ditch. Interpretation is cautious however, as no clear archaeological pattern is visible. Test trench excavation is recommended for clarification.

5.42 Series of parallel linear trends have been identified within (G55). These are thought to represent plough furrows and are of no archaeological interest.

5.43 Areas of magnetic disturbance have been identified to the south of (G52) and the north of (G53) relating to ferrous material within the adjacent boundaries. Magnetic disturbance within the south of Area AS22 (G56) also relates to ferrous material within the adjacent boundary whilst disturbance within (G55) is associated with an iron borehole cover at this location.

MN102

Area AS19-AS22/G52-G53 Resistance Survey (Figures 21 & 22)

5.44 Resistance survey was conducted within Areas AS19 and AS20 (G52 & G53) to aid the interpretation of the gradiometer survey.

5.45 Resistance proved problematic due to the dry conditions of the site within early November 2008, however some clear responses of interest have been recorded and an archaeological interpretation can be made.

5.46 A clear low resistance curvilinear response (1) has been identified towards the east of (G52) and appears to correlate with the gradiometer response (A) previously discussed (section 5.34). The response is thought to represent a sub-circular enclosure ditch. Morphologically, the low resistance response (1) appears more sub-circular in form but its dimensions are almost identical to those recorded within the gradiometer survey. A broad high resistance response has been identified within the north of the possible enclosure, perhaps representing an area of rubble or a compacted surface. Test trench excavation is recommended for clarification.

5.47 Curvilinear low resistance responses (5 & 6) have been identified to the north, northeast and northwest of the possible sub-circular enclosure (A/1). These responses correspond to faint and fragmented trends and isolated positive responses identified within the gradiometer survey and are thought to represent further ditches, perhaps indicating an outer enclosure ditch or external annexe(s). Test trench excavation is recommended to investigate.

5.48 Towards the south of (G53) within AS20 curvilinear high resistance trends (2) correspond to responses (B), a possible D-shaped enclosure, which was identified within the gradiometer survey. Test trench excavation is recommended to further investigate.

5.49 Curvilinear low resistance response (3), within the north of (G53), corresponds closely to a curving positive response (C) which was previously identified within the gradiometer survey. This response is thought to represent a curving ditch or gully. No clear archaeological form is discernable, but given the close proximity of possible enclosures

(A/1) and (B/2) an archaeological origin is likely. Test trench excavation is recommended for clarification.

5.50 A curving low resistance linear response (4) has been identified within the south and east of (G53). This response corresponds to response (D) which was previously identified within the gradiometer survey and is thought to represent a former field boundary as depicted on the first edition Ordnance Survey map (1843). The response runs south of the sub-circular response (A/1) and north of responses (B/2) and (C/3) and its location may have been influenced by earthworks which are no longer visible on the ground surface. Given the curvilinear nature of this probable former boundary, archaeological interpretation is tentative and test trench excavation is recommended to clarify.

5.51 Parallel linear low resistance responses (7) have been identified within the east of (G52). These responses are thought to represent field drains and are not thought to be of any archaeological interest. Test trench excavation is recommended to clarify.

5.52 Broad areas of high resistance within the resistance data sets are thought to be a result of near-surface geological variations are not considered to be of archaeological interest. However, it should be noted that these responses may mask or obscure any responses of archaeological potential, if present, within the affected area.

5.53 Broad areas of low resistance response within the south of (G52) and the north of (G53) are thought to relate to adjacent field boundary ditches and are interpreted as being modern in origin. Again, however, these responses may mask or obscure any responses of archaeological potential, if present, within the affected area.

MN104

Area AS34 /G57-G71 (Figures 23 & 24)

5.54 Occasional pit-type responses have been identified throughout Area AS34 (G57-G64, G66-G68 & G70) which may be archaeological in nature, perhaps representing plough-damaged archaeological remains. However, no archaeological patterns are discernable within the broad background response littered with ferrous responses. It is possible that

these responses relate to further ferrous material buried more deeply within the topsoil. Test trench excavation is recommended for clarification.

5.55 Numerous fragmented linear responses and trends have been identified throughout Area AS34. Whilst it is possible that some of these trends and responses are of archaeological potential, perhaps representing ditches, no clear archaeological patterns are visible. It is thought likely that these responses relate to agricultural activity such as plough furrows and drainage ditches. Test trench exaction is recommended for clarification.

5.56 An alignment of ferrous responses within the south of (G65) and fragmented linear responses within (G67-G69 & G71) correspond closely to former field boundaries depicted on the first edition Ordnance Survey map (1843) and are not thought to be of any archaeological interest.

5.57 Areas of magnetic disturbance at the perimeters of Area AS34 (G57, G58, G60, G61 & G69) relate to magnetic disturbance within the adjacent boundaries and is of no archaeological interest.

MN104

Area AS35-AS37 & AS63/G72-G76 (Figures 25 & 26)

5.58 A fragmented linear response within the west of (G75) may be of archaeological interest, perhaps representing a ditch. No clear archaeological pattern is apparent, however, and this response may relate to agricultural practices. Test trench excavation is recommended to clarify the origins of the response.

5.59 Isolated pit-type responses have been recorded within (G73 & G75) which may be of interest. No archaeological patterns can be seen, however, and it is possible that these responses simply relate to ferrous debris buried more deeply within the topsoil. Test trench excavation is recommended to determine the source of the responses.

5.60 A clear linear response has been identified within (G76). This response is thought to represent a ditch and corresponds closely to a former field boundary depicted on the first

edition Ordnance Survey map (1843). Archaeological significance is thought to be negligible. Similarly, the ferrous linear response within (G73) also corresponds to a boundary on the first edition Ordnance Survey map and is thought unlikely to be of any archaeological interest.

5.61 Several linear and curvilinear trends have been identified throughout the datasets (G72 – G76). These trends may be archaeological in origin, perhaps representing plough-damaged archaeological remains. However, these are generally weak and ill-defined, and they form no clear archaeological patterns. Whilst an archaeological interpretation cannot be dismissed, an agricultural interpretation is preferred here.

5.62 Within the west of Area AS37 (G76) a series of parallel linear trends represent former ploughing activity and are unlikely to be of any archaeological interest.

5.63 Within the south of Area AS37 (G76) magnetic disturbance dominates the dataset. This is due to the close proximity of a compound containing a number of structures and vehicles. Disturbance of this type may mask or obscure any responses of archaeological potential, if present, within the affected area. No archaeological assessment of this area can be offered. Similar disturbance is encountered within the south of Area AS35 (G72) resulting from the adjacent water treatment plant and within Area AS36 (G74) due to a manhole cover and area of ground disturbance.

MN104

Area AS41/G77-G78 (Figures 27 & 28)

5.64 Towards the south of Area AS41 (G78) a fragmented linear response has been identified, perhaps representing a ditch. This response does not correspond to any former boundary depicted on either the first edition (1843) or second edition (1871-5) Ordnance Survey mapping and, therefore, may be archaeological in origin. However, it is equally possible that agricultural activity such as field drainage may be represented here. Test trench excavation is recommended to further investigate.

5.65 Within the east of (G78) two short parallel linear responses can be identified within a broad background response. These responses may be archaeological in origin, perhaps

representing ephemeral or plough-damaged archaeological remains. However, given the level of modern magnetic disturbance within the vicinity it is possible that these responses originate from modern ground disturbance. Test trench excavation is recommended for confirmation.

5.66 Broad areas of magnetic disturbance have been identified within the north of Area AS41 (G77). These relate to ferrous material associated with an electricity pylon and to metal fencing at the perimeters of the field.

MN106

Area AS49, AS50 & AS52/G79-G84 (Figures 29 & 30)

5.67 Several fragmented linear responses, thought to represent ditches, have been identified within Areas AS49 (G79) and AS50 (G82). The linear responses do not correspond to former boundaries on either the first edition (1843) or second edition (1871-5) Ordnance Survey maps and therefore an archaeological interpretation must be considered. However, no clear archaeological patterns are visible and the linear form of these responses is thought to be equally indicative of drainage ditches or service trenches. Test trench excavation is recommended to further investigate.

5.68 A clear fragmented curvilinear response within Area AS52 (G84) corresponds to the curving townland boundary between Hampstead South and Drishoge. This boundary is depicted on first (1843), second (1871-5) and third (1906-9) edition Ordnance Survey maps. Given the curving nature of this former boundary an archaeological interpretation should be considered and test trench excavation is recommended.

5.69 Strong linear areas of magnetic disturbance appear to extend south from the former townland boundary within (G84). The strength of these responses is suggestive of modern service piping and archaeological potential is thought to be minimal.

5.70 A further linear response can be seen roughly parallel to and north of the Hampstead South – Drishoge townland boundary (G83 & G84). This response may be archaeological in origin, perhaps representing a ditch. However, an agricultural origin is an equally viable interpretation. Test trench excavation is recommended to clarify.

5.71 Elsewhere, occasional isolated positive responses have been identified within Area AS49 (G79), AS50 (G82) and AS52 (G83). These responses may indicate isolated archaeological pits. No archaeological patterns are discernable, however, and it is thought possible that these responses simply relate to ferrous debris buried more deeply within the topsoil. Interpretation is tentative and test trench excavation is recommended for confirmation.

5.72 Occasional faint curvilinear trends within Area AS50 (G81-G82) and AS52 (G83) are thought to indicate localised variations within the subsoil. However, an archaeological interpretation cannot be dismissed and these trends may represent ephemeral or plough-damaged archaeological remains. Test trench excavation is recommended.

5.73 Series of parallel linear trends are apparent throughout Areas AS49 (G79 & G80) and AS50 (G81 & G82). These trends are thought to represent former ploughing activity and are unlikely to be of any archaeological interest.

5.74 Areas of modern magnetic disturbance have been identified throughout the datasets. Disturbance within the south of (G80 and G81) results from nearby goalposts whilst a broad area of magnetic disturbance within the west of (G82) is thought to originate from a modern service pipe at this location. Isolated areas of magnetic disturbance within areas (G81 and G82) are thought to relate to larger ferrous objects within topsoil and an area of magnetic disturbance towards the north of (G84) is caused by ferrous material within an adjacent boundary.

6 Conclusion

MN101

6.1 An area of clear archaeological potential has been identified in Area AS1 (G8 & G16) within Belinstown townland. Responses within (G8 and G16) are contained within the joint constraint zone for DU008-056 (Archaeological Complex – Earthworks site), DU012-086 (Barrow – Unclassified), DU007-036 (Archaeological Complex – Earthworks site), DU012-001 (Archaeological Complex – ringforts site), DU011-00701 (Castle Site) and DU011-00702 (Earthworks Site), and are similar in morphology to early medieval complexes recently identified at Oldtown in Swords, Nevitt, North County Dublin, Flemmington, North County Dublin and Milverton, also in North County Dublin. As such, these areas should be considered of high archaeological potential.

6.2 Clear curvilinear responses within (G8) form a sub-circular ditched enclosure measuring 50m from north to south and 43m from east to west. Several internal responses are thought to indicate occupational features such as small ditches, pits and postholes and possible annexes have been identified radiating east and northeast from the enclosure. Test trench excavation is recommended to confirm the nature and extent of the responses.

6.3 Within (G16), 187m to the northwest of (G8), fragmented curvilinear responses indicative of a second sub-circular enclosure have been identified. The enclosure measures 49m in diameter and contains several internal responses thought to represent occupation. A web of broken linear responses, thought to represent annexes extends from the enclosure to the north and west. Overall, the complex measures 78m from north to south and 95m from east to west. Test trench excavation is recommended to confirm the nature and extent of the responses.

6.4 Elsewhere within Area AS1, occasional pit-type responses and short curvilinear trends have been identified throughout the datasets (G1-G4, G6-G13, G16-G23, G28-G29, G35-G36, G39, G41-G43 and G44-G49) perhaps representing isolated or ephemeral archaeological remains. No clear archaeological forms are visible, however, and it is possible that these responses indicate localised variations within the subsoil or, in some instances, ferrous material buried more deeply within the subsoil. Test trench excavation is recommended to confirm the nature of these responses.

6.5 Localised areas of increased background response within Area AS1 (G11 and G21) may be of interest, perhaps representing spreads of burnt material. Test trench excavation is recommended to investigate.

6.6 Fragmented linear responses and trends representing former field boundaries depicted on the first (1843) and second (1871-5) edition Ordnance Survey maps have been identified within Area AS1 (G2-G4, G7, G16, G18, G28 & G34).

6.7 Responses within (G1-G5) display no clear areas of archaeological potential within the vicinity of recorded archaeological monuments DU007-036 (Archaeological Complex – Earthworks Site) and DU012-001 (Archaeological Complex – Ringforts Site).

6.8 Within (G50) ground penetrating radar (GPR) has identified responses which may represent the presence of an earlier continuous structure between Lissenhall Bridge (RMP DU011-081 Bridge; RPS 341 Fingal) and Balheary Bridge (RPS 340) spanning both the Broadmeadow and the Ward rivers. A linear anomaly is visible extending northwards from Lissenhall Bridge towards Balheary Bridge over an area of 30m. This is interpreted as the response of the old road wall, or its foundations and that could suggest a continuous bridge structure within the survey area (Welsh, 2009; Appendix 2). The presence of a continuous Bridge structure at this location is also supported by cartographic sources including Rocque's map of Dublin 1970 and the 1st edition OS Map of Dublin 1837. Given that the GPR survey has identified anomalies of possible archaeological potential, particularly at the location of the arch (illustrated as Photo 2 and Dwg. No. 09460_C1 in Appendix 2); it is recommended that further investigation in the form of test excavation and/or building survey analysis of the arch and other potential arches within the GPR survey area is undertaken.

MN102

6.9 A possible archaeological complex has been identified within Areas AS19 (G52) and AS20 (G53) in the townland of Fosterstown South. Curvilinear trends and responses are thought to represent at least two ditched enclosures (A/1 & B/2) whilst several further curvilinear responses (C/3) may indicate additional archaeological activity. Test trench excavation is recommended to confirm the nature and extent of the responses.

6.10 Elsewhere, numerous isolated responses of archaeological potential and short linear and curvilinear trends have been identified throughout the datasets (G51-G56) perhaps representing ephemeral or plough-damaged archaeological remains. In these cases, however, no clear archaeological patterns are visible and it is possible that these responses indicate localised variations within the subsoil or, in some instances, ferrous material buried more deeply within the topsoil. Test trench excavation is recommended to confirm the nature of these responses.

6.11 Fragmented linear responses and trends (D/4) representing former field boundaries depicted on former Ordnance Survey maps have been identified within areas AS19 (G52) and AS20 (G53). Linear responses identified within (G54) and (G56) do not correspond to former Ordnance Survey mapping and their origins are unclear. Test trench excavation of these responses is recommended for clarification.

MN104

6.12 Positive responses identified within Area AS34 (G57-G64, G66-G68 & G70), AS63 (G73), AS36 (G75) and AS41 (G78) may represent ephemeral or plough-damaged archaeological remains and test trench excavation should be undertaken to investigate.

6.13 Linear responses within Area AS34 (G65, G67-G69 & G71), AS63 (G73), AS37 (G76) and AS41 (G78) correspond closely to former field boundaries depicted on former Ordnance Survey mapping. Linear responses within Areas AS34 (G57-G66), AS36 (G75) and AS41 (G78), however, do not correspond to known former field boundaries and an archaeological interpretation cannot be dismissed. Test trench excavation is recommended.

MN106

6.14 Several fragmented linear responses within Area AS49 (G79), AS50 (G82) and AS52 (G83, G84) are thought to represent ditches. These responses do not correspond to known former boundaries depicted on former Ordnance Survey mapping and an archaeological interpretation should be considered.

6.15 A curvilinear response within AS52 (G84) corresponds to the townland boundary between Hampstead South and Drishoge. Given the curving nature of the response an archaeological interpretation should be considered. Test trench excavation is recommended

6.16 Isolated pit-type responses have been identified within Area AS49 (G79), AS50 (G82) and AS52 (G83). These responses may represent ephemeral or plough-damaged archaeological remains and test trench excavation should be undertaken to investigate.

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Summary Technical Information

Fluxgate Gradiometer Survey

Surveys are undertaken using a Geoscan Research FM36 or a Bartington *Grad* 601-2 instrument.

Geoscan FM36

The FM36 gradiometer operates with two sensors, at constant 0.5m vertical separation. The near surface variations within the vertical component of the earths magnetic field are measured. Mounted to an ST1 sample trigger the instrument is used in reconnaissance and detailed modes. For detailed survey, data are recorded at virtual fixed sample intervals of 0.25m or 0.5m along 1m traverses, giving 800 or 1600 readings per 20m x 20m grid.

Bartington GRAD 601-2

The Bartington *Grad* 601-2 instrument is similar in operation to the FM36 gradiometer. However, the sensors have a separation of 1m allowing greater sensitivity. It is operated with dual gradiometer sensors, allowing fast data collection.

Frequent realignment of the instruments and zero drift correction; ensure a constant high quality of data. Extremely sensitive, these instruments can detect variations in soil magnetism to 0.1nT, affording diverse application throughout a variety of archaeological, soil morphological and geological conditions.

Electrical Resistance

The technique is used to record variations in electrical resistance by passing an electrical current through the ground. The standard instrument for archaeological investigations is a twin-probe array of mobile and remote electrodes maintained at a distance of about 20m.

The mobile electrodes (one current and one potential, usually 1m apart) are mounted on a survey frame and connected to a Geoscan RM15 resistance meter, which records the specific resistance of the soil (measured in ohms).

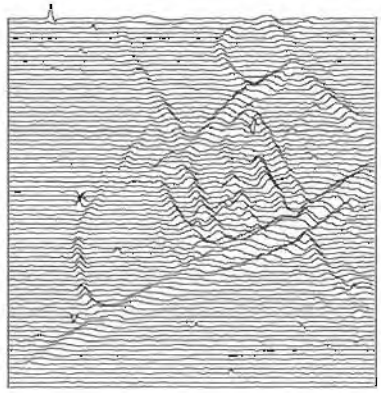
The resistance meter is connected to the pair of remote probes (one current and one potential), which remain in a fixed location. Data are collected as the survey frame and mobile probes reach each designated sample interval. Surveys are usually undertaken at 1 m sample intervals along 1 m traverses (i.e., 400 readings per 20m x 20m grid. The adaptability of the instrument enables increased sampling intervals, as well as a range of probe separations and arrays to operate at varying depth penetration.

ISO 9001:2000 EQA QUALITY ASSURED ORGANISATION

Data Display Formats

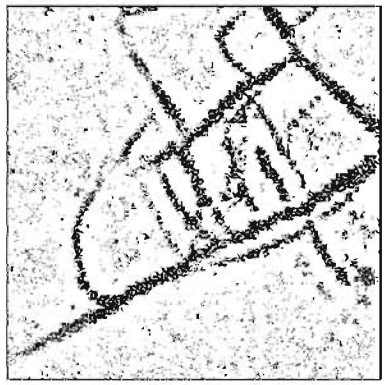
XY Trace

The data are presented as a series of linear traces, enabling a semi-profile display of the respective anomalies along the X and Y-axes. This display option is essential for distinguishing between modern ferrous materials (buried metal debris) and potential archaeological responses. The XY trace plot provides a linear display of the magnitude of the response within a given data set.



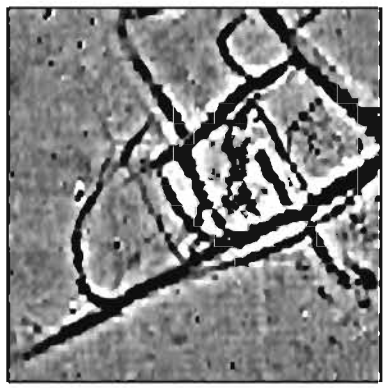
Dot Density Plot

Each datum is assigned a cell in which the intensity or number of dots displayed is proportional to the magnitude of the individual response. The visibility or presentation of responses within a given survey area is governed by numeric parameters specific to both soil morphological and archaeological conditions observed on site. Typically, the range of weak to strong responses is manifested by a low to high level of dot density. The format is useful for displaying gradiometer and resistance data particularly for identifying low-level responses.



Greyscale

As with dot density plots, the greyscale format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within the given data set. This display method also enables the identification of discrete responses that may be at the limits of instrument detection.



**XY Trace and dot density plots are presented in archive form for display of the raw survey data. Summary greyscale images of the interpolated data are included for presentation purposes and to assist interpretation.*

Glossary of Interpretation Terms

Archaeology

This category refers to responses usually supported by comparative archaeological evidence (i.e., photographic transcriptions, excavation, etc). The term is generally associated with significant concentrations of former settlement, such as ditched enclosures, storage pits and associated features.

?Archaeology

This term corresponds to anomalies that display typical archaeological patterns where no record of comparative archaeological evidence is available. In some cases, it may prove difficult to distinguish between these and evidence of more recent activity also visible in the data.

?Industrial

Such anomalies generally possess a strong magnetic response and may equate with archaeological features such as kilns, furnaces, concentrations of fired debris and associated industrial material.

Area of Increased Magnetic Response

These responses often lack any distinctive archaeological form, and it is therefore difficult to assign any specific interpretation. The resulting responses are site specific, possibly associated with concentrations of archaeological debris or more recent disturbance to underlying archaeological features.

Trend

This category refers to low-level magnetic responses barely visible above the magnetic background of the soil. Interpretation is tentative, as these anomalies are often at the limits of instrument detection.

Ploughing/Ridge & Furrow

Visible as a series of linear responses, these anomalies equate with recent or archaeological cultivation trends.

?Natural

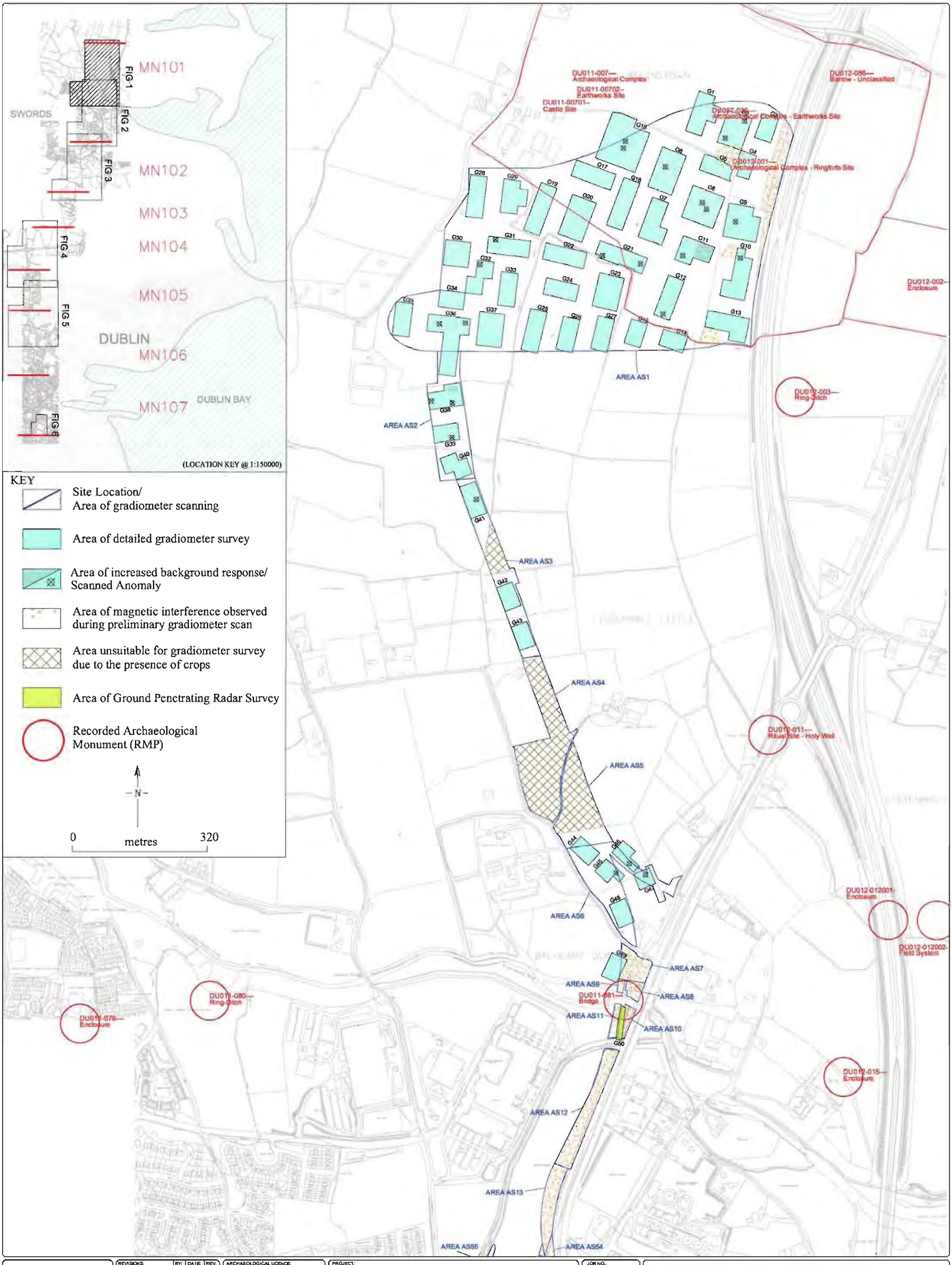
Resulting from localised natural variations in the magnetic background of the subsoil, these responses are often recorded in areas of low-lying land prone to flooding.

Ferrous

These anomalies exhibit a typically strong magnetic response, often referred to as 'iron spikes,' and are the result of modern metal debris located within the topsoil.

Area of Magnetic Disturbance

This term refers to large-scale magnetic interference from existing services or structures. The extent of this interference may in some cases obscure anomalies of potential archaeological interest.



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PROJECT: METRO NORTH

TITLE: MN101:SURVEY LOCATION, RMP LOCATION & LOCATION OF SCANNED ANOMALIES

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_01

FIG. NO.: Fig. 1

SCALE: 1/8000 @ A3

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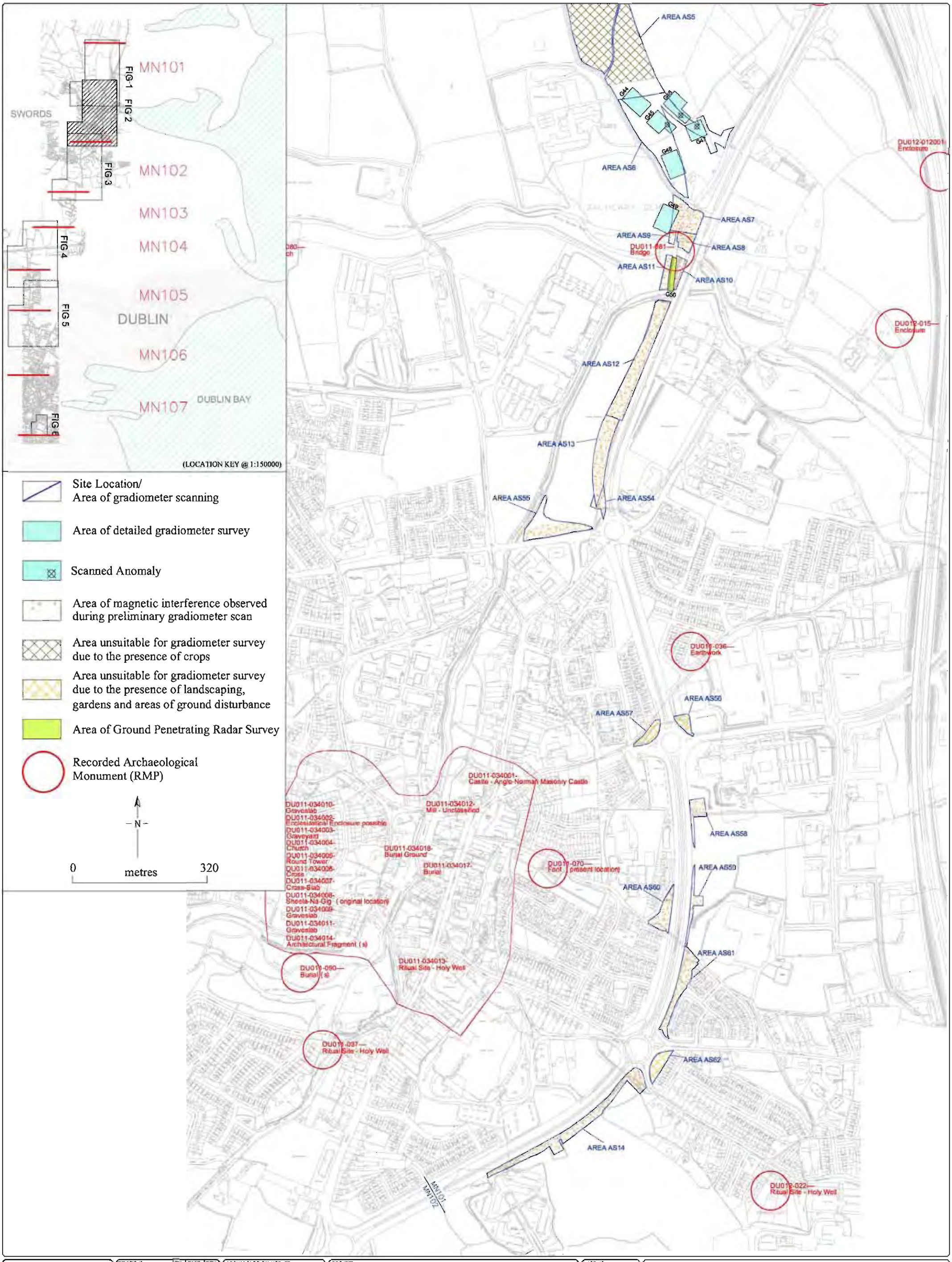

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PROJECT: METRO NORTH

TITLE: MN101 CONT.:SURVEY LOCATION, RMP LOCATION & LOCATION OF SCANNED ANOMALIES

CLIENT: RAILWAY PROCUREMENT AGENCY

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DRAWING NO.: 08090_02

FIG. NO.: Fig. 2

SCALE: 1/8000 @ A3

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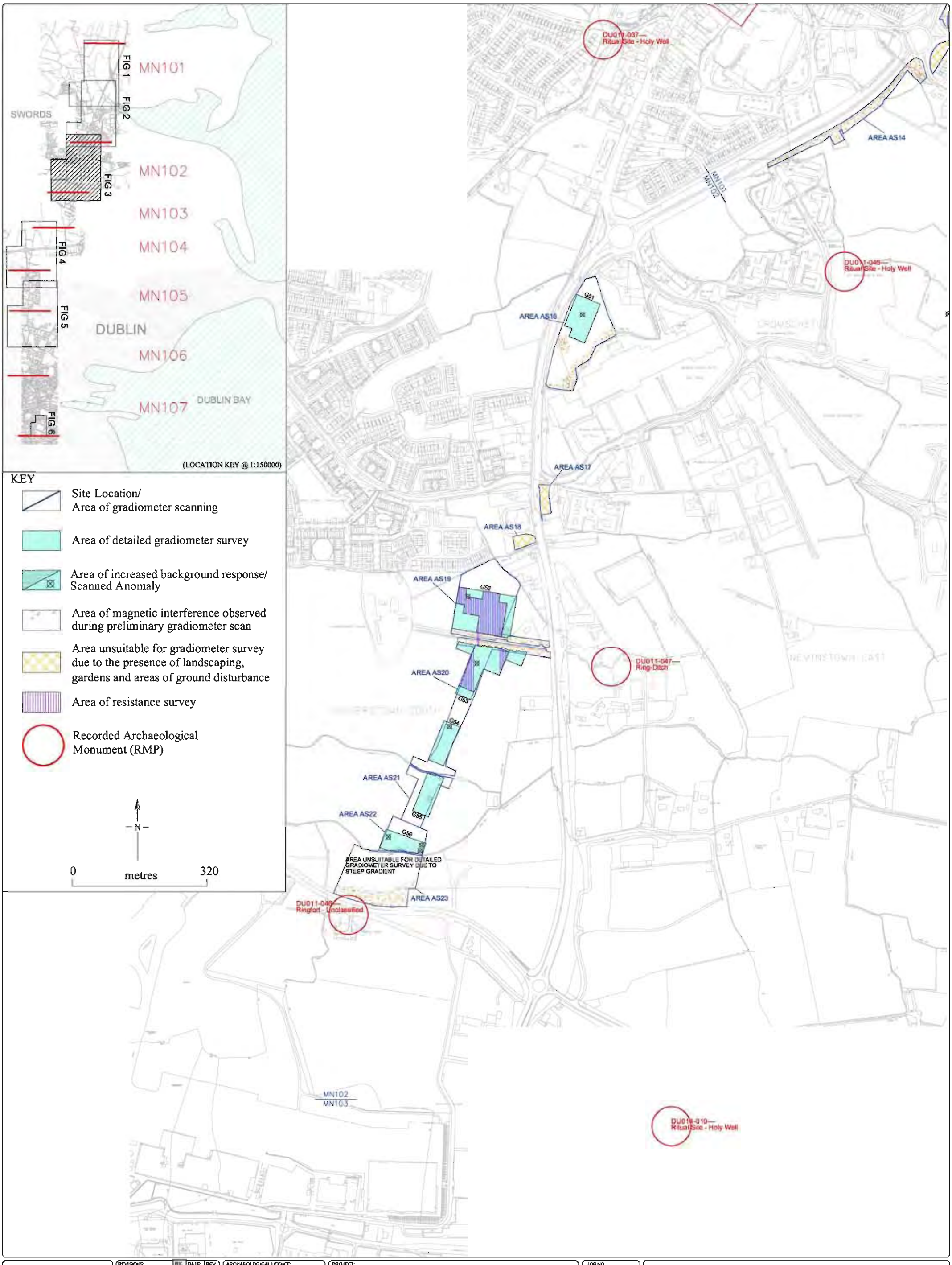

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CERT NO. 2975

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ARCHAEOLOGICAL LICENCE: 08R0117

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PROJECT: METRO NORTH

TITLE: MN102:SURVEY LOCATION, RMP LOCATION & LOCATION OF SCANNED ANOMALIES

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_03

FIG. NO.: Fig. 3

SCALE: 1/8000 @ A3

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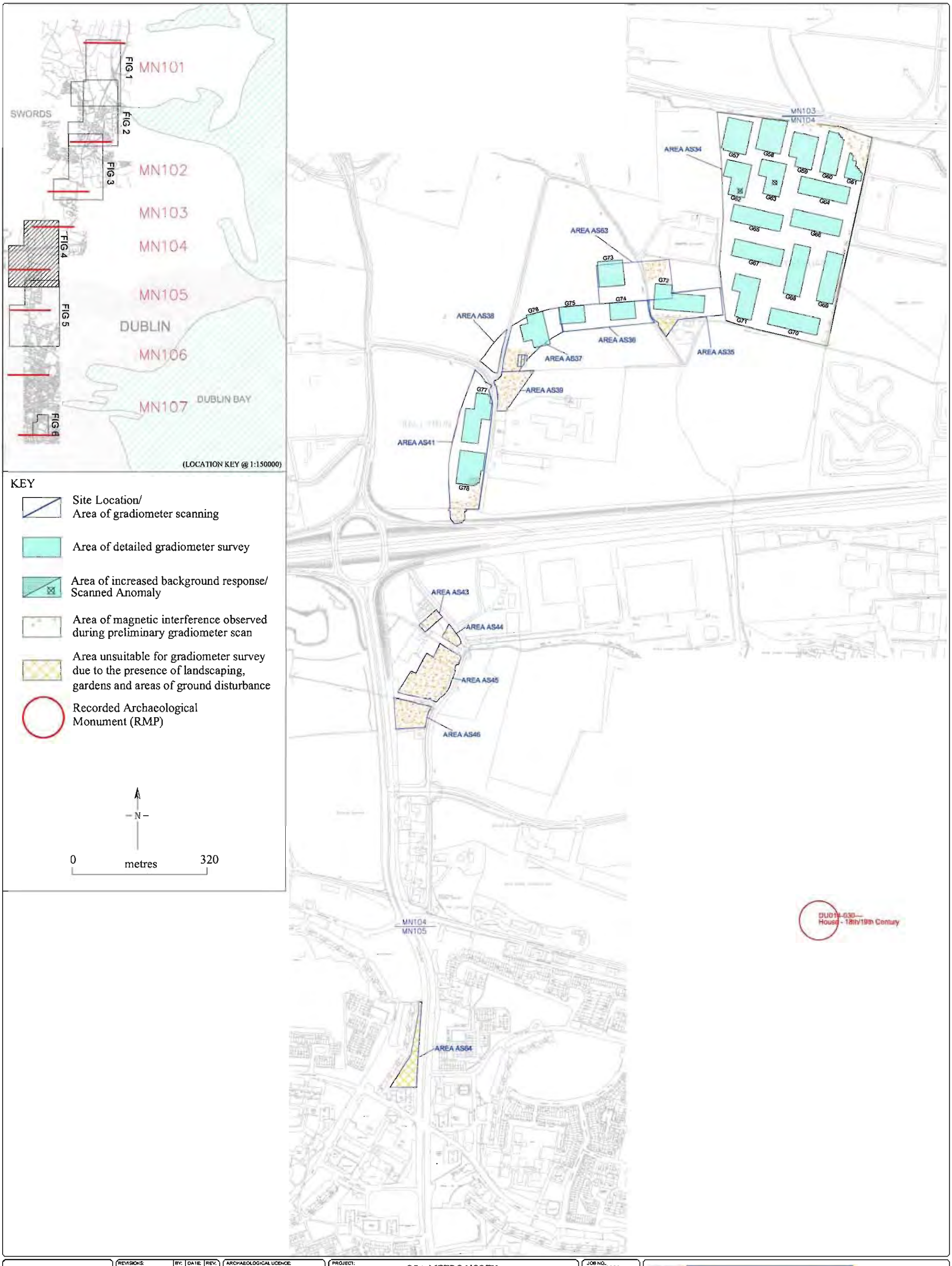

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PROJECT: RPA METRO NORTH

TITLE: MN104:SURVEY LOCATION, RMP LOCATION & LOCATION OF SCANNED ANOMALIES

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_04

FIG. NO.: Fig. 4

SCALE: 1/8000 @ A3

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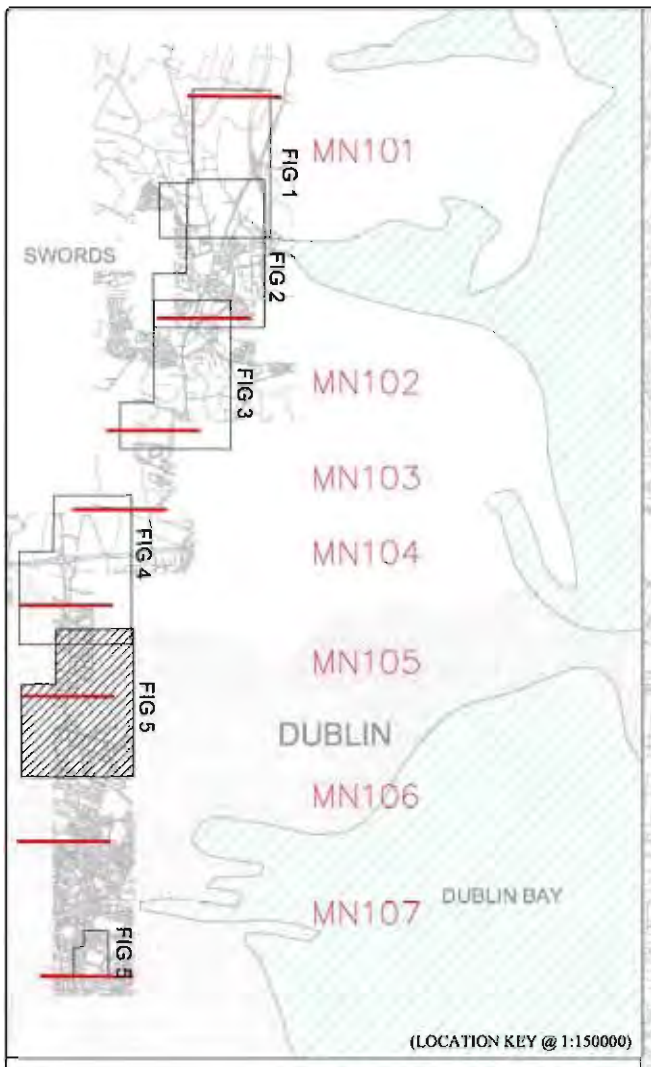
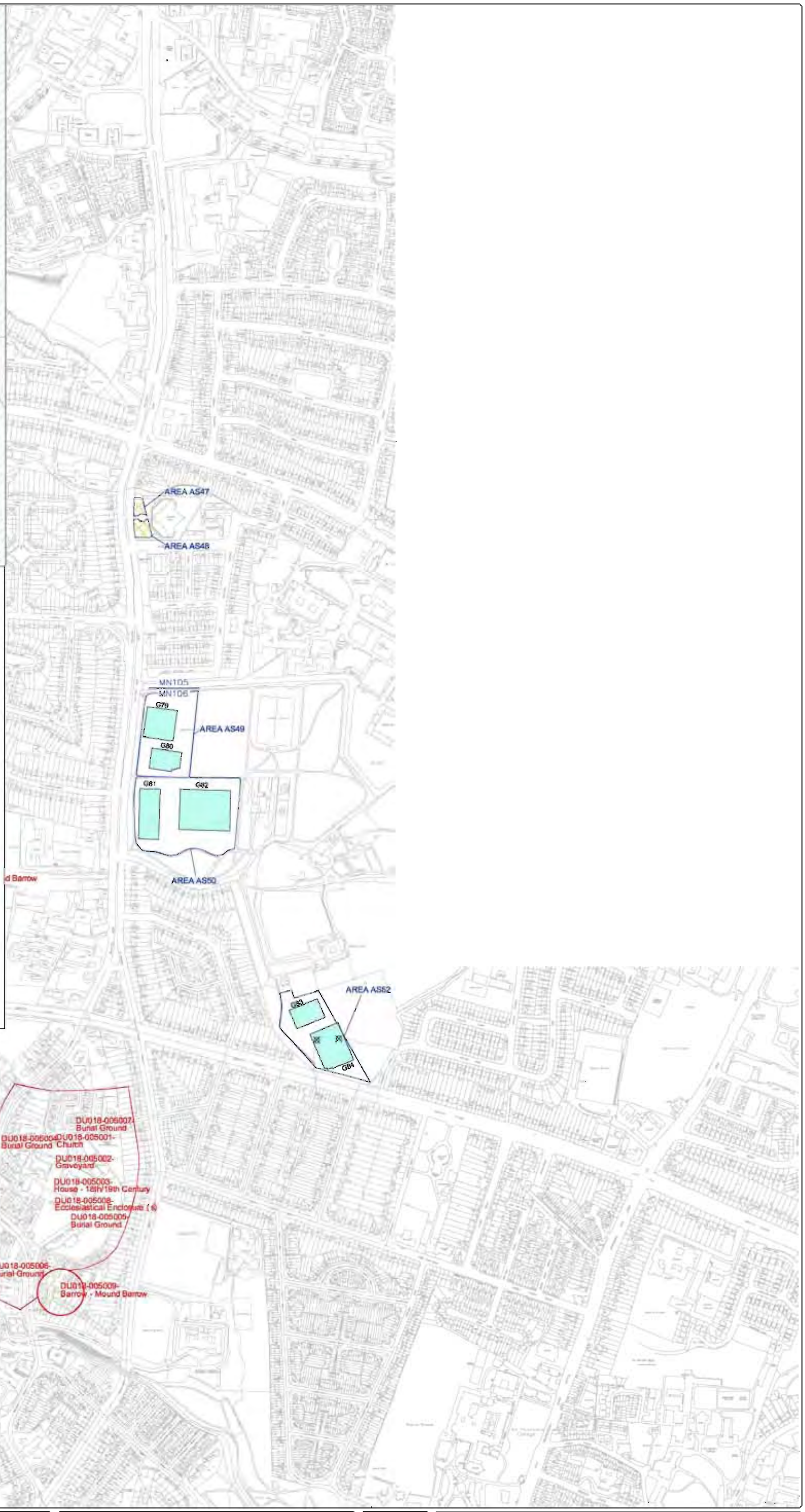


KEY

- Site Location/ Area of gradiometer scanning
- Area of detailed gradiometer survey
- Scanned Anomaly
- Area unsuitable for gradiometer survey due to the presence of landscaping and areas of ground disturbance
- Recorded Archaeological Monument (RMP)

N

0 metres 320



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PROJECT: METRO NORTH

TITLE: MN105-MN106:SURVEY LOCATION, RMP LOCATION & LOCATION OF SCANNED ANOMALIES

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_05

FIG. NO.: Fig. 5

SCALE: 1/8000 @ A3

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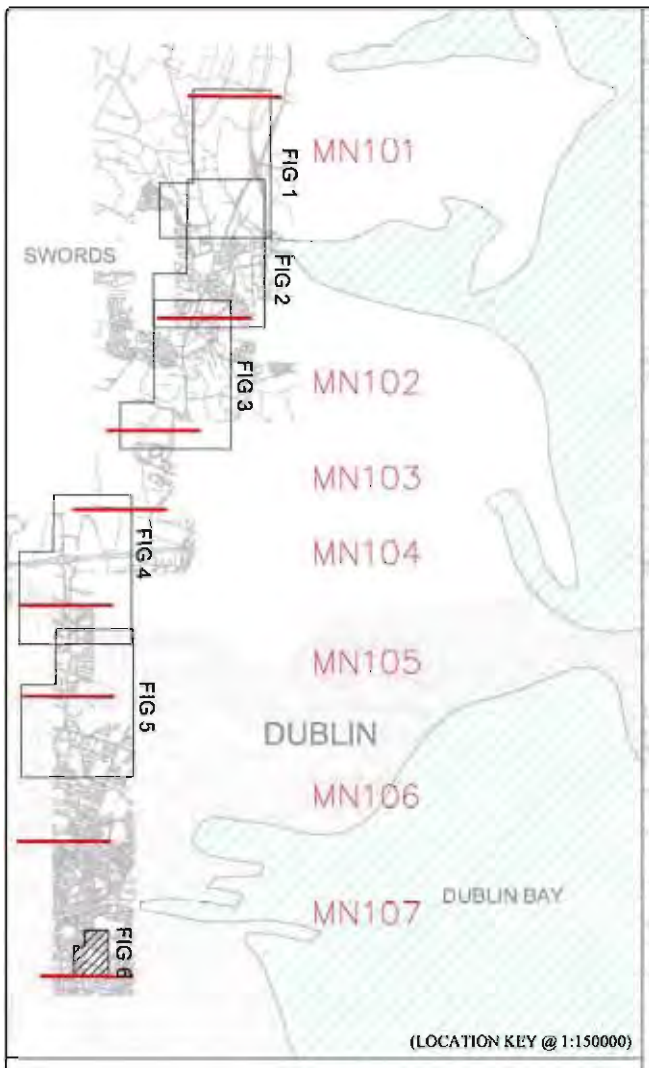

KEY

Site Location

Area unsuitable for geophysical survey due to modern landscaping , the presence of pathways, water features and metal railings

Recorded Archaeological Monument (RMP)

N

0 metres 100

DU018-020651- House - Indeterminate Date

DU018-020650- House - Indeterminate Date

DU018-020257- House - 16th/17th Century

DU018-020238- House - 18th/19th Century

DU018-020241- House - 18th/19th Century

DU018-020258- House - 18th/19th Century

DU018-020259- House - 18th/19th Century

DU018-020260- House - Indeterminate Date

DU018-020261- House - Indeterminate Date

DU018-020413- Church

DU018-020262- House - 18th/19th Century

DU018-020640- House - Indeterminate Date

DU018-020240- House - 18th/19th Century

DU018-020181- Bowling Green

DU018-020649- House - Indeterminate Date

DU018-020327- House - 18th/19th Century

DU018-020646- House - 16th/17th Century

AREA AS53

DU018-020166- Graveyard possible

MN107

DU018-020334- Park

DU018-020543- House - Indeterminate Date

DU018-020544- House - Indeterminate Date

DU018-020337- Bridge

DU018-020036- Town Defences - Town Gate

DU018-020243- House - 18th/19th Century

DU018-020520- House - Indeterminate Date

DU018-020519- House - Indeterminate Date

DU018-020336- Ritual Site - Holy Well

DU018-020647 House - Indeterminate Date

DU018-020249- House - 16th/17th Century

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PROJECT: METRO NORTH

TITLE: MN107:SURVEY LOCATION, RMP LOCATION & LOCATION OF SCANNED ANOMALIES

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090

DRAWING NO.: 08090_06

FIG. NO. Fig. 6

SCALE: 1/2500 @ A3

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PROJECT: METRO NORTH

TITLE: MN101 AS1 (G1-G15): SUMMARY GREYSCALE DRAWING

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_07

FIG. NO.: Fig. 7

SCALE: 1/2000 @ A3

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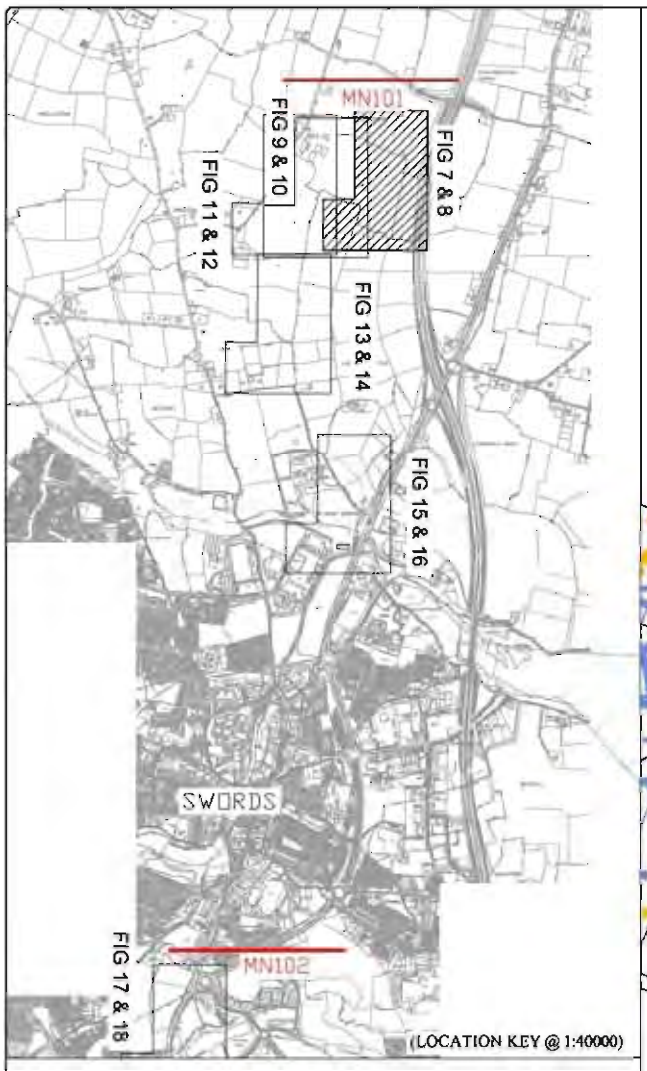

KEY

- Site Location/ Area of gradiometer scanning
- Area of magnetic interference observed during preliminary gradiometer scan
- Recorded Archaeological Monument (RMP)
- ? Archaeology
- Trend
- ? Ploughing Trend
- Area of Increased Magnetic Response
- ? Natural
- Area of Magnetic Disturbance
- Ferrous

N

0 metres 80

BELINSTOWN

DU007-036— Archaeological Complex - Earthworks Site

DU012-001— Archaeological Complex - Ringforts Site

G1 G2 G3 G4 G5 G6 G7 G8 G9 G10 G11 G12 G13 G14 G15 G16 G18 G21

AREA AS1

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PRODUCED BY: BT / DATE SURVEYED: N/A	TITLE: MN101 AS1 (G1-G15): SUMMARY INTERPRETATION DRAWING	DRAWING NO.: 08090_08	Tel: 01-7997200
CHECKED BY: DH / DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO. Fig. 8	Fax: 01-7997201
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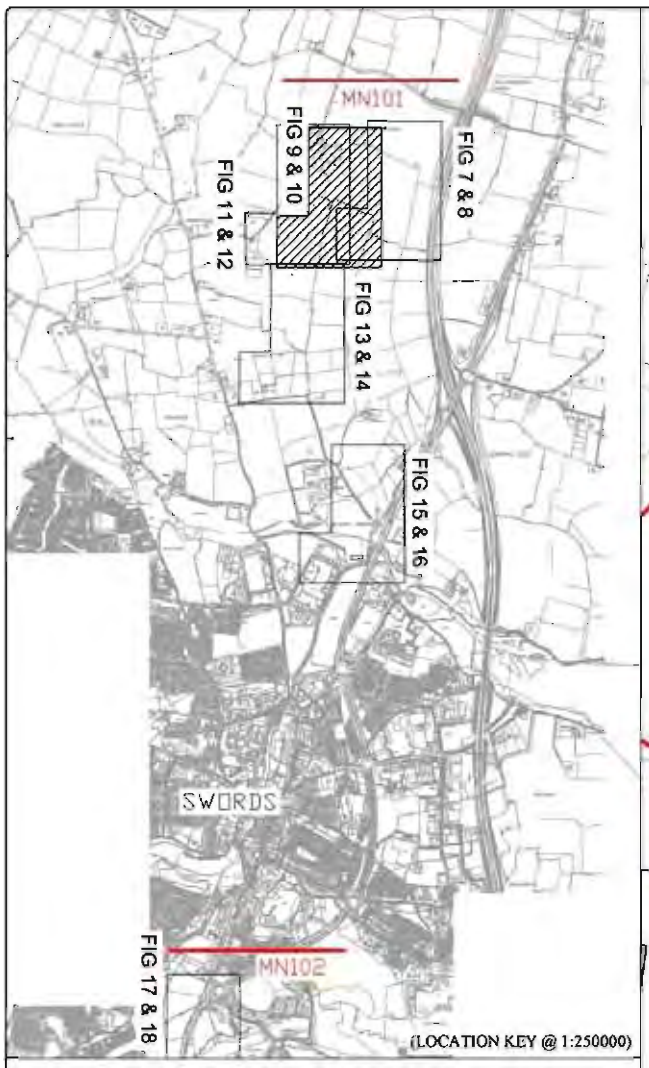

KEY

Site Location/
Area of gradiometer scanning

Recorded Archaeological
Monument (RMP)

0 metres 80

2.0 nT -1.0

DU011-007—
Archaeological Complex

DU011-00702--
Earthworks Site

DU011-00701--
Castle Site

G16 G17 G18 G29 G19 G20 G31 G22 G21 G33 G34 G24 G23 G25 G26 G27 G15 G36 G37

AREA AS1

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PROJECT: METRO NORTH					
TITLE: MN101 AS1 (G16-G27): SUMMARY GREYSCALE DRAWING					
CLIENT: RAILWAY PROCUREMENT AGENCY					
PRODUCED BY: BT	DATE SURVEYED: N/A				
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JOB NO.: 08090	DRAWING NO.: 08090_09	FIG. NO.: Fig. 9	SCALE: 1/2000 @ A3		

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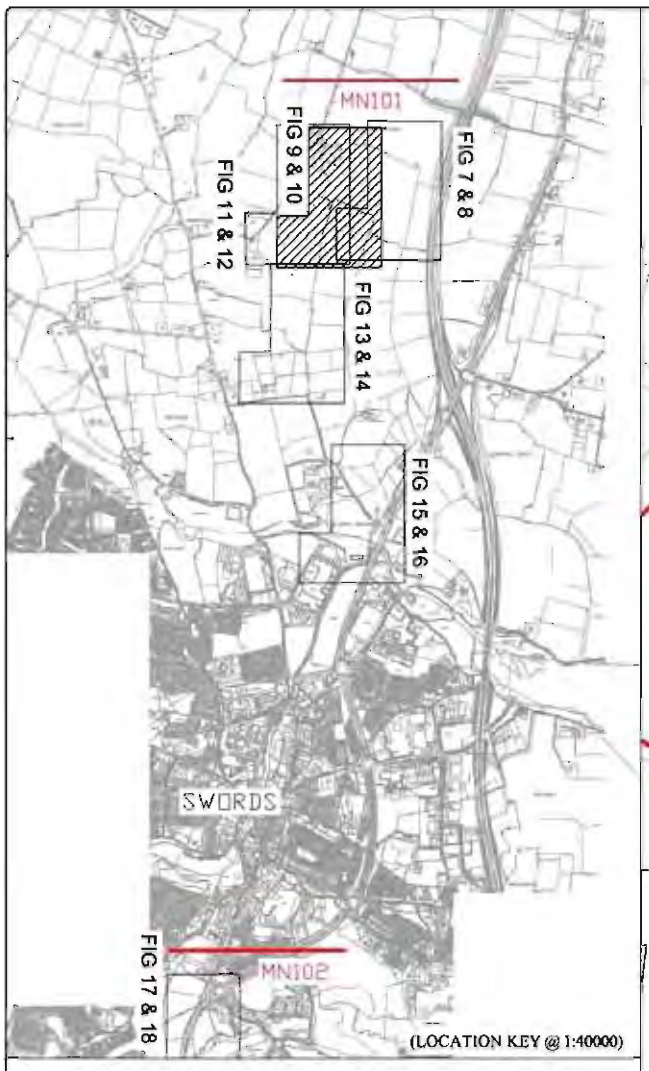

KEY

- Site Location/ Area of gradiometer scanning
- Recorded Archaeological Monument (RMP)
- ? Archaeology
- Trend
- Area of Increased Magnetic Response
- ? Natural
- Area of Magnetic Disturbance
- Ferrous

N

0 metres 80

DU011-007— Archaeological Complex

DU011-00702– Earthworks Site

DU011-00701– Castle Site

G16 G17 G18 G19 G20 G21 G22 G23 G24 G25 G26 G27 G29 G31 G33 G37 G15

AREA AS1

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TITLE: MN101 AS1 (G16-G27): SUMMARY INTERPRETATION DRAWING

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DRAWING NO: 08090_10

FIG. NO. Fig. 10

SCALE: 1/2000 @ A3

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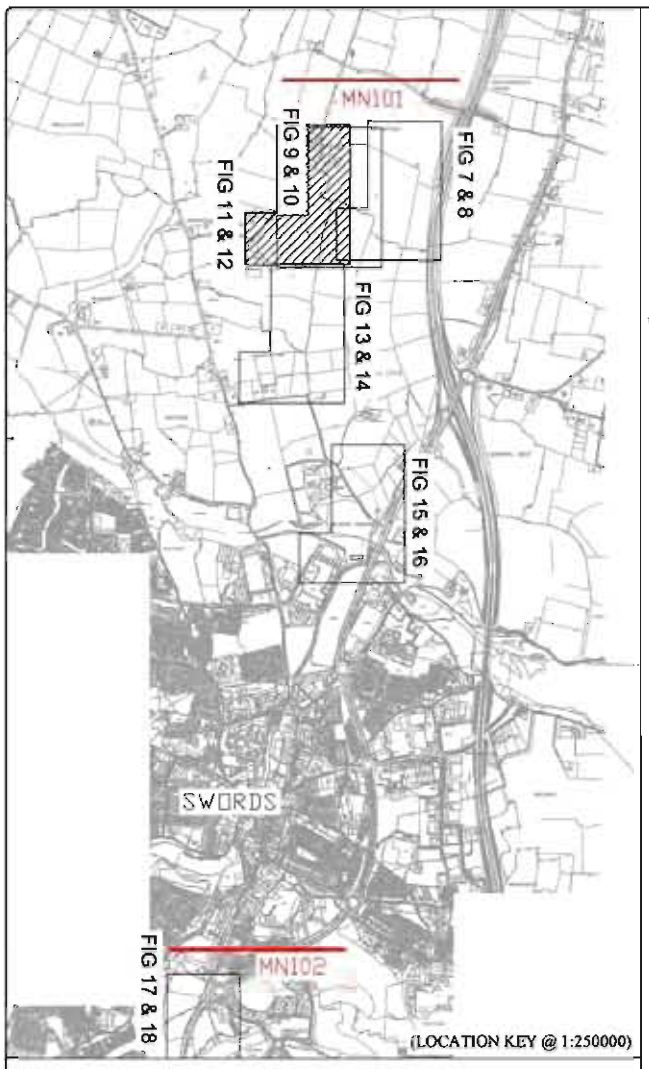
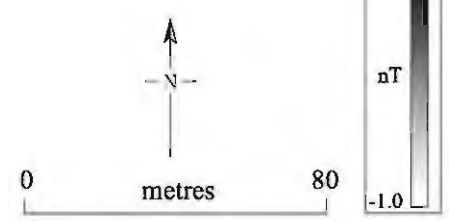


KEY

Site Location/
Area of gradiometer scanning

Recorded Archaeological
Monument (RMP)



DU011
Archae

DU
Ear

DU011-00701--
Castle Site

G28
G29
G19
G30
G31
G22
G32
G33
G24
G34
G35
G25
G37
G36
G26

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					PRODUCED BY: BT / DATE SURVEYED: N/A	TITLE: MN101 AS1 (G28-G37): SUMMARY GREYSCALE DRAWING	DRAWING NO.: 08090_11
					CHECKED BY: DH / DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO.: Fig. 11 / SCALE: 1/2000 @ A3

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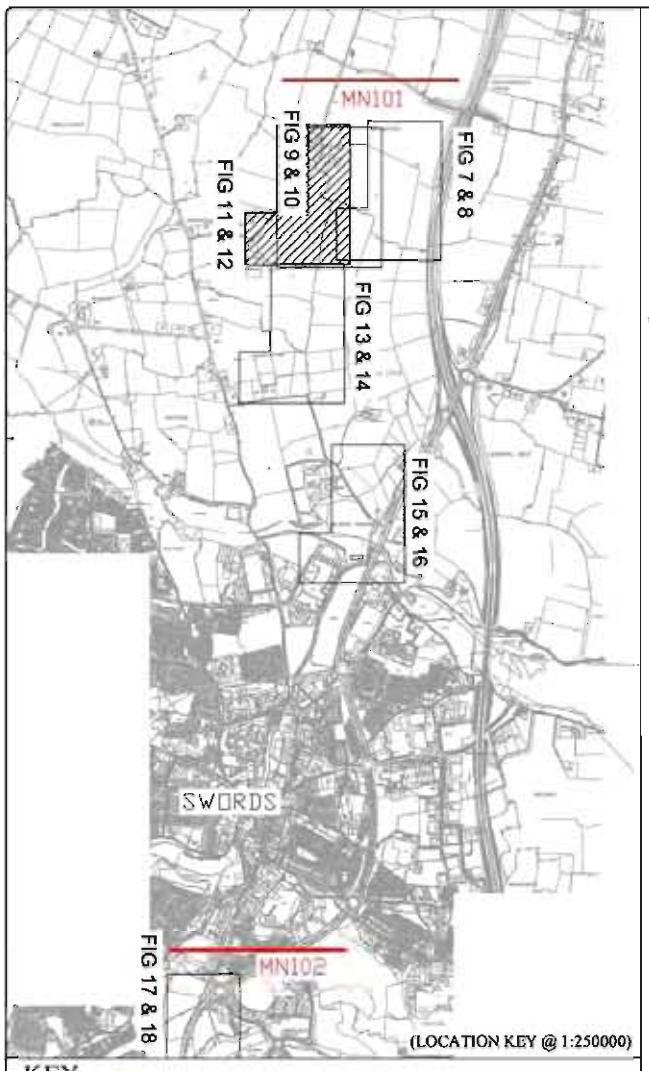

KEY

Site Location/
Area of gradiometer scanning

Recorded Archaeological
Monument (RMP)

? Archaeology

Trend

Area of Increased
Magnetic Response

? Natural

Ferrous

Area of Magnetic
Disturbance

N

0 metres 80

DU011
Archae

DU
Ear

DU011-00701--
Castle Site

G28
G29
G19
G30
G31
G22
G32
G33
G24
G34
G35
G37
G25
G36
G26

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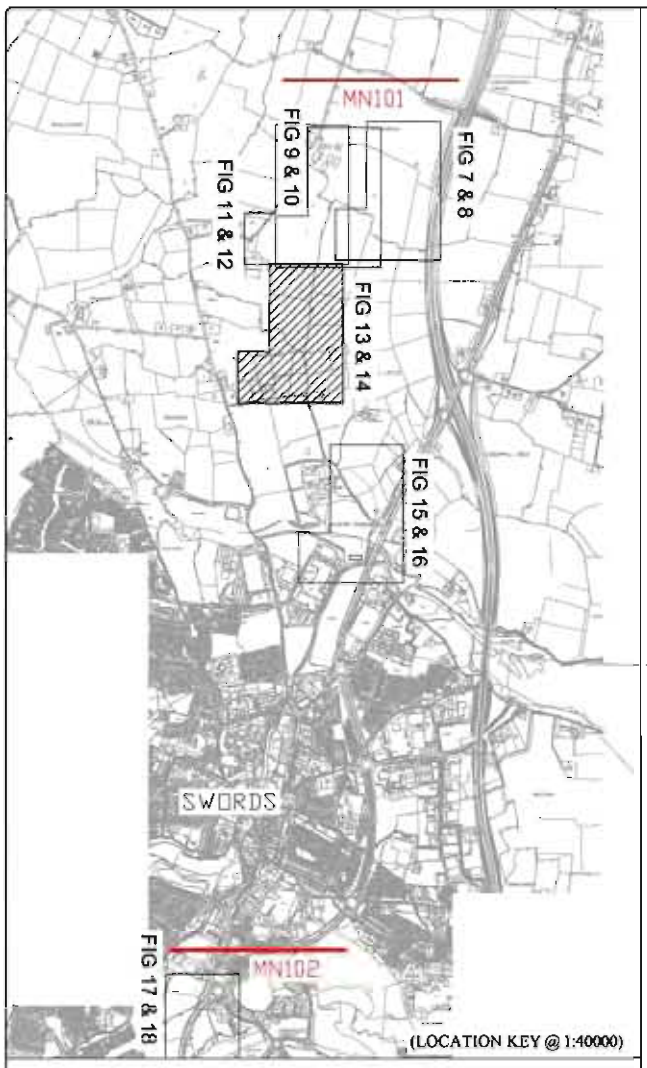
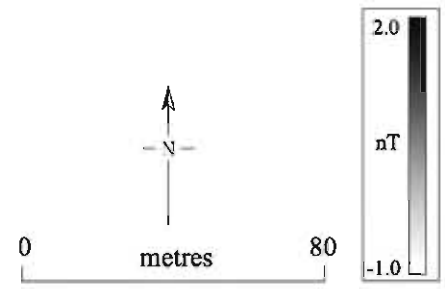
		PRODUCED BY: BT DATE SURVEYED: N/A	TITLE: MN101 AS1 (G28-G37): SUMMARY INTERPRETATION DRAWING	DRAWING NO: 08090_12	27 Merrion Square Dublin 2 Tel: 01-7997200 Fax: 01-7997201 Email: archaeology@mglarc.com www.mglarc.com
		CHECKED BY: DH DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO. Fig. 12 SCALE: 1/2000 @ A3	



KEY

Site Location/
Area of gradiometer scanning

Area unsuitable for gradiometer survey due to the presence of crops



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PROJECT: METRO NORTH

TITLE: MN101 AS2 - AS3 (G38-G43): SUMMARY GREYSCALE DRAWING

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_13

FIG. NO.: Fig. 13

SCALE: 1/2000 @ A3

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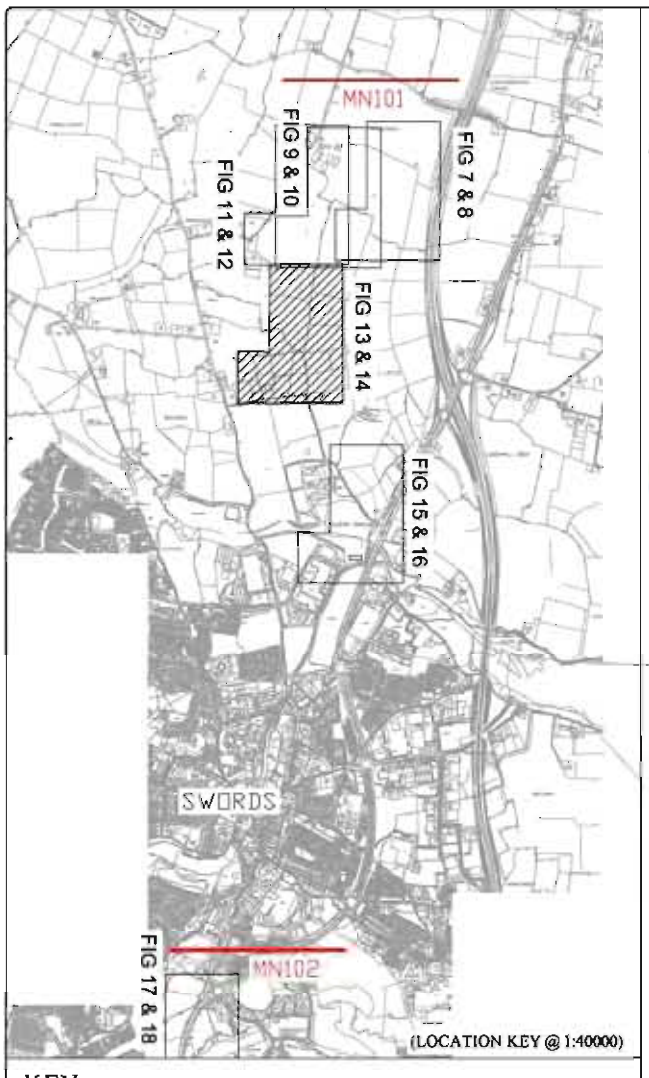

KEY

- Site Location/ Area of gradiometer scanning
- Area unsuitable for gradiometer survey due to the presence of crops
- ? Archaeology
- Trend
- ? Natural
- Ferrous
- Area of Magnetic Disturbance

N

0 metres 80

AREA AS2

AREA AS3

G38

G39

G40

G41

G42

G43

1.83m FF

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CHECKED BY: DH	DATE ISSUED: 01/07/2009		
PROJECT: METRO NORTH			
TITLE: MN101 AS2 - AS3 (G38-G43): SUMMARY INTERPRETATION DRAWING			
CLIENT: RAILWAY PROCUREMENT AGENCY			
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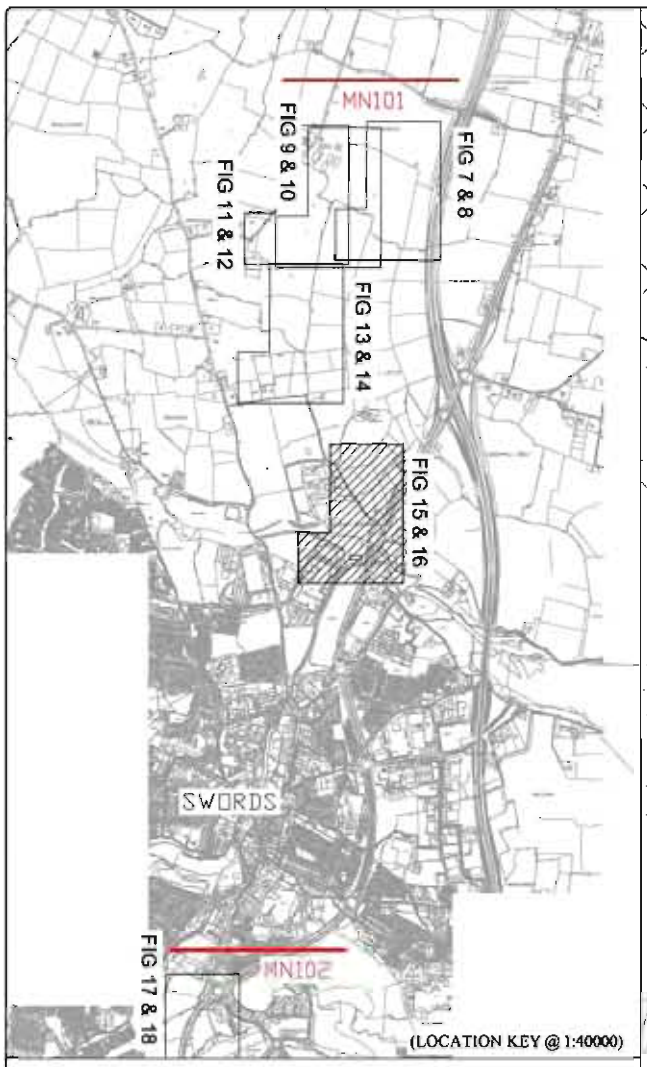

Site Location/
Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan

Area unsuitable for gradiometer survey due to the presence of crops

Area of Ground Penetrating Radar Survey

Recorded Archaeological Monument (RMP)

2.0
nT
-1.0

N

0 metres 80

G44
G46
G45
G47
G48
AREA AS6
G49
AREA AS9
AREA AS7
AREA AS8
DU011-081
Bridge
AREA AS11
AREA AS10
G50: FOR FURTHER INFORMATION SEE APPENDIX 2
G50

ISO 9001:2000
CERT NO. 2975

REVISIONS:	BY:	DATE:	REV:

ARCHAEOLOGICAL LICENCE: 08R0117
PRODUCED BY: BT
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CHECKED BY: DH
DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH
TITLE: MN101 AS5 - AS11 (G44-G50): SUMMARY GREYSCALE DRAWING
CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090
DRAWING NO. 08090_15
FIG. NO. Fig. 15
SCALE: 1/2000 @ A3

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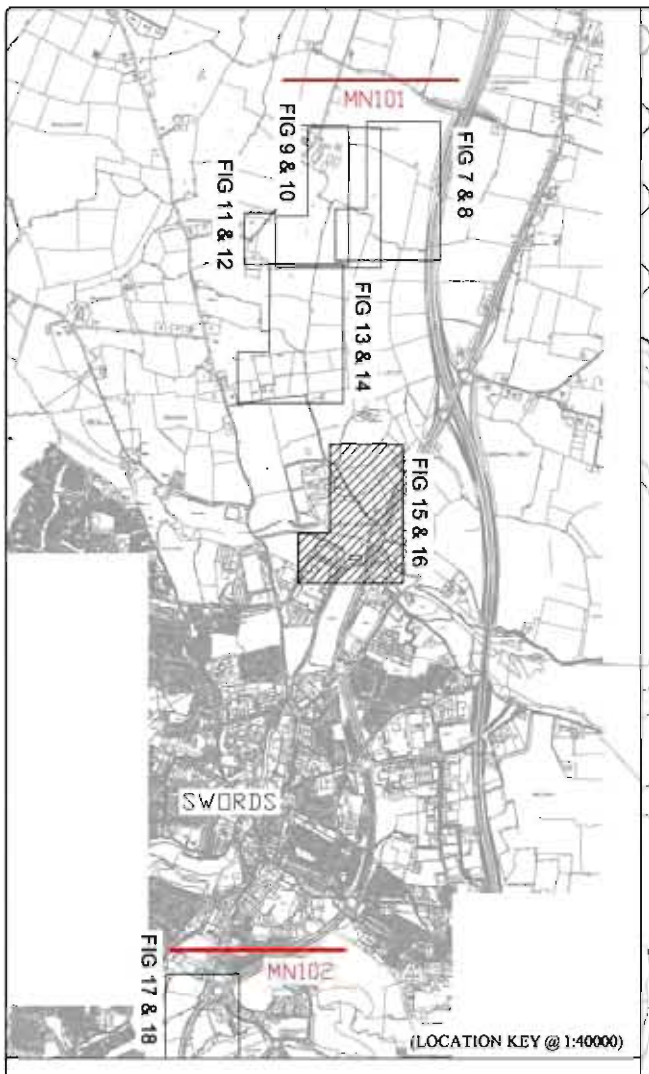


Site Location/
Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan

Area unsuitable for gradiometer survey due to the presence of crops

Area of Ground Penetrating Radar Survey

Recorded Archaeological Monument (RMP)

? Archaeology

Trend

Negative Response

Area of Magnetic Disturbance

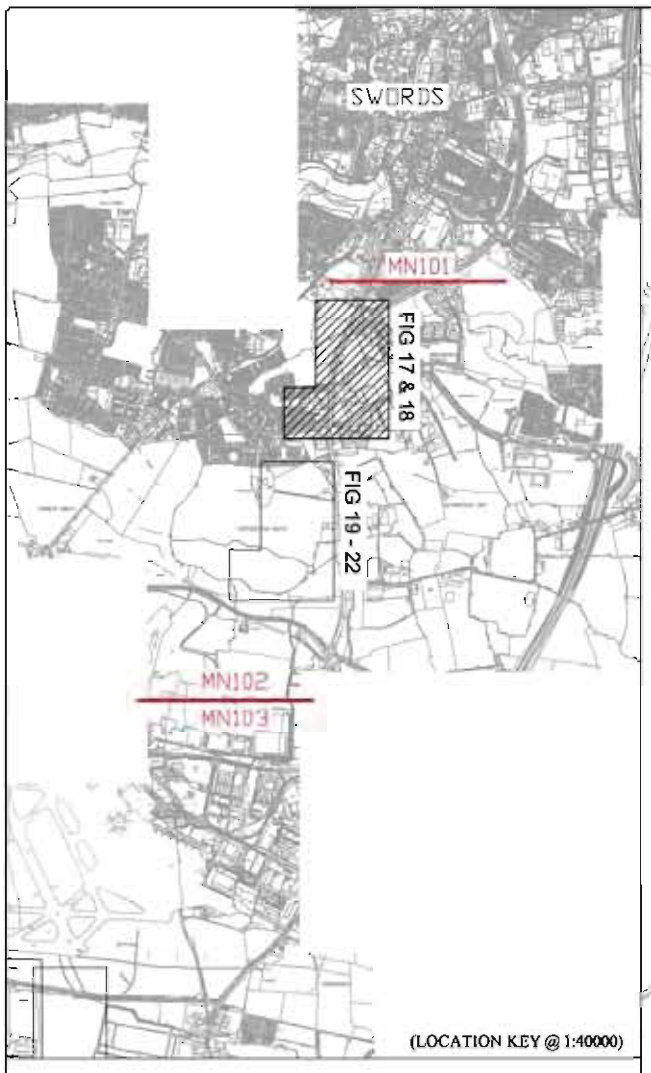
Ferrous

N

0 metres 80

G44
G46
G45
G47
G48
AREA AS6
AREA AS7
G49
AREA AS9
AREA AS8
DU011-081
Bridge
AREA AS11
AREA AS10
G50: FOR FURTHER INFORMATION SEE APPENDIX 2
G50
BALHEARY DEMESNE
St Marys Novitiate
Swords Business Campus

ISO 9001:2000 EQA CERT NO. 2975	REVISIONS: BY: DATE: REV:	ARCHAEOLOGICAL LICENCE: 08R0117	PROJECT: METRO NORTH	JOB NO. 08090	Margaret Gowen & Co Ltd Archaeological Consultants & Project Managers
		PRODUCED BY: BT DATE SURVEYED: N/A	TITLE: MN101 AS5 - AS11 (G44-G50): SUMMARY INTERPRETATION DRAWING	DRAWING NO.: 08090_16	27 Merrion Square Dublin 2 Tel: 01-7997200 Fax: 01-7997201 Email: archaeology@mglarc.com www.mglarc.com
		CHECKED BY: DH DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO. Fig. 16 SCALE: 1/2000 @ A3	



KEY

Site Location/
Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan

Area unsuitable for gradiometer survey due to the presence of gardens and modern landscaping

2.0
nT
-1.0

N

0 metres 80

AREA AS16

G51

AREA AS17

Boroimhe Willows
Boroimhe Pines
Boroimhe Poplars
Boroimhe Elms
Airside Retail Park
Car Park
Hotel
Nevinstown Lane
Iona Wintrop
Private Clinic
BM 46.79
47.0
47.4
46.3
183m FF
UND
ES

ISO 9001:2000
CERT NO. 2975

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DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH

TITLE: MN102 AS16 (G51): SUMMARY GREYSCALE DRAWING

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090
DRAWING NO.: 08090_17
FIG. NO.: Fig. 17
SCALE: 1/2000 @ A3

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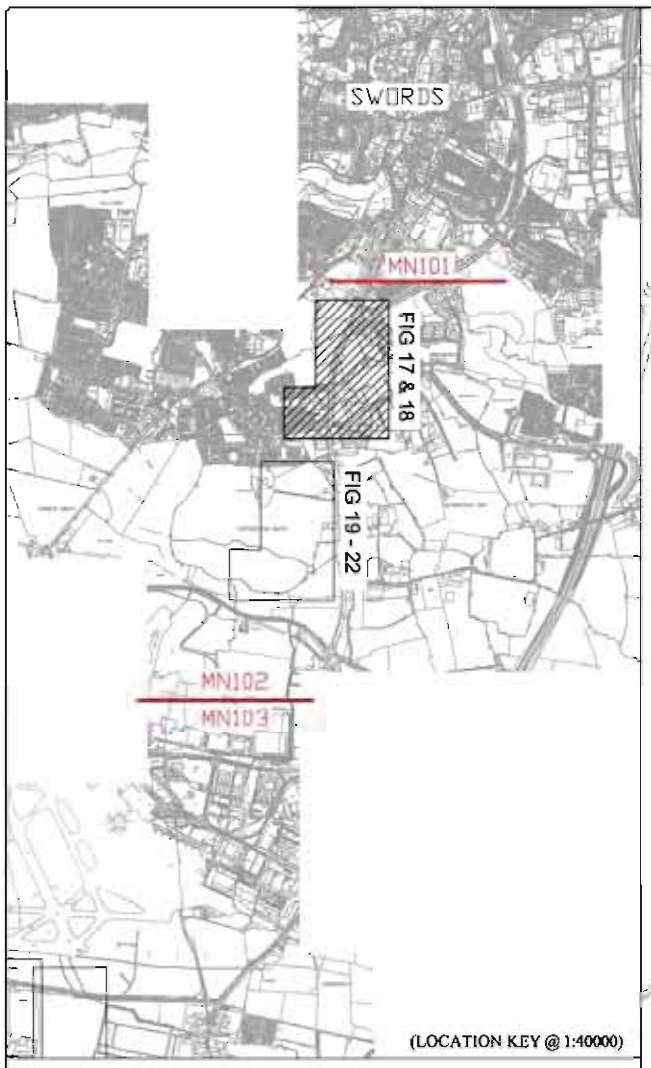

KEY

- Site Location/ Area of gradiometer scanning
- Area of magnetic interference observed during preliminary gradiometer scan
- Area unsuitable for gradiometer survey due to the presence of crops
- ? Ploughing Trend
- Negative Trend
- Area of Magnetic Disturbance
- Ferrous

N

0 metres 80

AREA AS16

AREA AS17

G51

Boroimhe Poplars

Boroimhe Elms

Airside Retail Park Car Park

Hotel

Nevinstown Lane

Tara Wintrop Private Clinic

BM 46.79

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PROJECT: METRO NORTH

TITLE: MN102 AS16 (G51): SUMMARY INTERPRETATION DRAWING

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090

DRAWING NO: 08090_18

FIG. NO. Fig. 18

SCALE: 1/2000 @ A3

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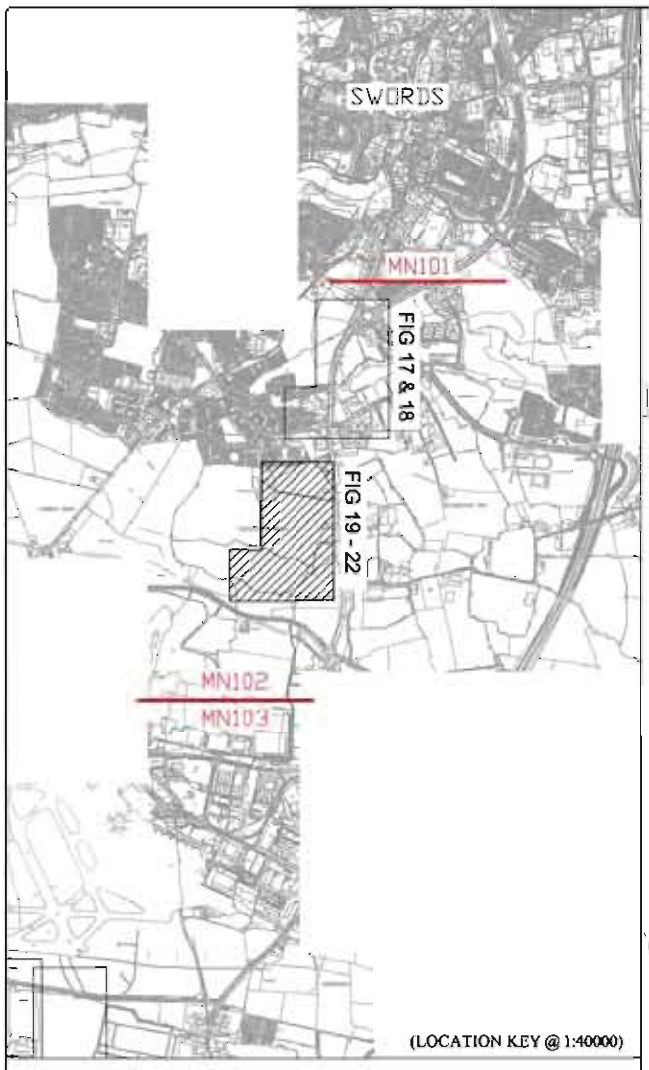
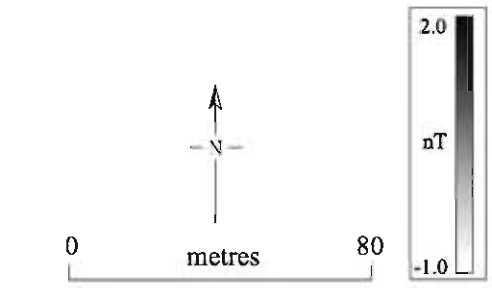


KEY

Site Location/
Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan



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		PRODUCED BY: BT; DATE SURVEYED: N/A	TITLE: MN102 AS19 - AS22 (G52-G56): SUMMARY GREYSCALE DRAWING
		CHECKED BY: DH; DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090 · DRAWING NO: 08090_19 · FIG. NO. Fig. 19 · SCALE: 1/2000 @ A3

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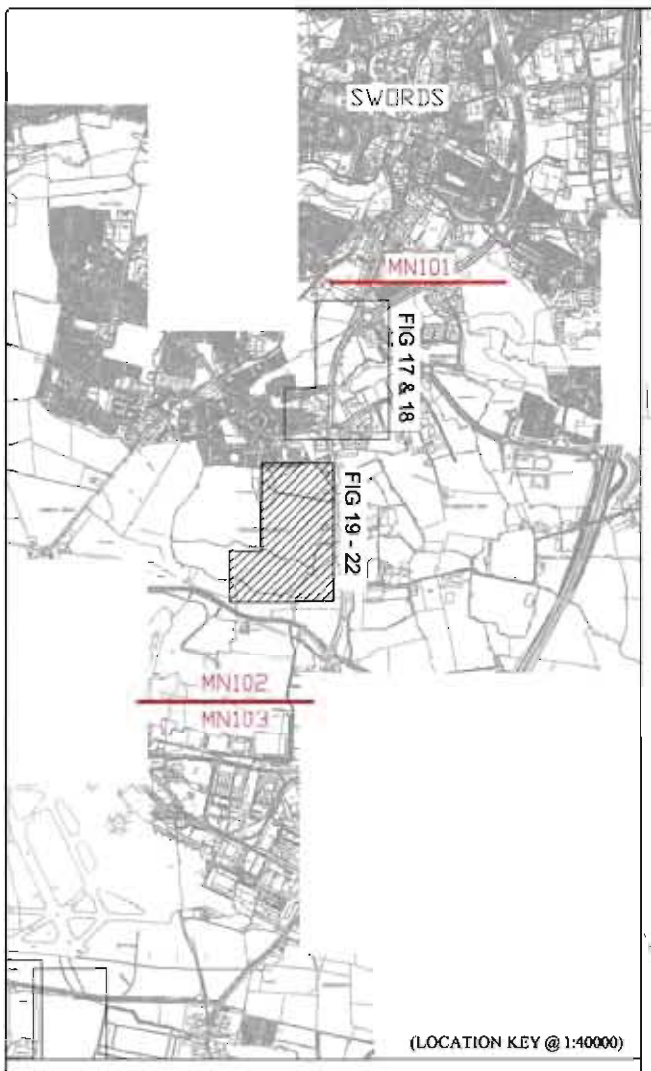

KEY

- Site Location/ Area of gradiometer scanning
- Area of magnetic interference observed during preliminary gradiometer scan
- ? Archaeology
- Trend
- ? Ploughing Trend
- Negative Trend
- Area of Increased Magnetic Response
- Area of Magnetic Disturbance
- Ferrous

N

0 metres 80

AREA AS19
G52
D
A
C
D
D
B
AREA AS20
D
G53
G54
E
AREA AS21
G55
AREA AS22
G56
AREA UNSUITABLE FOR DETAILED GRADIOMETER SURVEY DUE TO STEEP GRADIENT

ISO 9001:2000
CERT NO. 2975

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ARCHAEOLOGICAL LICENCE: 08R0117
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DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH
TITLE: MN102 AS19 - AS22 (G52-G56): SUMMARY INTERPRETATION DRAWING
CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090
DRAWING NO.: 08090_20
FIG. NO. Fig. 20
SCALE: 1/2000 @ A3

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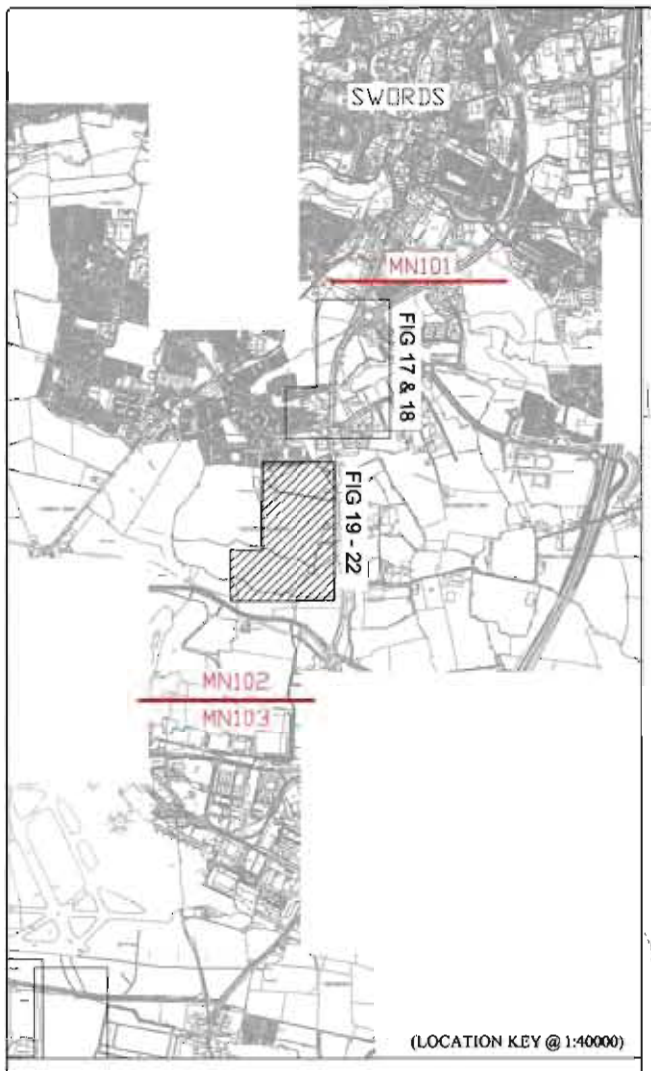
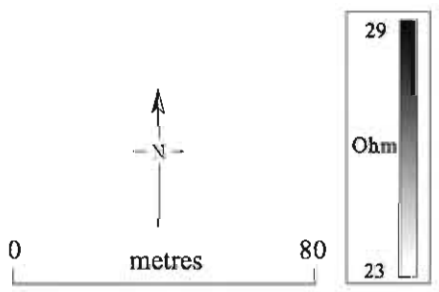


KEY

Site Location/
Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan



ISO 9001:2000
CERT NO. 2975

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ARCHAEOLOGICAL LICENCE: 08R0117

PRODUCED BY: BT | DATE SURVEYED: N/A

CHECKED BY: DH | DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH

TITLE: MN102 AS19 - AS22 (G52-G53): RESISTANCE SURVEY SUMMARY GREYSCALE DRAWING

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_21

FIG. NO.: Fig. 21

SCALE: 1/2000 @ A3

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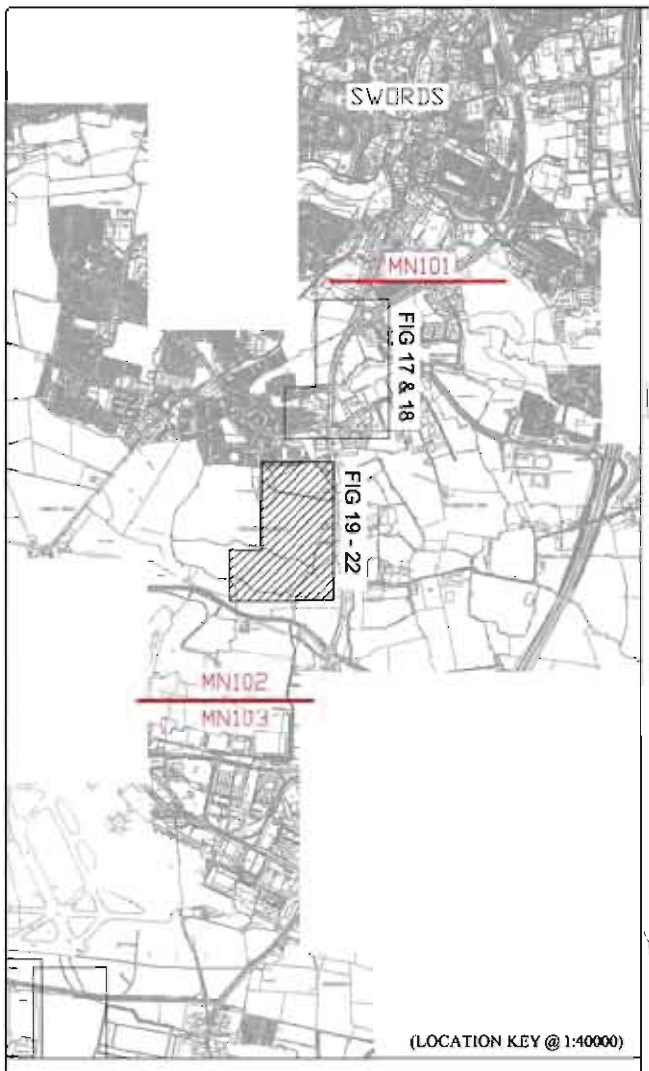


Site Location/
Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan

Low Resistance

? Archaeology / ? Ditch

? Archaeology / Trend

? Field boundary

? Ditch / ?Drainage

? Modern

High Resistance

? Archaeology

? Archaeology / Trend

? Ploughing Trend

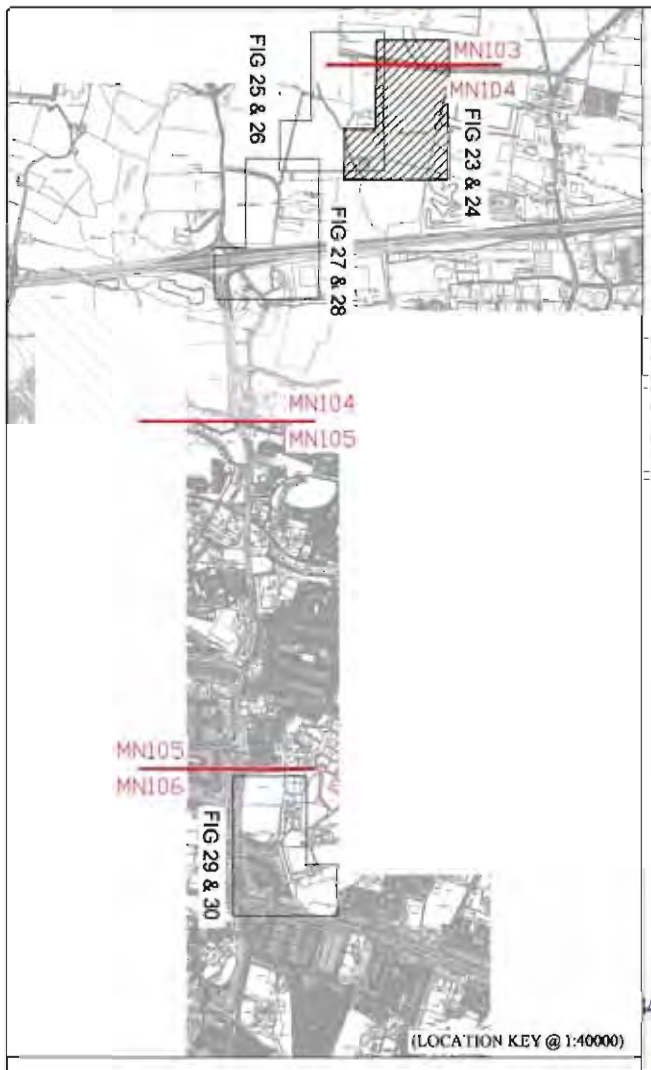
? Natural

N

0 metres 80

AREA AS19
G52
AREA AS20
G53
G54
AREA AS21
G55
AREA AS22
G56
AREA UNSUITABLE FOR DETAILED GRADIOMETER SURVEY DUE TO STEEP GRADIENT

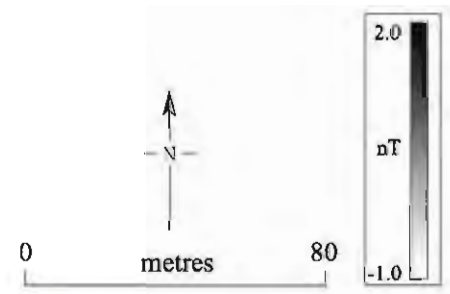
ISO 9001:2000 EQA QUALITY ASSURED ORGANISATION CERT NO. 2975	REVISIONS:	BY:	DATE: REV:
ARCHAEOLOGICAL LICENCE: 08R0117	PROJECT: METRO NORTH	JOB NO. 08090	Margaret Gowen & Co Ltd Archaeological Consultants & Project Managers
PRODUCED BY: BT DATE SURVEYED: N/A	TITLE: MN102 AS19 - AS22 (G52-G53): RESISTANCE SURVEY SUMMARY INTERPRETATION DRAWING	DRAWING NO.: 08090_22	27 Merrion Square Dublin 2 Tel: 01-7997200 Fax: 01-7997201 Email: archaeology@mglarc.com www.mglarc.com
CHECKED BY: DH DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO. Fig. 22 SCALE: 1/2000 @ A3	



KEY

Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan



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PROJECT: METRO NORTH

TITLE: MN104 AS34 - AS35 (G57-G71): SUMMARY GREYSCALE DRAWING

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_23

FIG. NO.: Fig. 23

SCALE: 1/2000 @ A3

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KEY

- Site Location/ Area of gradiometer scanning
- Area of magnetic interference observed during preliminary gradiometer scan
- ? Archaeology
- Trend
- Area of Magnetic Disturbance
- Ferrous

N

0 metres 80

G57 G58 G59 G60 G61 G62 G63 G64 G65 G66 G67 G68 G69 G70 G71 G72

AREA AS35

ISO 9001:2000 EQA QUALITY ASSURED ORGANISATION CERT NO. 2975	REVISIONS:	BY:	DATE:	REV:	ARCHAEOLOGICAL LICENCE: 08R0117
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PROJECT: METRO NORTH

TITLE: MN104 AS34- AS35 (G57-G71): SUMMARY INTERPRETATION DRAWING

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090 | DRAWING NO.: 08090_24 | FIG. NO.: Fig. 24 | SCALE: 1/2000 @ A3

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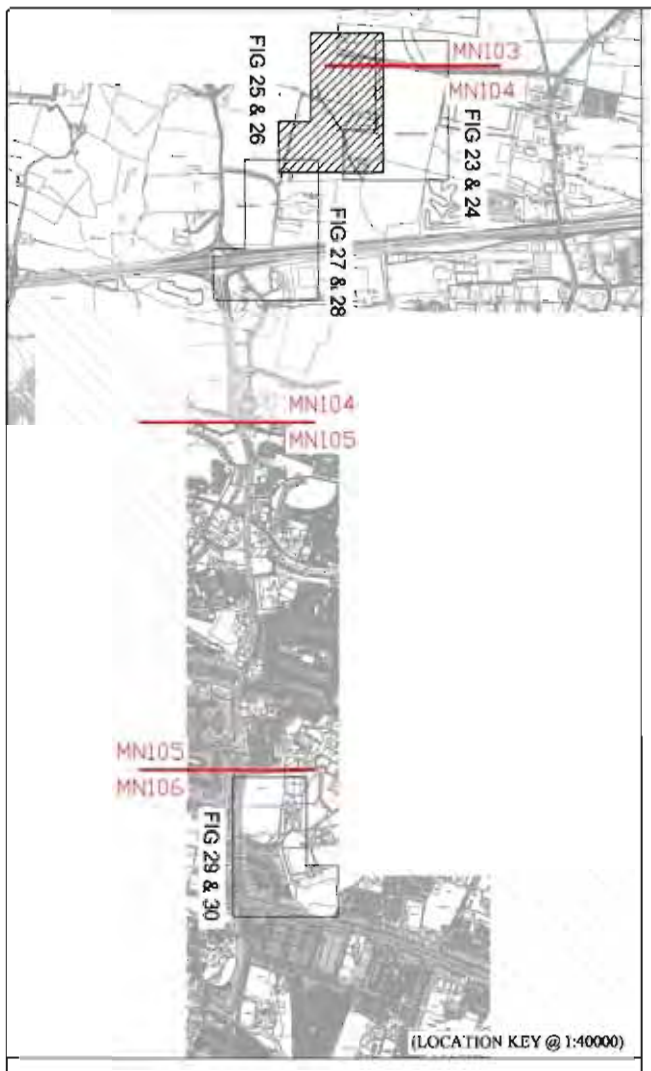


KEY

Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan

2.0
nT
-1.0

N

0 metres 80

AREA AS34

AREA AS63

G73

G72

G74

G75

G76

AREA AS36

AREA AS35

AREA AS37

ISO 9001:2000 EQA CERT NO. 2975	REVISIONS: BY: DATE: REV:	ARCHAEOLOGICAL LICENCE: 08R0117	PROJECT: METRO NORTH	JOB NO.: 08090	Margaret Gowen & Co Ltd Archaeological Consultants & Project Managers
		PRODUCED BY: BT DATE SURVEYED: N/A	TITLE: MN104 AS35 - AS37 & AS63 (G72-G76): SUMMARY GREYSCALE DRAWING	DRAWING NO.: 08090_25	27 Merrion Square Dublin 2 Tel: 01-7997200 Fax: 01-7997201 Email: archaeology@mglarc.com www.mglarc.com
		CHECKED BY: DH DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO.: Fig. 25 SCALE: 1/2000 @ A3	

KEY

- Site Location/ Area of gradiometer scanning
- Area of magnetic interference observed during preliminary gradiometer scan
- ? Archaeology
- Trend
- ? Ploughing Trend
- Negative Trend
- Area of Magnetic Disturbance
- Ferrous

N

0 metres 80

AREA AS34

AREA AS63

G73

G72

G74

G75

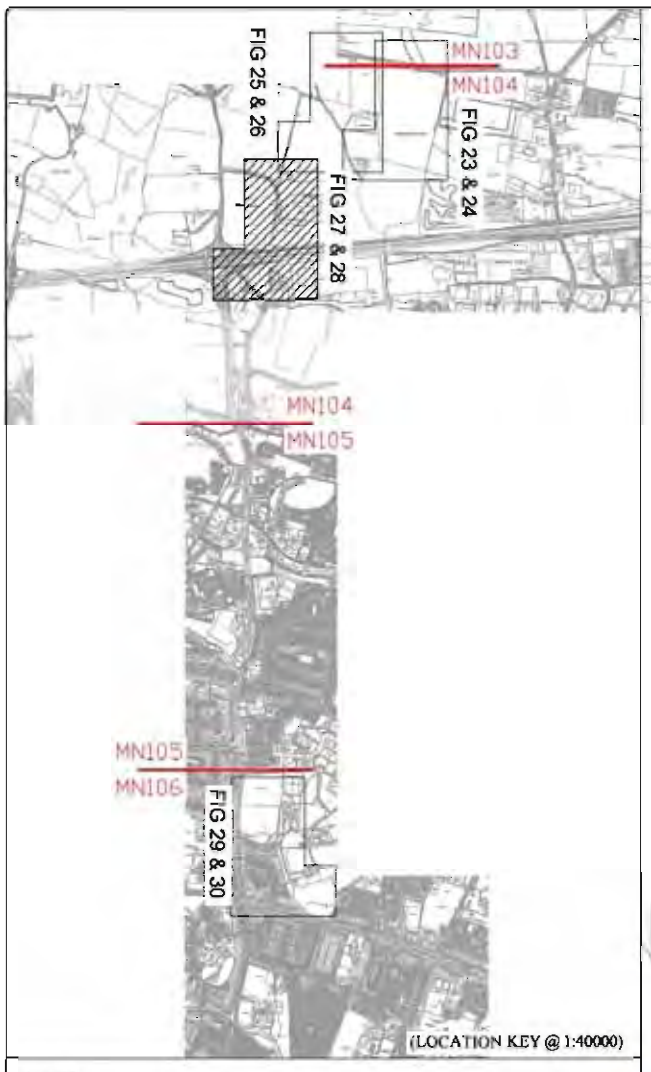
G76

AREA AS35

AREA AS36

AREA AS37

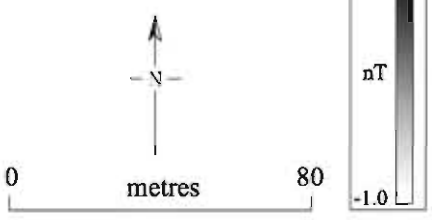
ISO 9001:2000 EQA CERT NO. 2975	REVISIONS:	ARCHAEOLOGICAL LICENCE: 08R0117	PROJECT: METRO NORTH	JOB NO. 08090	Margaret Gowen & Co Ltd Archaeological Consultants & Project Managers
	BY: DATE: REV:	PRODUCED BY: BT / DATE SURVEYED: N/A	TITLE: MN104 AS35 - AS37 & AS63 (G72-G76): SUMMARY INTERPRETATION DRAWING	DRAWING NO.: 08090_26	27 Merrion Square, Dublin 2, Tel: 01-7997200, Fax: 01-7997201, Email: archaeology@mglarc.com, www.mglarc.com
		CHECKED BY: DH / DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO. Fig. 26 / SCALE: 1/2000 @ A3	



KEY

Area of gradiometer scanning

Area of magnetic interference observed during preliminary gradiometer scan



ISO 9001:2000 EQA QUALITY ASSURED ORGANISATION CERT NO. 2975	REVISIONS:	BY:	DATE:	REV.	ARCHAEOLOGICAL LICENCE: 08R0117	PROJECT: METRO NORTH	JOB NO. 08090
					PRODUCED BY: BT / DATE SURVEYED: N/A	TITLE: MN104 AS37 - AS41 (G77-G78): SUMMARY GREYSCALE DRAWING	DRAWING NO.: 08090_27
					CHECKED BY: DH / DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO. Fig. 27
							SCALE: 1/2000 @ A3

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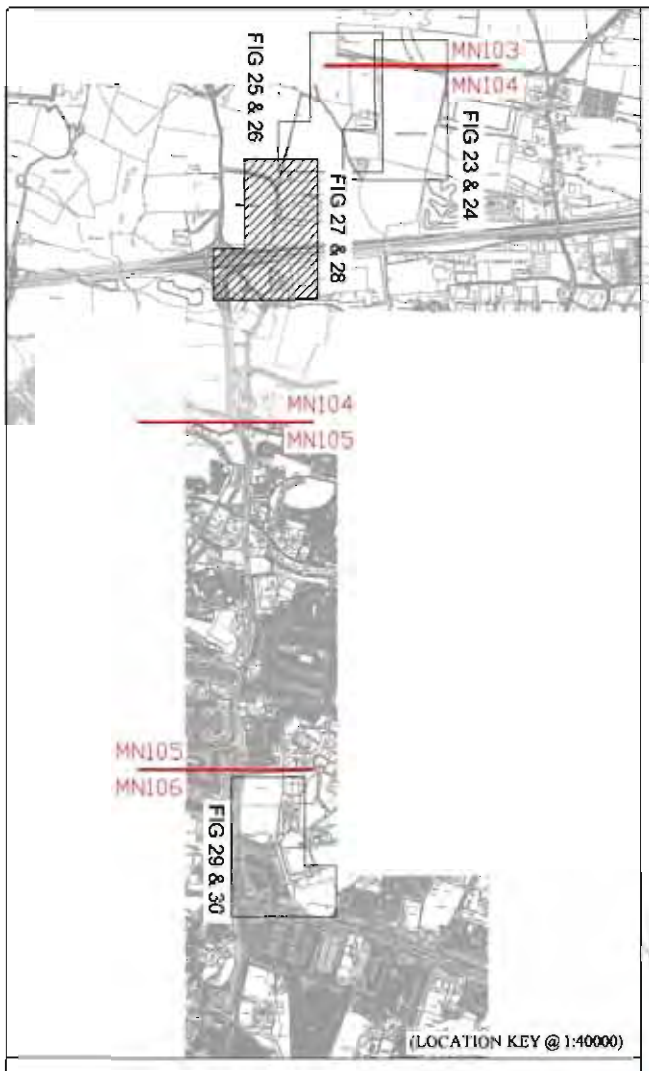

KEY

- Site Location/ Area of gradiometer scanning
- Area of magnetic interference observed during preliminary gradiometer scan
- ? Archaeology
- Trend
- ? Ploughing Trend
- Area of Magnetic Disturbance
- Ferrous

N

0 metres 80

AREA AS38
AREA AS37
AREA AS39
G77
AREA AS41
G78
AREA AS43
AREA AS44

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PROJECT: METRO NORTH

TITLE: MN104 AS37 - AS41 (G77-G78): SUMMARY INTERPRETATION DRAWING

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JOB NO. 08090

DRAWING NO.: 08090_28

FIG. NO. Fig. 28

SCALE: 1/2000 @ A3

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G79

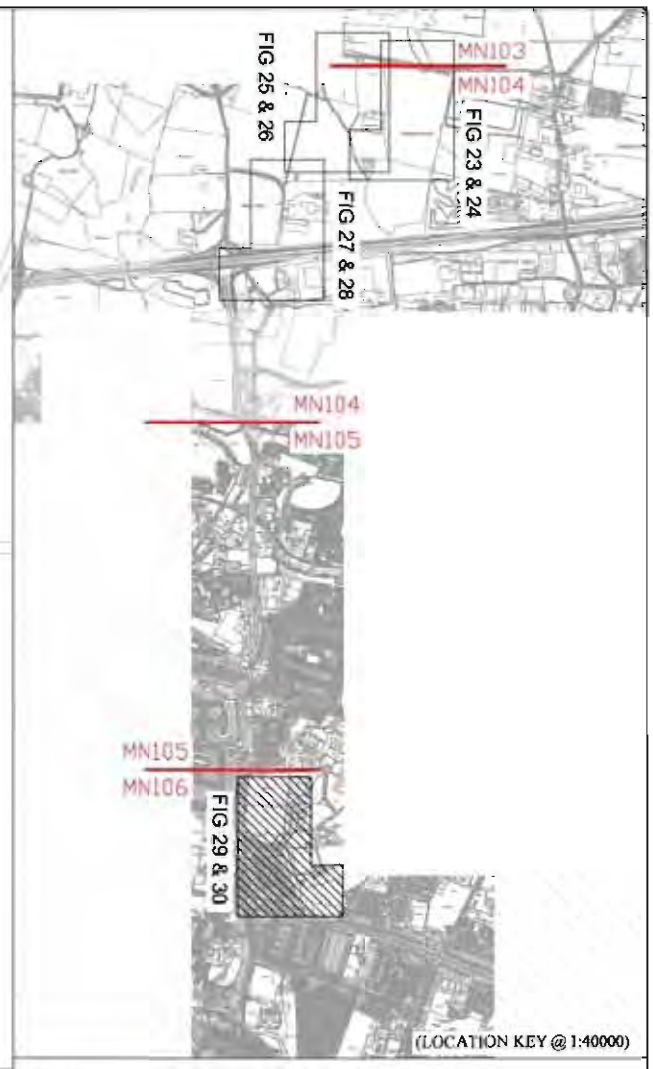
G80

AREA AS49

G81

G82

AREA AS50



KEY

Site Location/
Area of gradiometer scanning

2.0
nT
-1.0

N

0 metres 80

G83

G84

AREA AS52

ISO 9001:2000 EQA QUALITY ASSURED CERT NO. 2975	REVISIONS:	BY:	DATE:	REV.	ARCHAEOLOGICAL LICENCE: 08R0117	PROJECT: METRO NORTH	JOB NO. 08090
					PRODUCED BY: BT / DATE SURVEYED: N/A	TITLE: MN106 AS49 - AS52 (G79-G84): SUMMARY GREYSCALE DRAWING	DRAWING NO.: 08090_29
					CHECKED BY: DH / DATE ISSUED: 01/07/2009	CLIENT: RAILWAY PROCUREMENT AGENCY	FIG. NO. Fig. 29
							SCALE: 1/2000 @ A3

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G79

G80

AREA AS49

G81

G82

AREA AS50

Tennis Ground

G83

G84

AREA AS52

MN103
MN104
FIG 25 & 26
FIG 27 & 28
MN104
MN105
MN105
MN106
FIG 29 & 30

(LOCATION KEY @ 1:40000)

KEY

Site Location/
Area of gradiometer scanning

? Archaeology

Trend

? Ploughing Trend

Area of Magnetic Disturbance

Ferrous

N

0 metres 80

ISO 9001:2000
EQA QUALITY ASSURED ORGANISATION
CERT NO. 2975

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TITLE: MN106 AS49 - AS52 (G79-G84): SUMMARY INTERPRETATION DRAWING

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090

DRAWING NO.: 08090_30

FIG. NO.: Fig. 30

SCALE: 1/2000 @ A3

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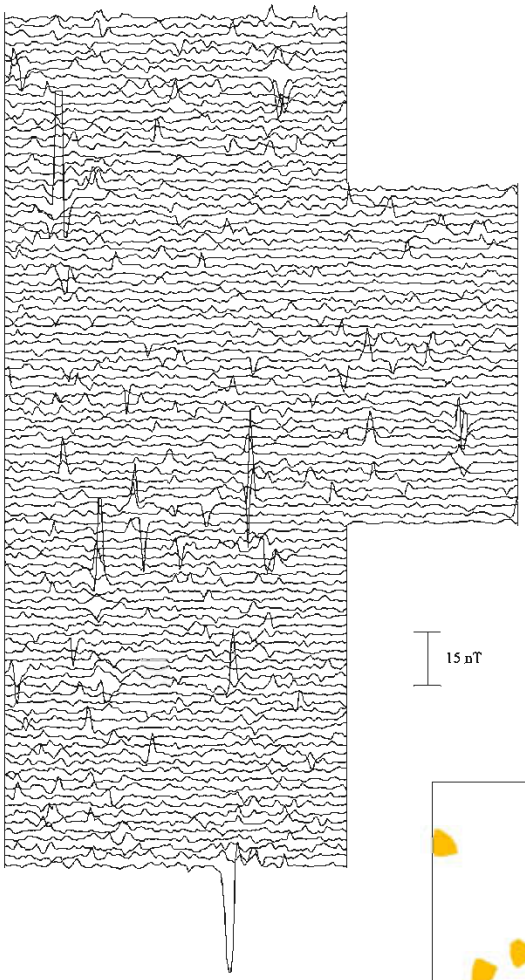
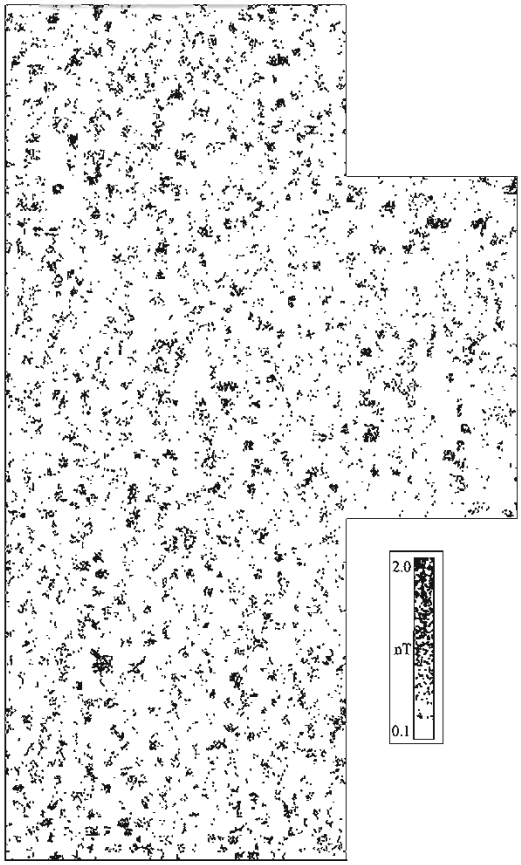
Appendix 1

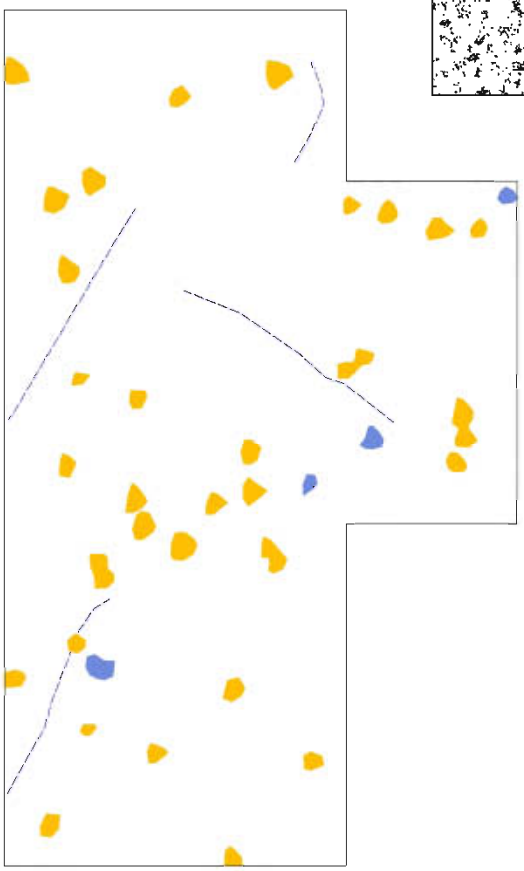
A1.1 Archive plots

G1: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



15 nT





? Archaeology Trend Ferrous

0 metres 25

REVISIONS: BY: DATE: REV:

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ARCHAEOLOGICAL LICENCE: 08R0117
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DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH
TITLE: G1: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090
DRAWING NO.: 08090_31
FIG. NO.: A1.1
SCALE: 1/625 @ A3

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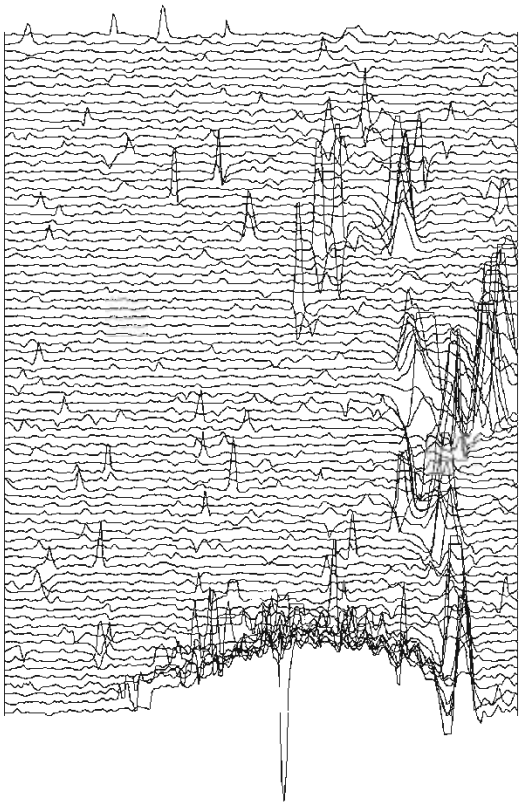
G2: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



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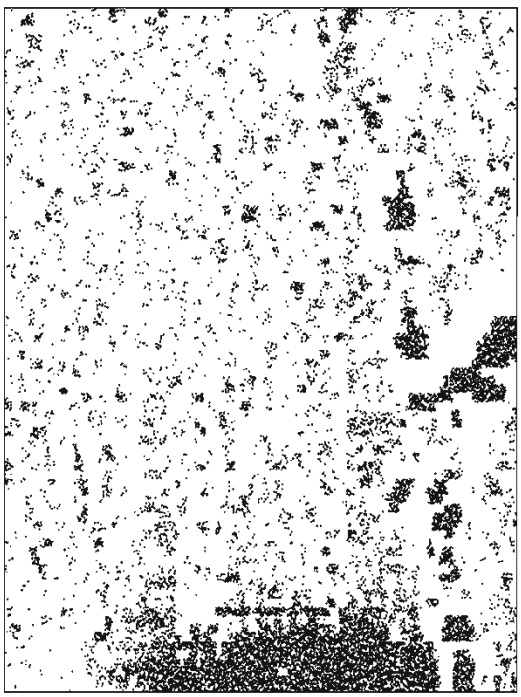

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nT
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? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

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ARCHAEOLOGICAL LICENCE: 08R0117
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PROJECT: METRO NORTH
TITLE: G2: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090
DRAWING NO.: 08090_32
FIG. NO.: A1.2
SCALE: 1/625 @ A3

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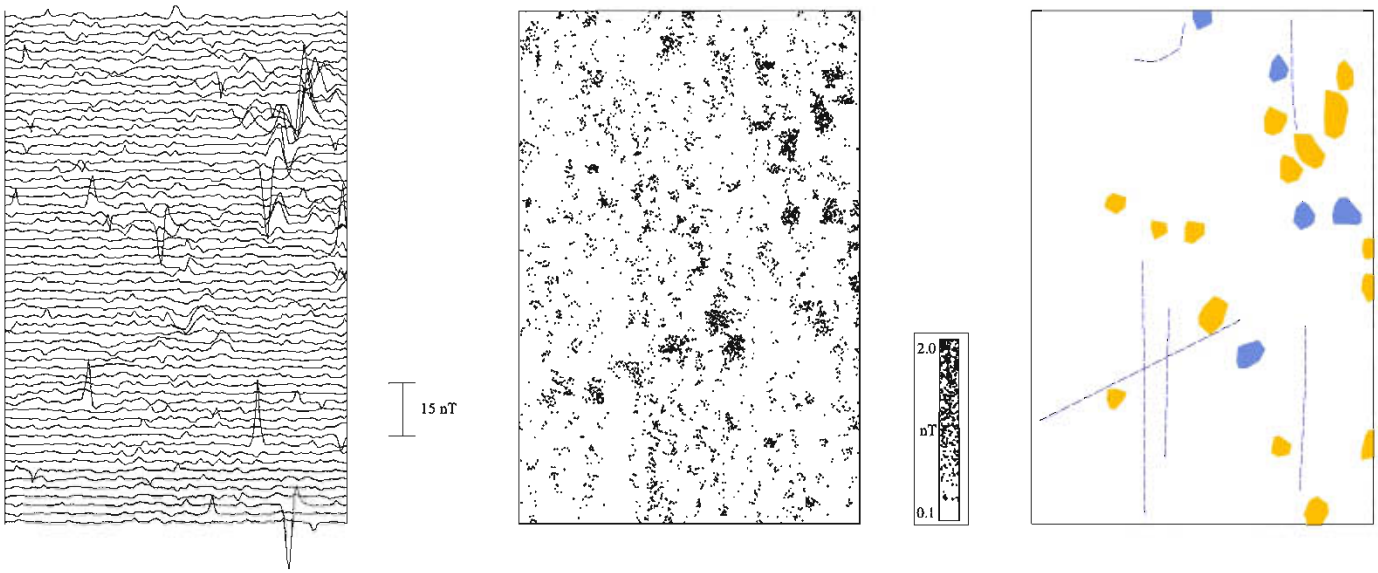
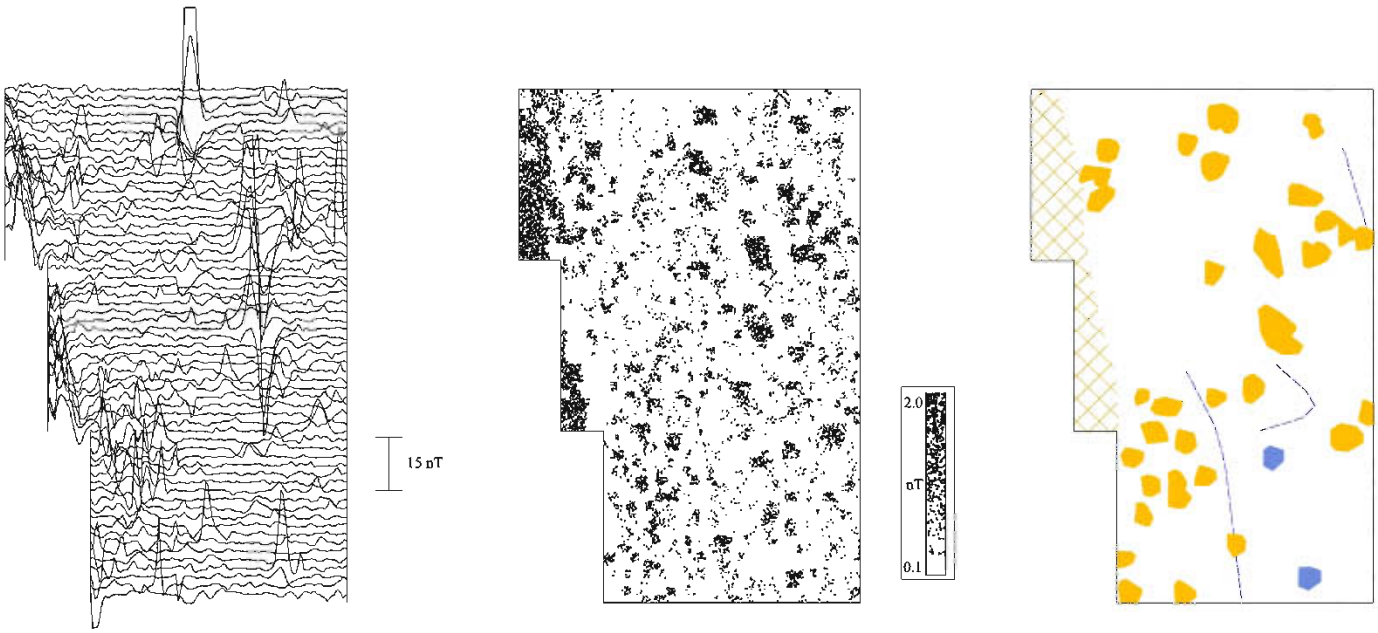
G3: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



G4: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



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? Archaeology | Trend | Ferrous | Area of Magnetic Disturbance

0 metres 25

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ARCHAEOLOGICAL LICENCE: 08R0117
PRODUCED BY: BT | DATE SURVEYED: N/A
CHECKED BY: DH | DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH
TITLE: G3 & G4: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090
DRAWING NO.: 08090_33
FIG. NO.: A1.3
SCALE: 1/625 @ A3

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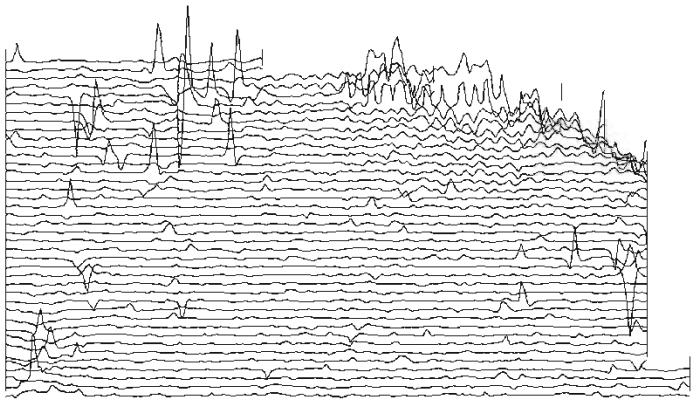
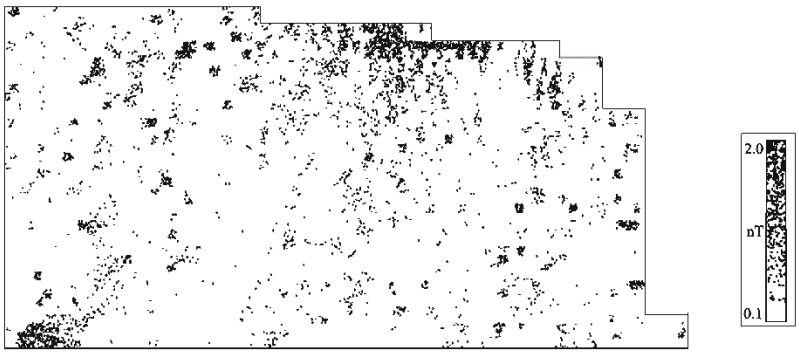
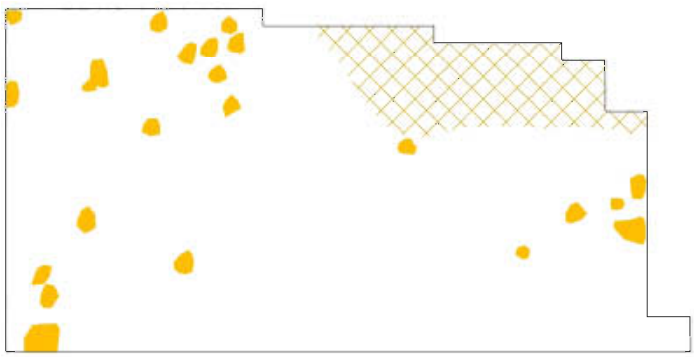
G5: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







Ferrous

Area of Magnetic Disturbance

0 metres 25

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ARCHAEOLOGICAL LICENCE: 08R0117

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PROJECT: METRO NORTH

TITLE: G5: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_34

FIG. NO.: A1.4

SCALE: 1/625 @ A3

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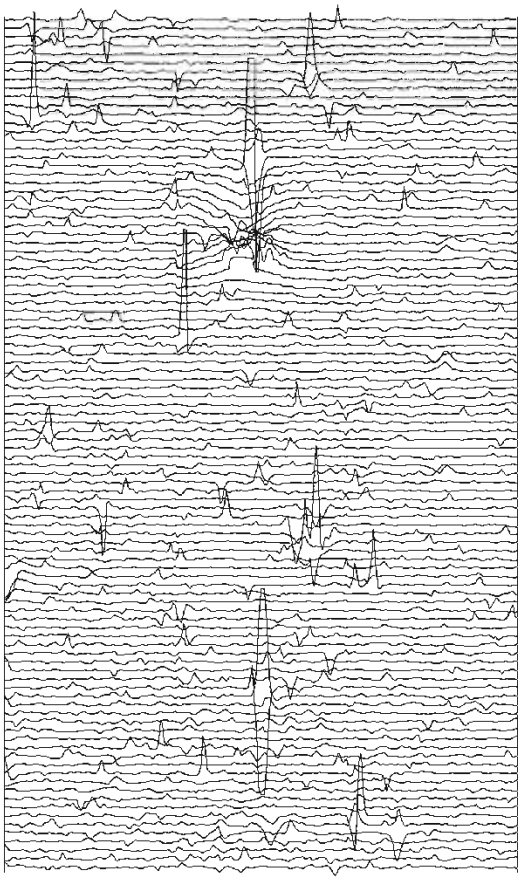
G6: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



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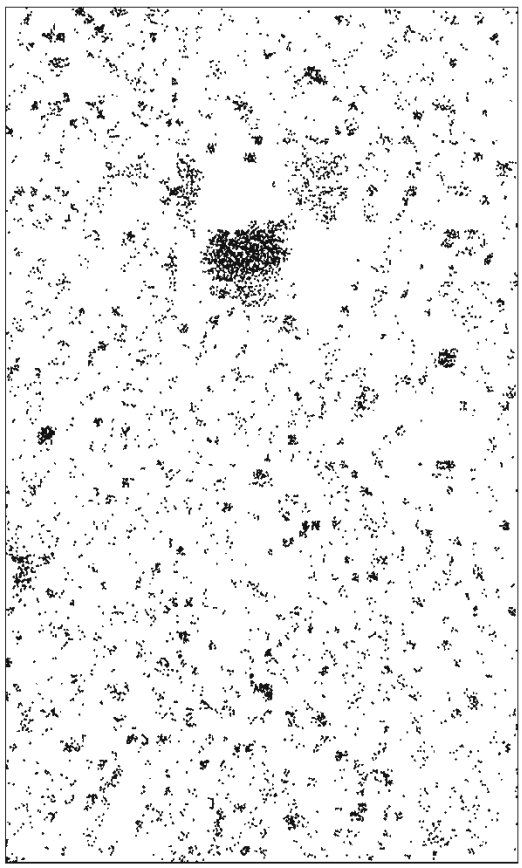

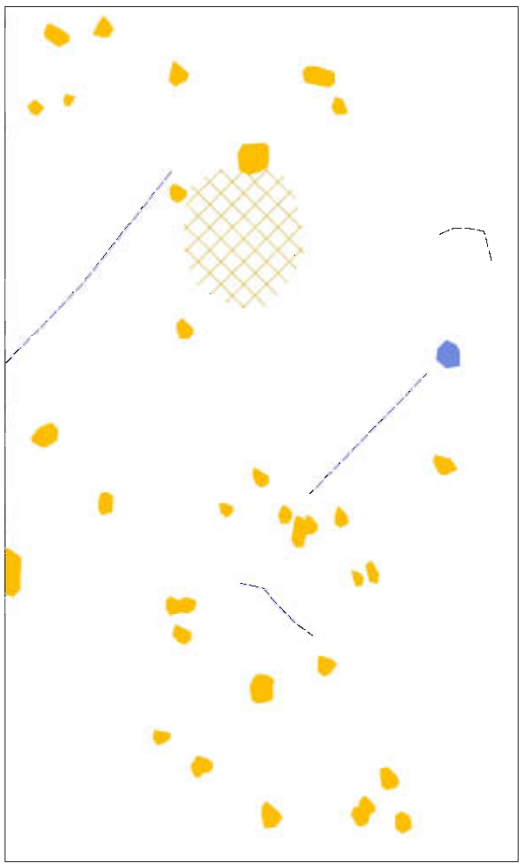

? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

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PROJECT: METRO NORTH

TITLE: G6: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_35

FIG. NO.: A1.5

SCALE: 1/625 @ A3

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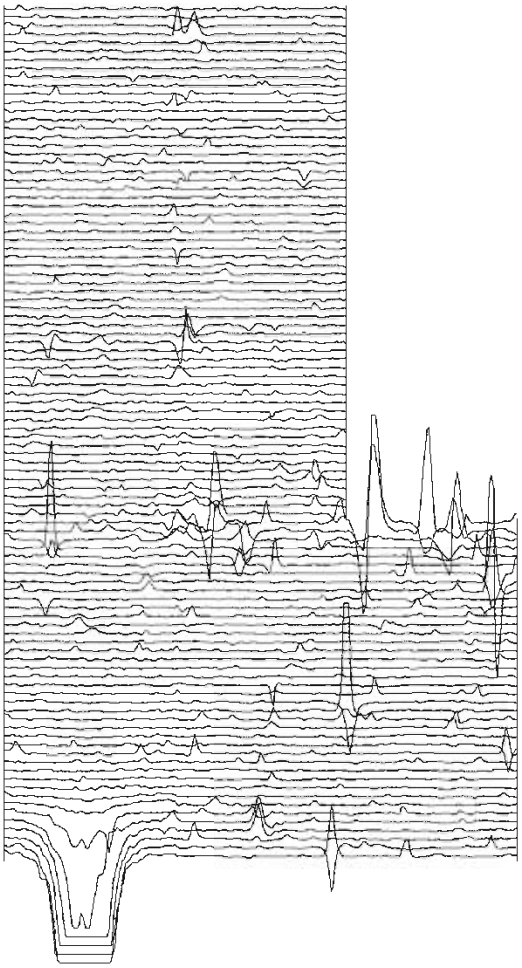
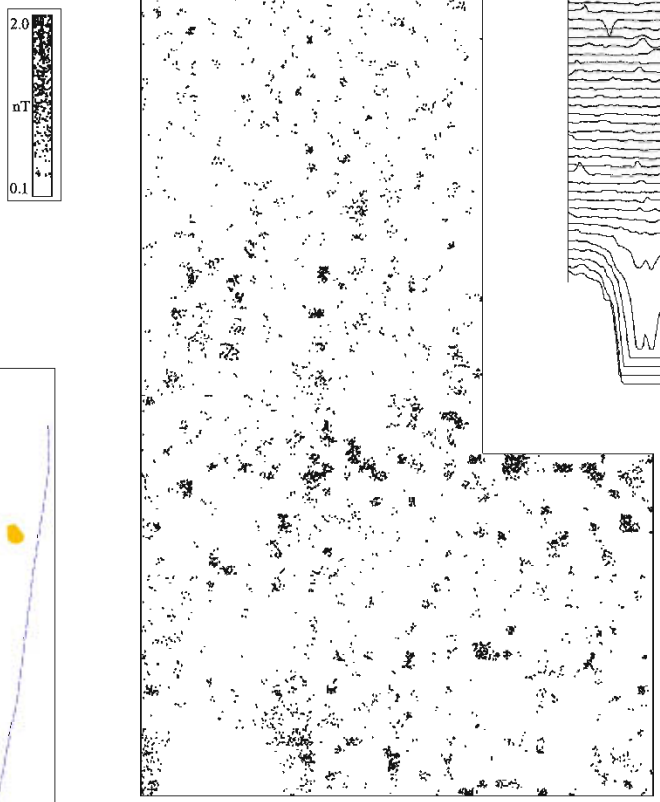
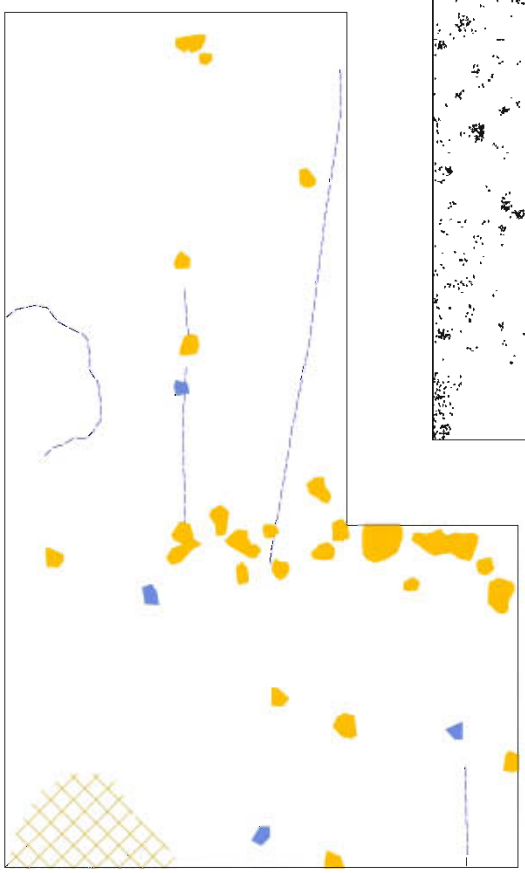
G7: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

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ARCHAEOLOGICAL LICENCE: 08R0117
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DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH
TITLE: G7: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090
DRAWING NO.: 08090_36
FIG. NO.: A1.6
SCALE: 1/625 @ A3

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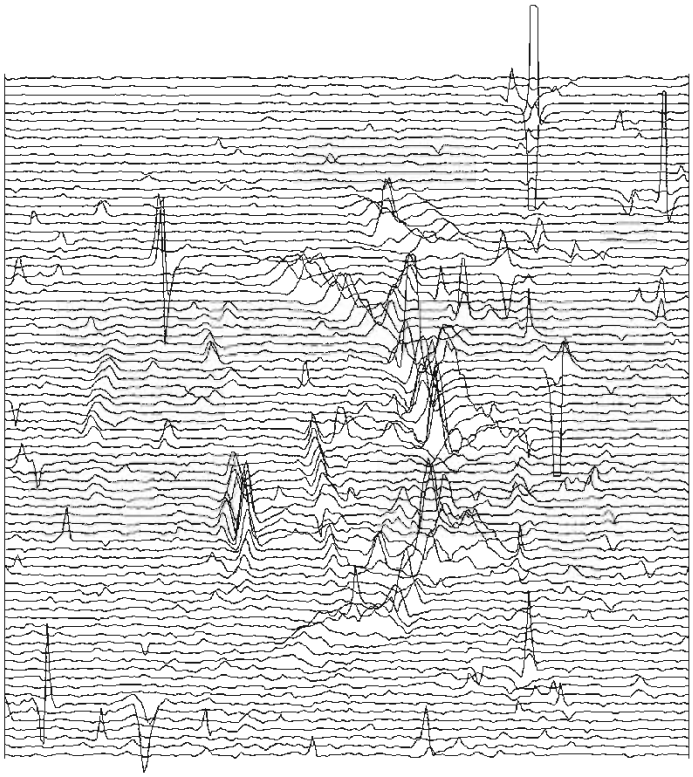
G8: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



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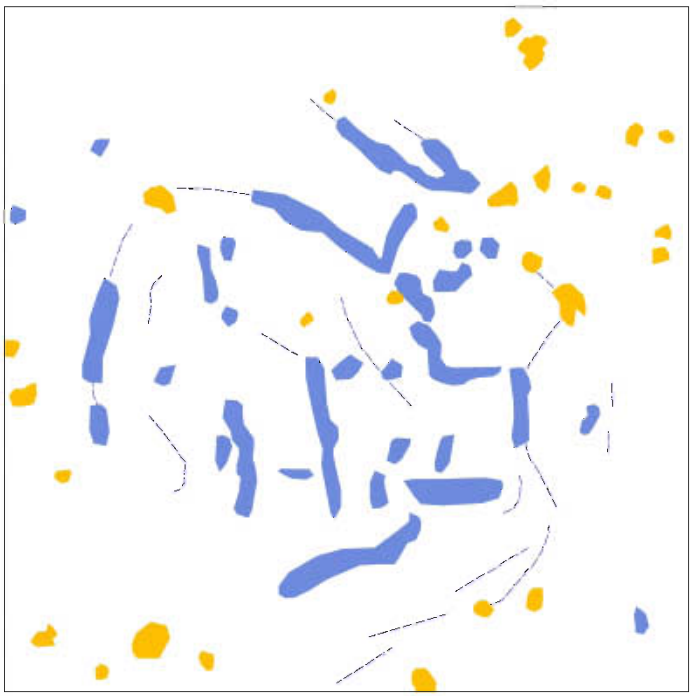

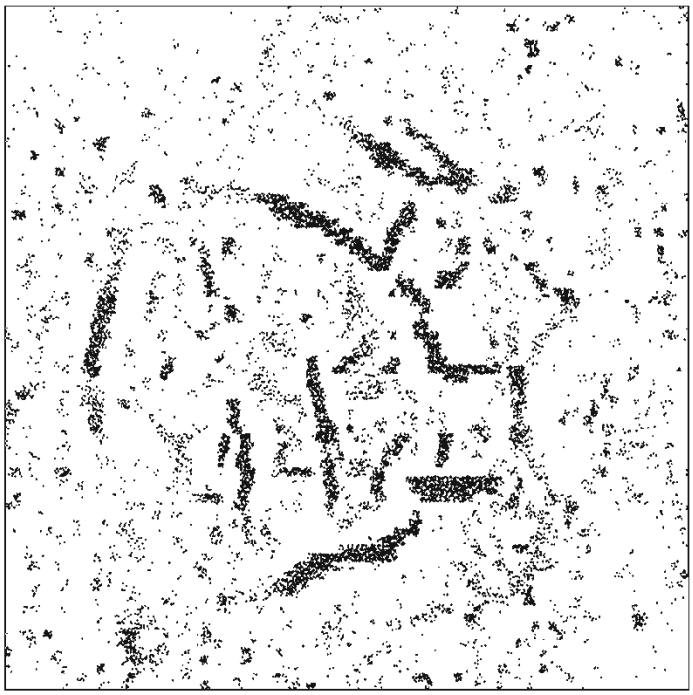

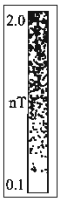

? Archaeology Trend Ferrous

0 metres 25

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ARCHAEOLOGICAL LICENCE: 08R0117
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DATE SURVEYED: N/A
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DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH
TITLE: G8: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090
DRAWING NO. 08090_37
FIG. NO. A1.7
SCALE: 1/625 @ A3

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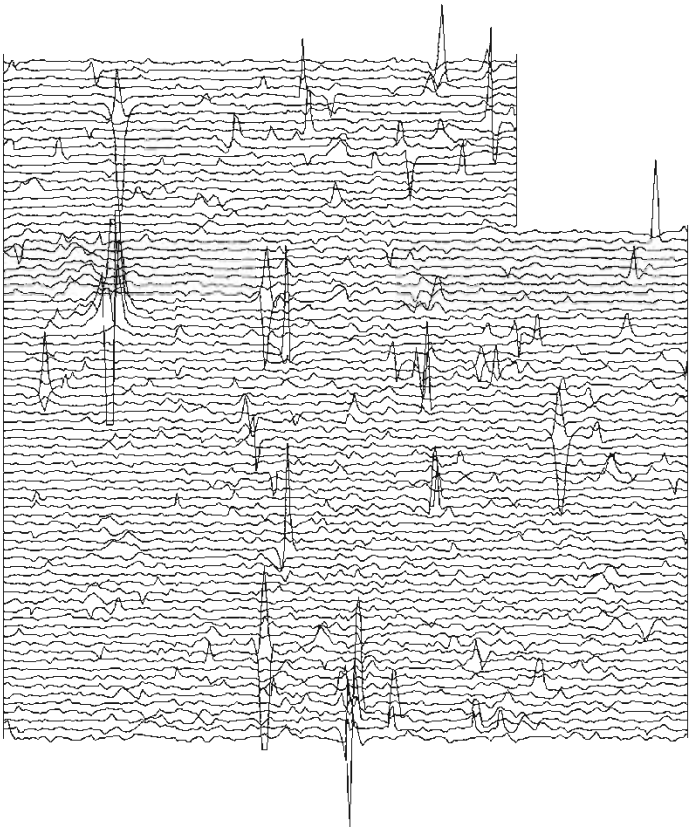
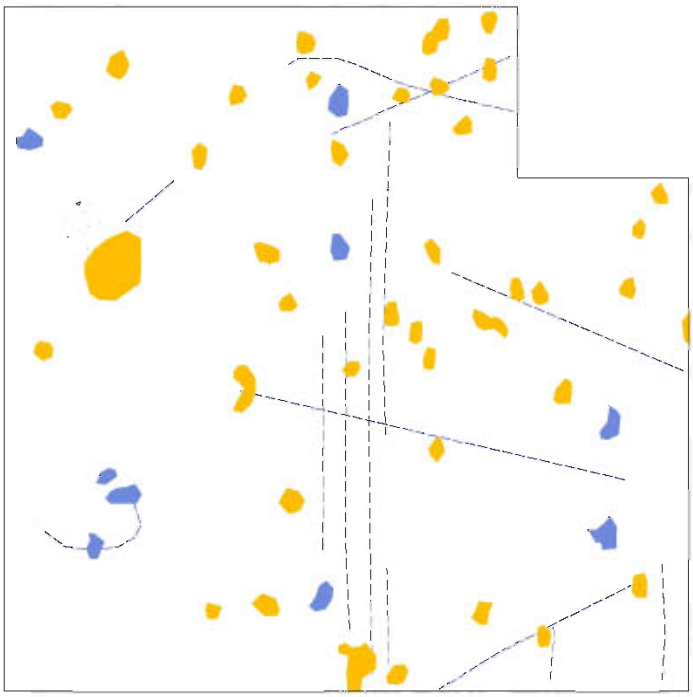
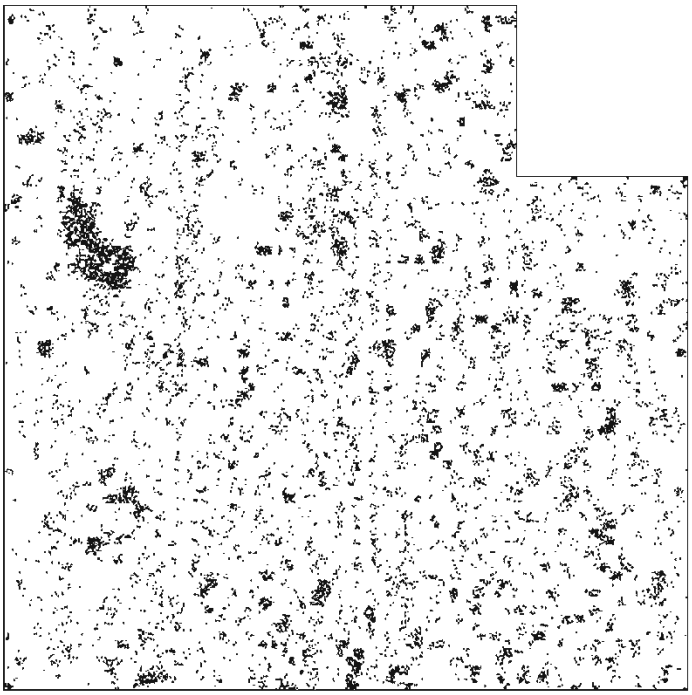
G9: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







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? Archaeology | Trend | Area of Increased Magnetic Response | Ploughing Trend | Ferrous

0 metres 25

ISO 9001:2000 EQA QUALITY ASSURED ORGANISATION CERT NO 7876

ARCHAEOLOGICAL LICENCE:	08R0117
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PROJECT: METRO NORTH

TITLE: G9: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.: 08090

DRAWING NO.: 08090_38

FIG. NO.: A1.8

SCALE: 1/625 @ A3

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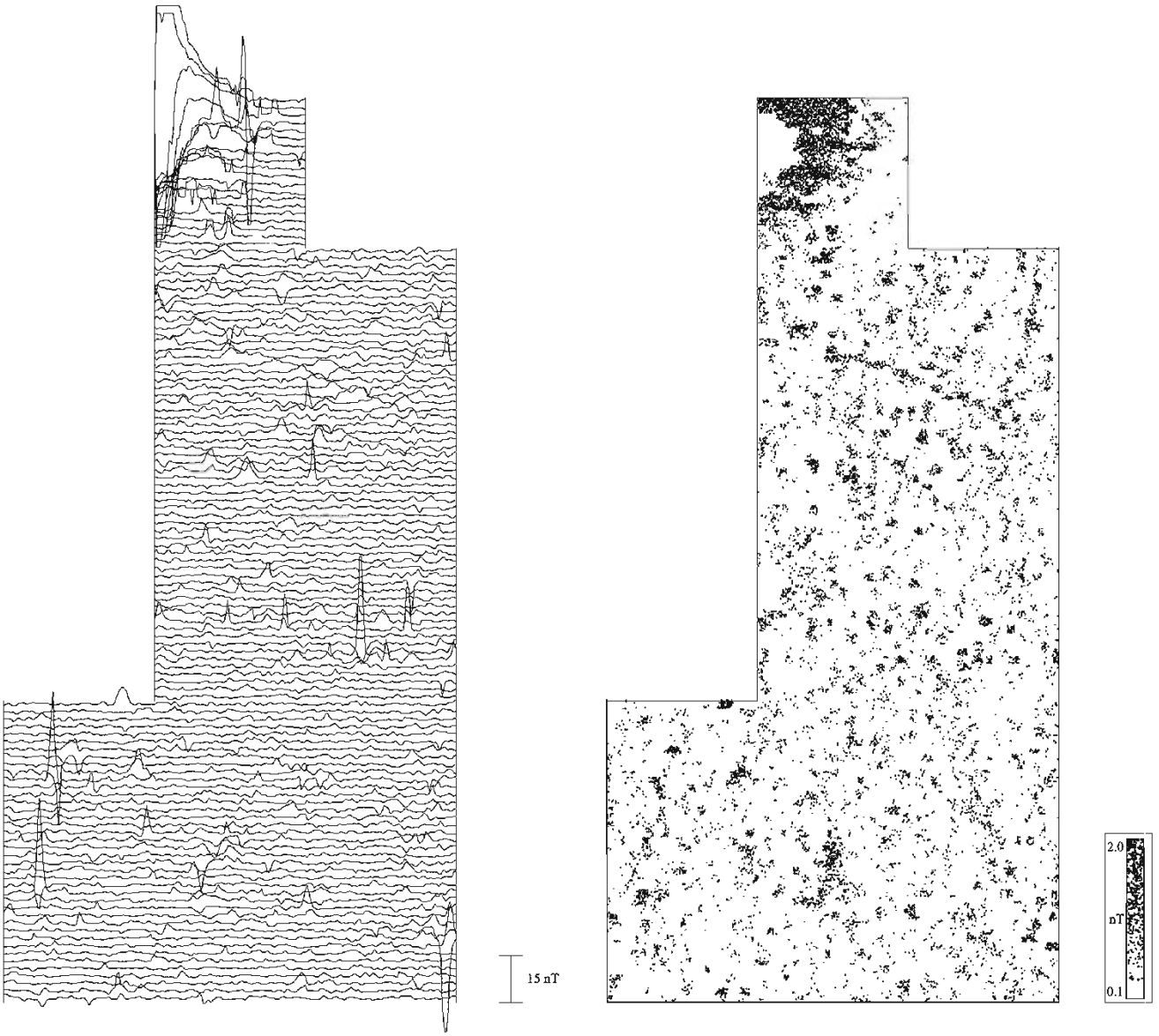
G10: XY-TRACE & DOT DENSITY PLOT



REVISIONS:	BY:	DATE:	REV:

0 metres 25

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ARCHAEOLOGICAL LICENCE:	08R0117
PRODUCED BY:	BT
DATE SURVEYED:	N/A
CHECKED BY:	DH
DATE ISSUED:	01/07/2009

PROJECT: METRO NORTH

TITLE: G10: XY-TRACE & DOT DENSITY PLOT

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.:	08090
DRAWING NO.:	08090_39
FIG. NO.:	A1.9
SCALE:	1/625 @ A3

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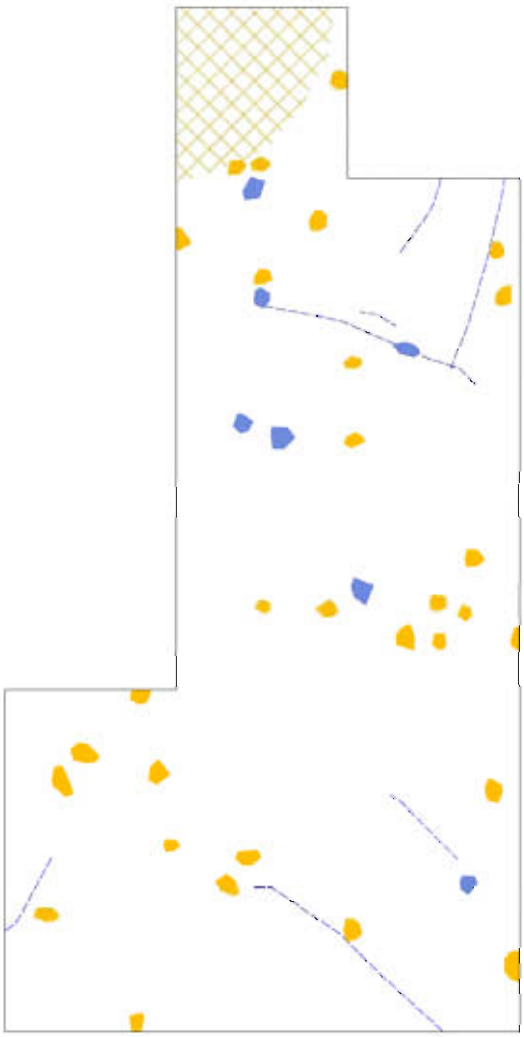
G10: INTERPRETATION



? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

METRO NORTH
G10: INTERPRETATION

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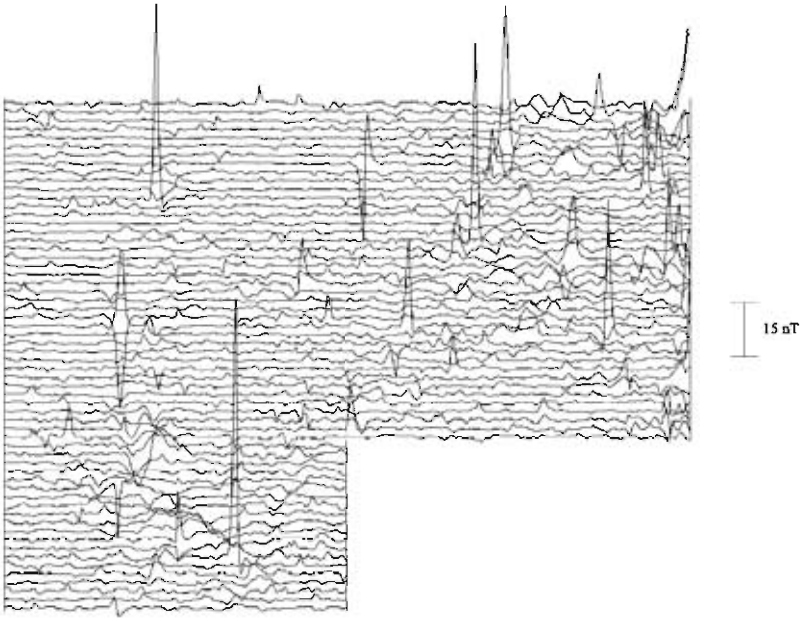
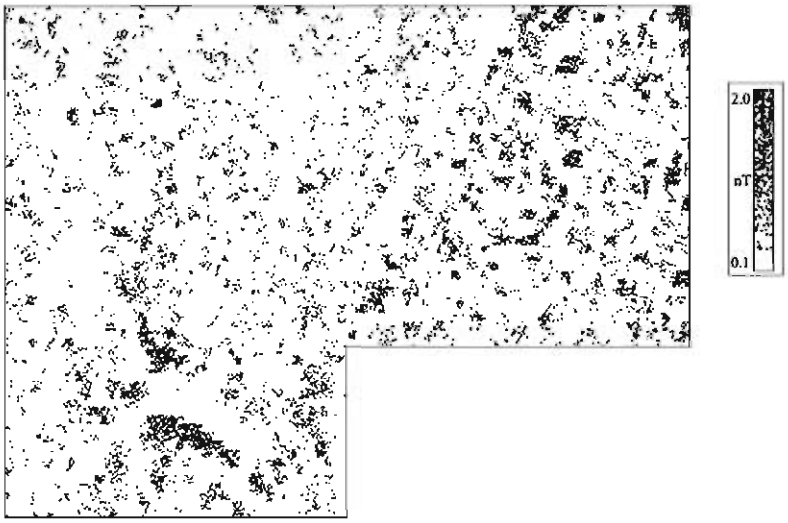
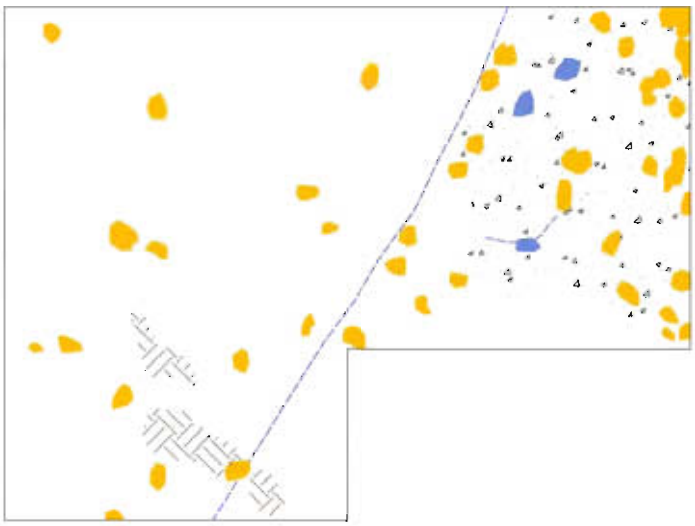
G11: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Area of Increased Magnetic Response ? Natural Ferrous 0 metres 25

METRO NORTH

G11: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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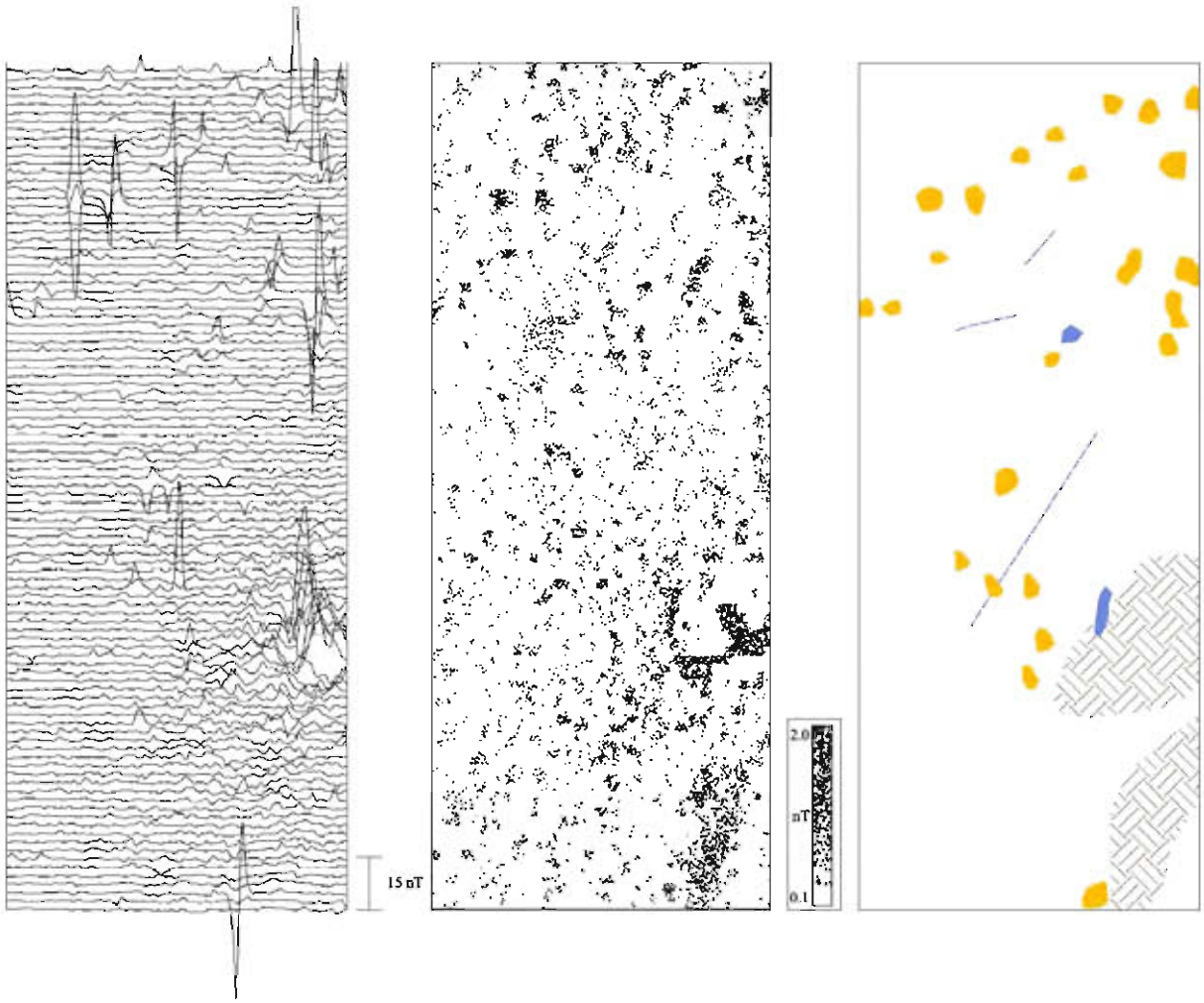
G12: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology Trend ? Natural Ferrous

0 metres 25

METRO NORTH

G12: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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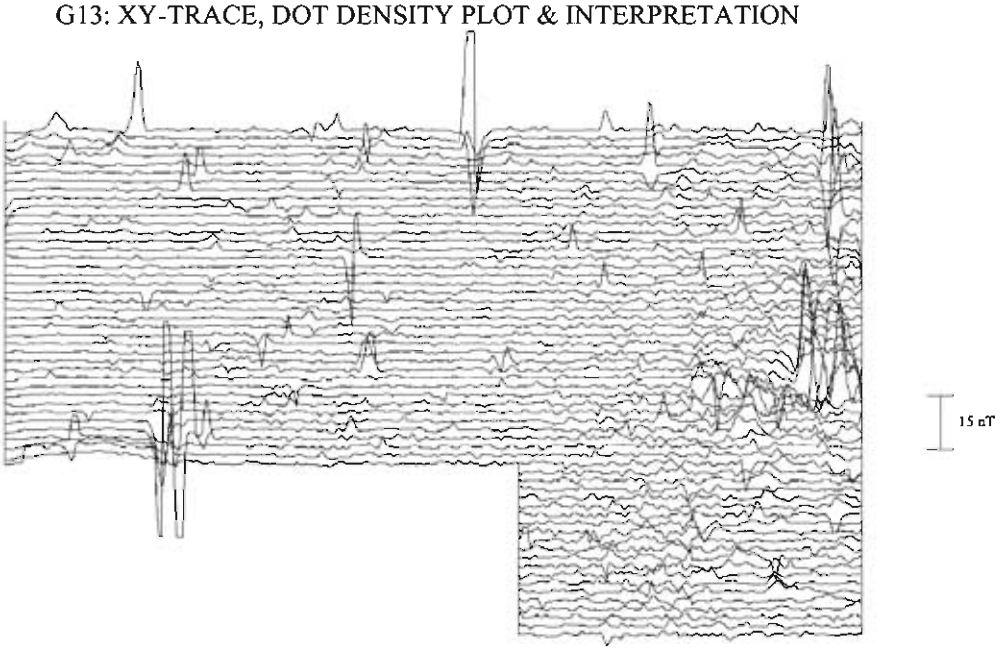
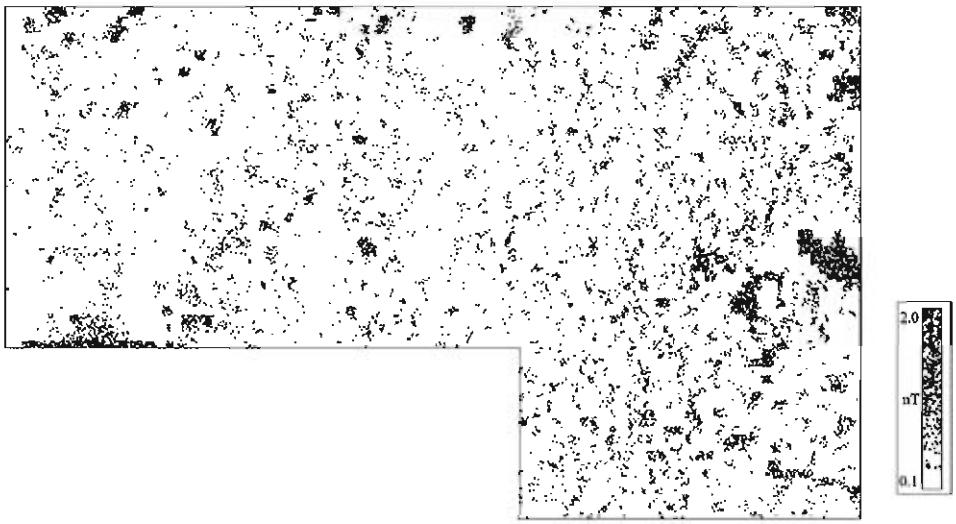
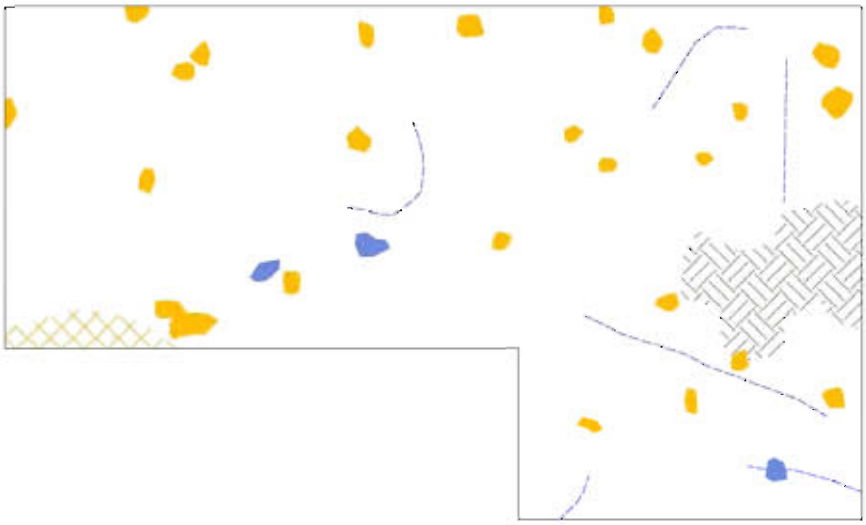
G13: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology | Trend | ? Natural | Ferrous | Area of Magnetic Disturbance

0 metres 25

METRO NORTH

G13: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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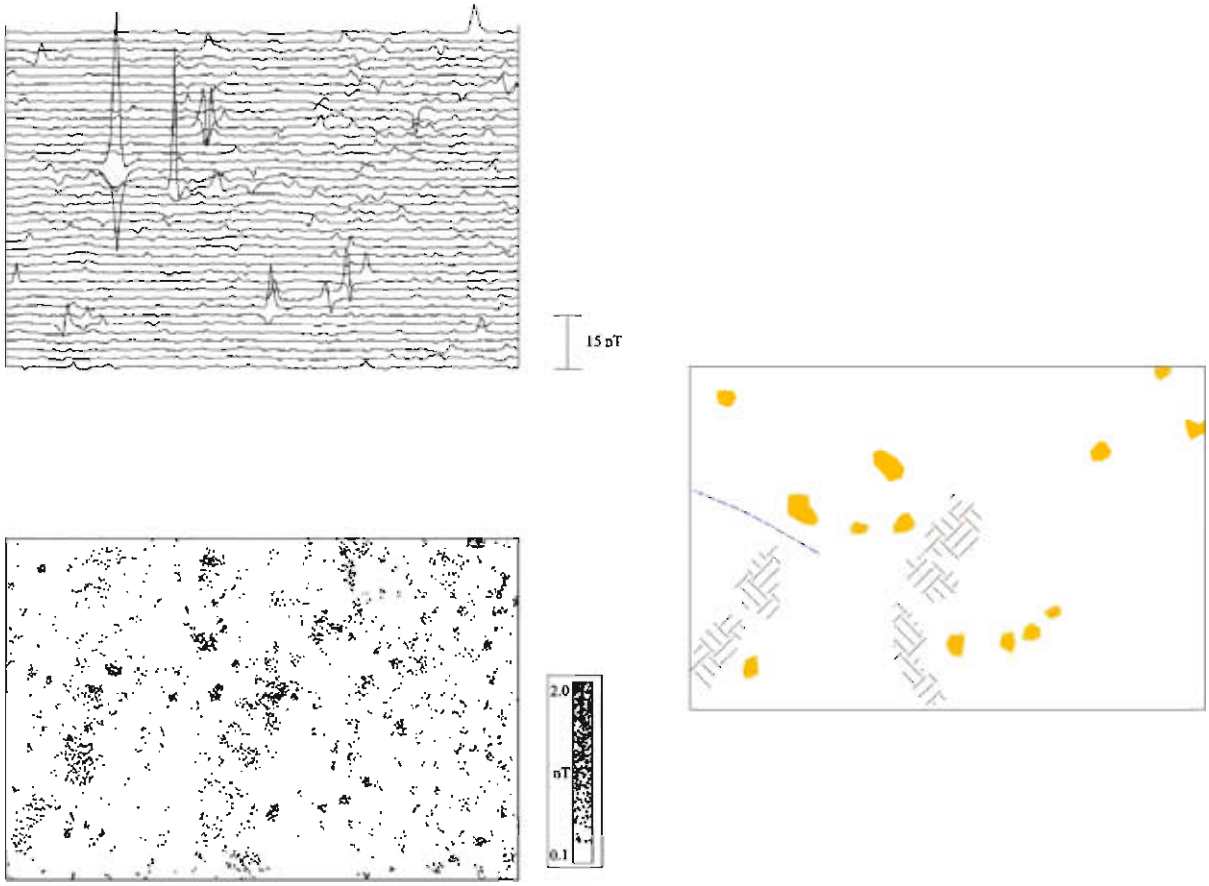
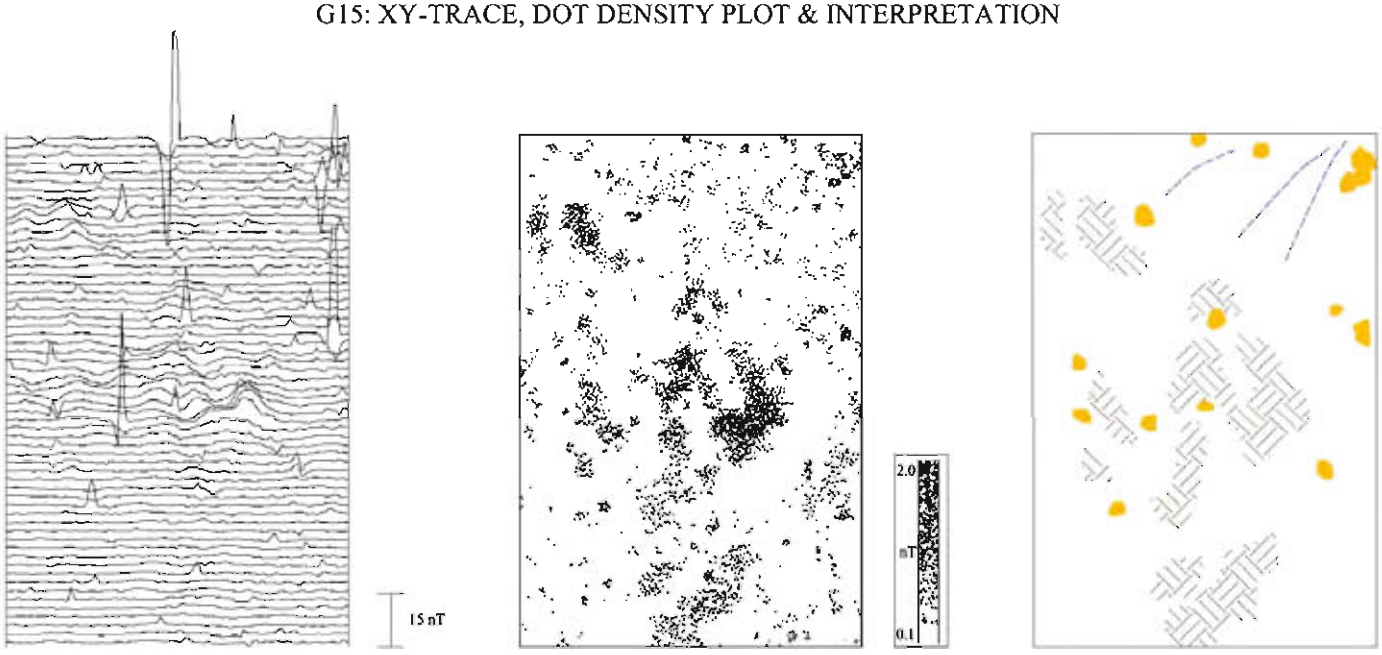
G14: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



G15: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



Trend ? Natural Ferrous

0 metres 25

METRO NORTH
G14 & G15: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
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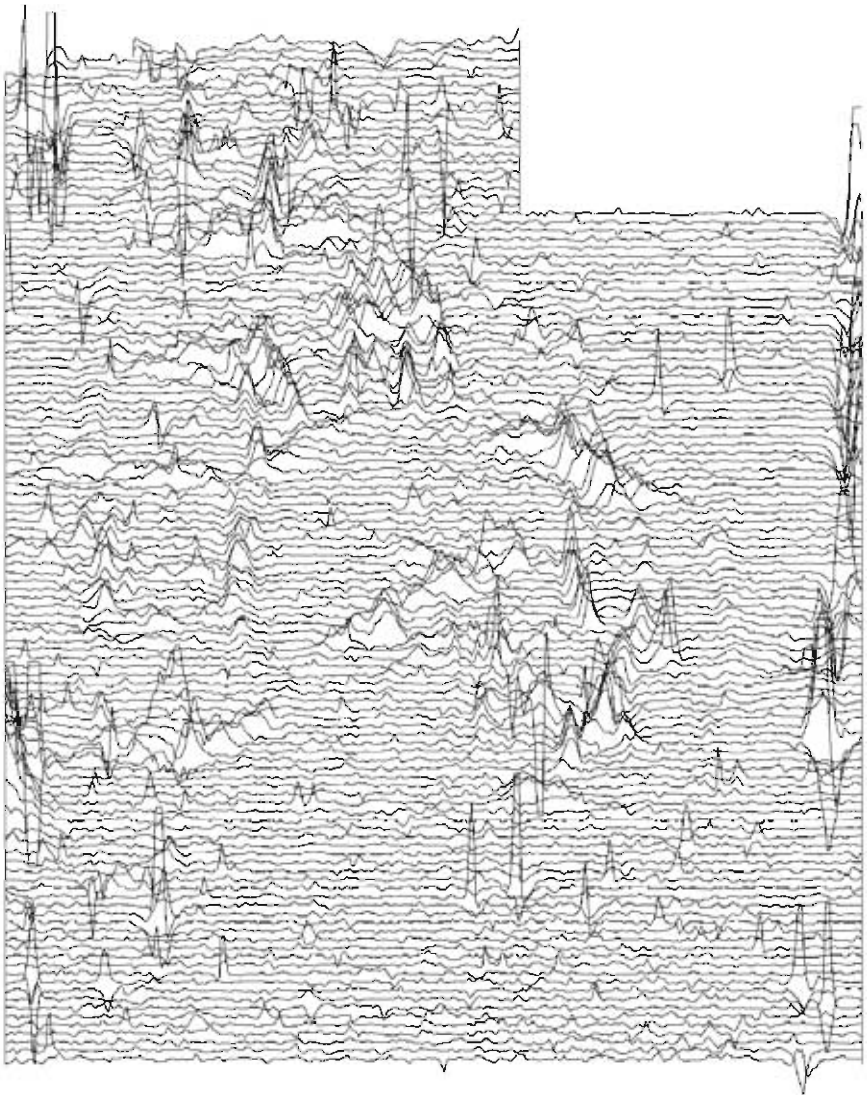
G16: XY-TRACE



0 metres 25

METRO NORTH
G16: XY-TRACE

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G16: DOT DENSITY PLOT

0 metres 25

METRO NORTH
G16: DOT DENSITY PLOT

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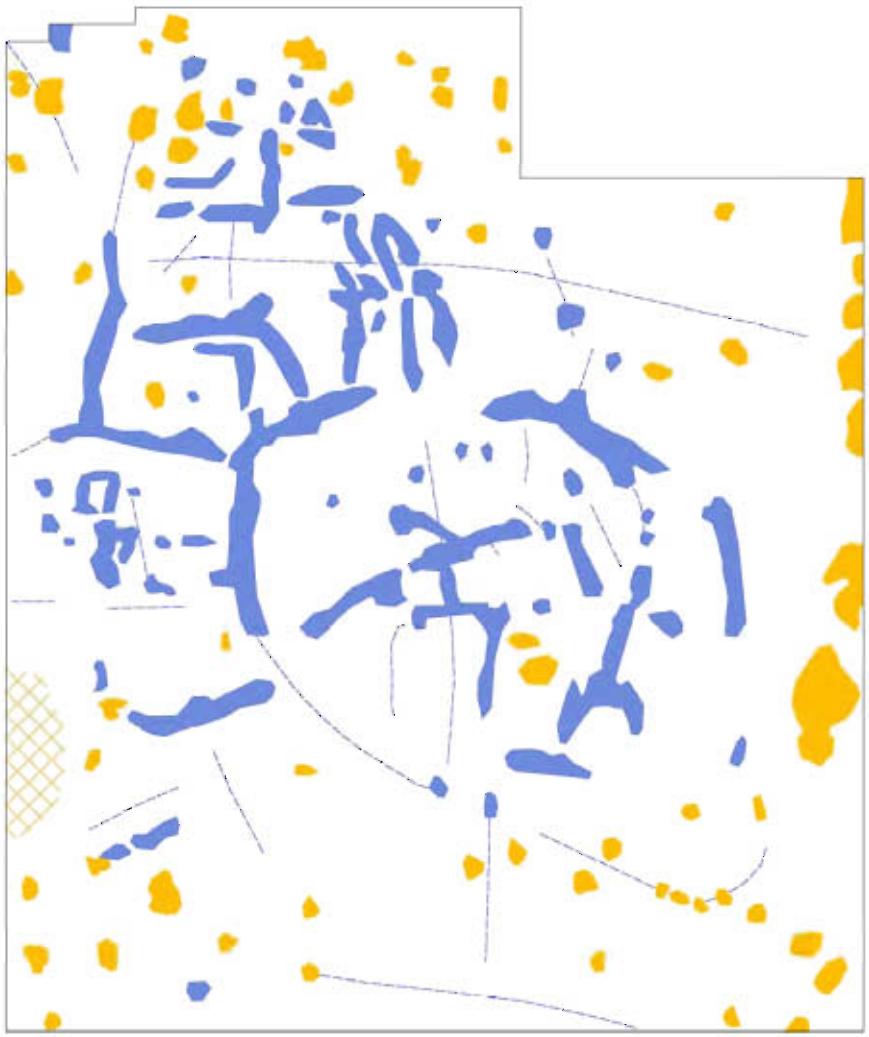
Dublin 2

G16: INTERPRETATION



? Archaeology | Trend | Ferrous | Area of Magnetic Disturbance

0 metres 25

METRO NORTH
G16: INTERPRETATION

RAILWAY PROCUREMENT AGENCY

Margaret Gowen & Co Ltd
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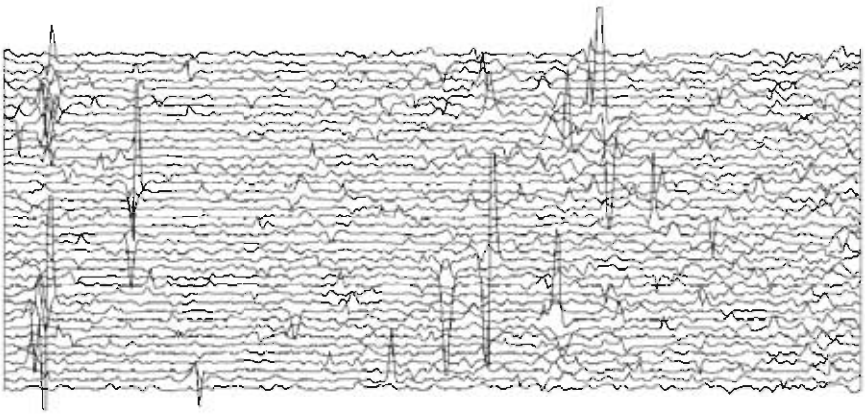
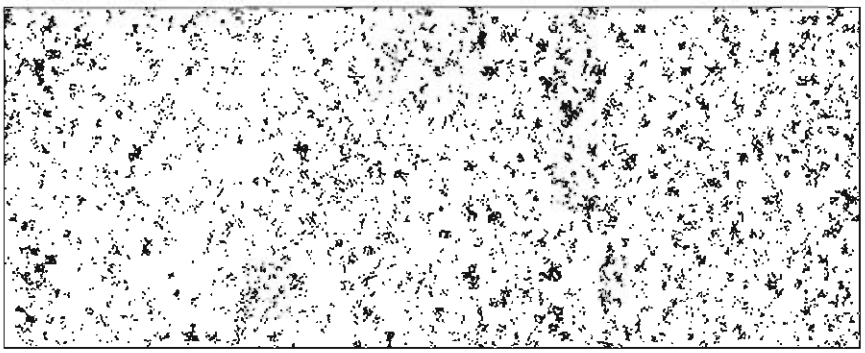
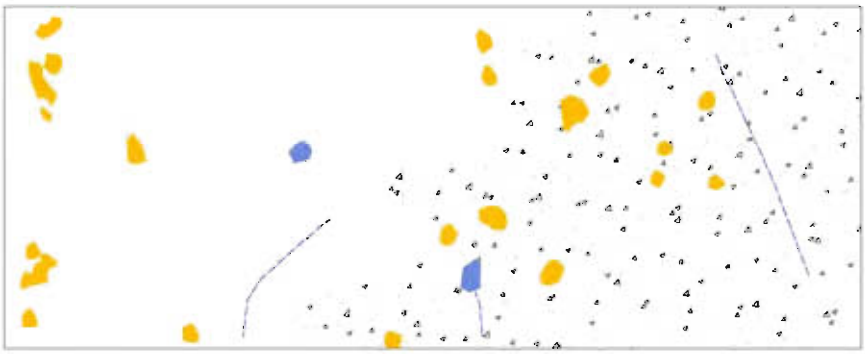
Email: archaeology@mgbrc.com
www.mgbrc.com

G17: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Area of Increased Magnetic Response Ferrous

0 metres 25

METRO NORTH

G17: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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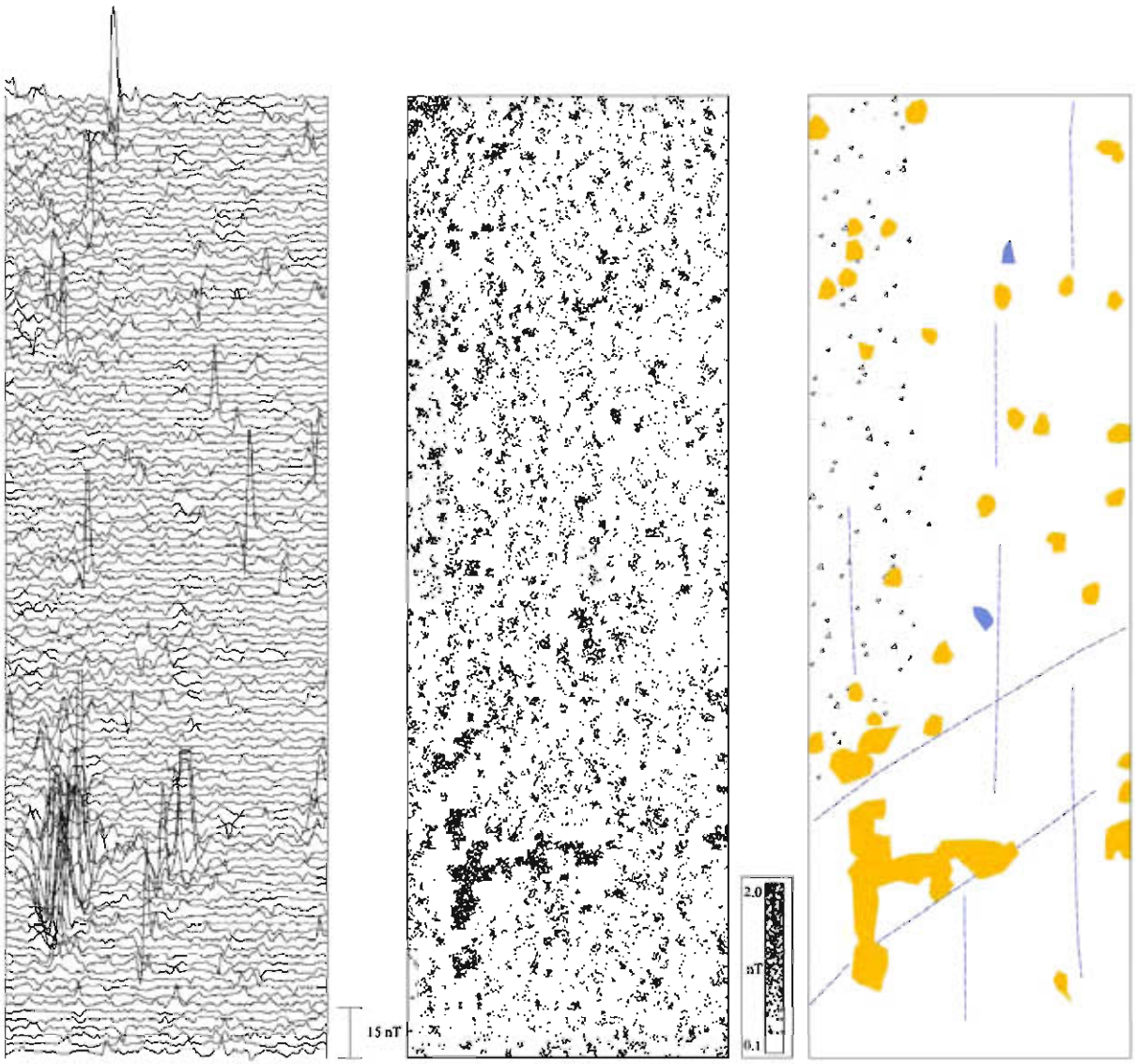
G18: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology Trend Area of Increased Magnetic Response Ferrous

0 metres 25

METRO NORTH

G18: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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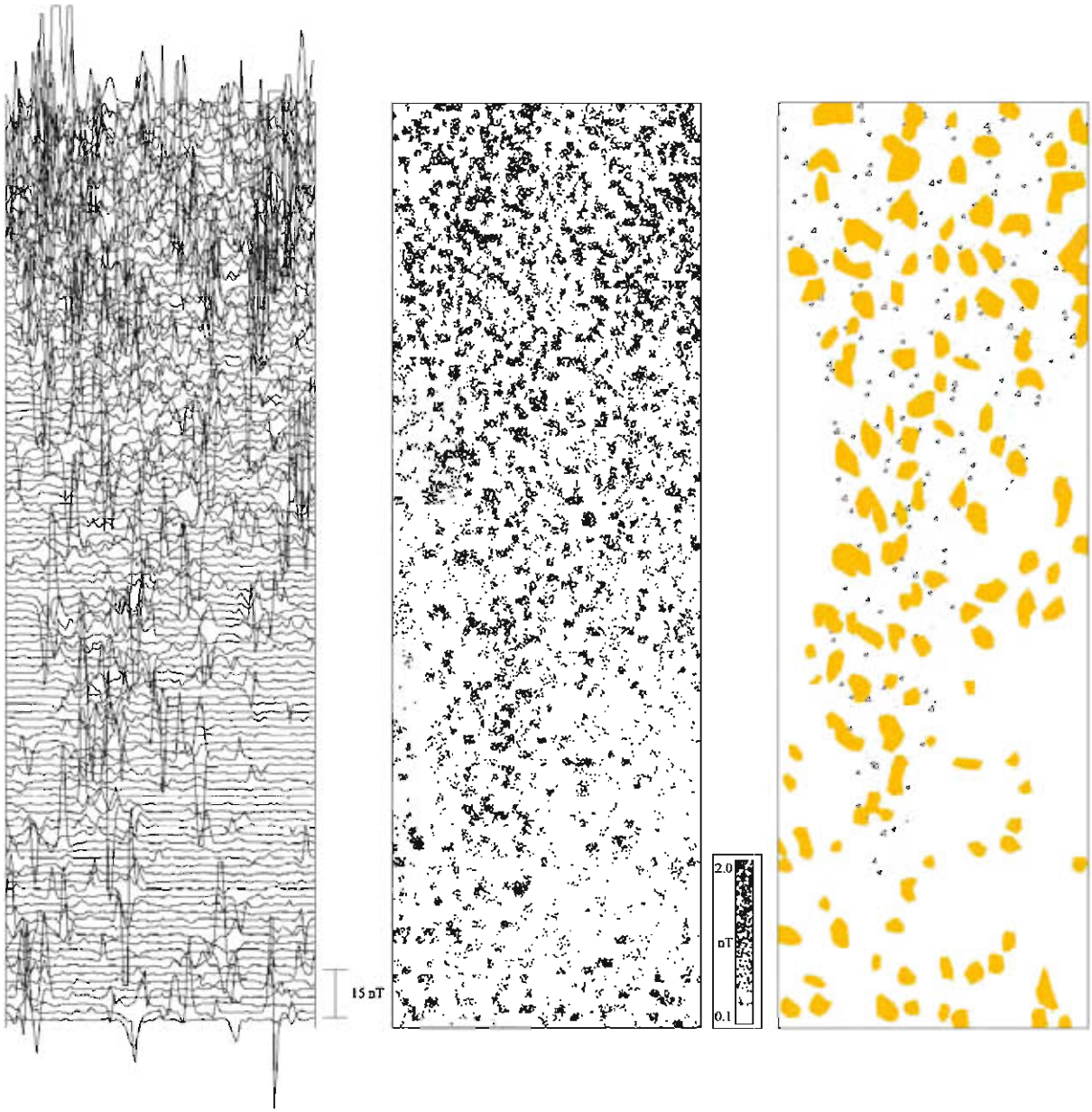
G19: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



Area of Increased Magnetic Response

Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G19: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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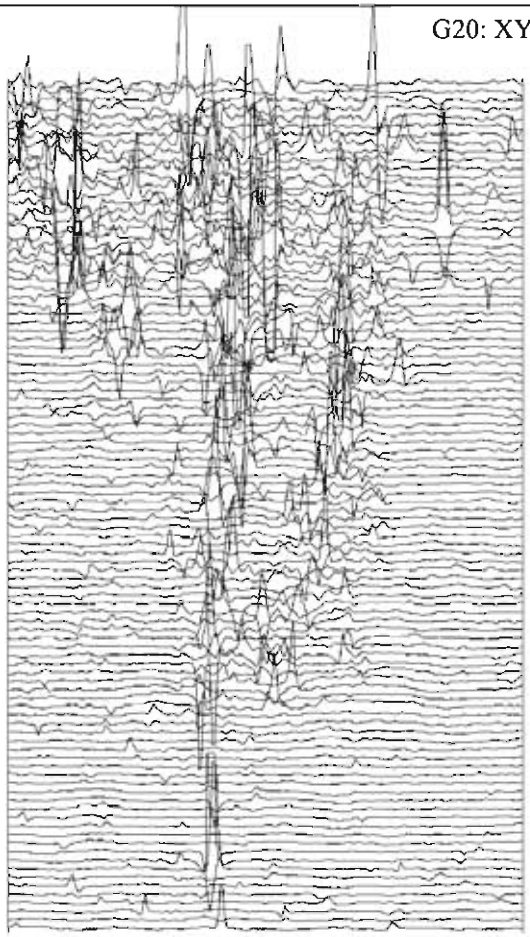
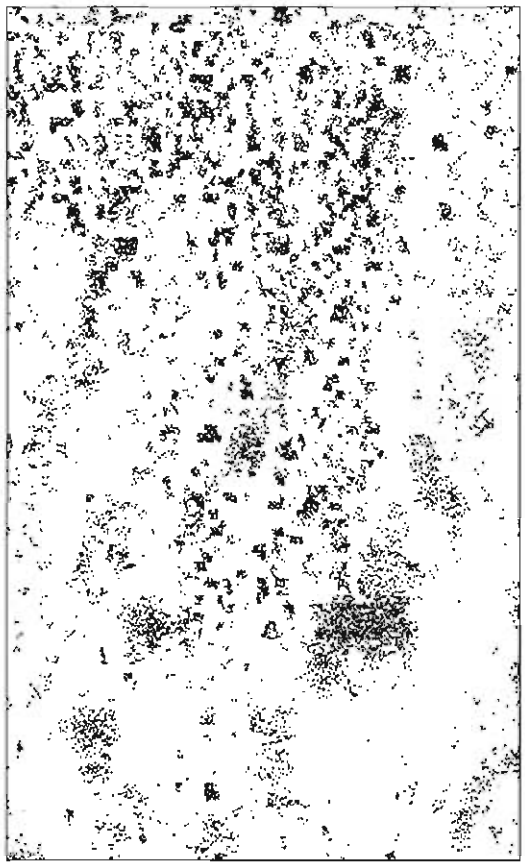
G20: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION





? Archaeology | Area of Increased Magnetic Response | ? Natural | Ferrous

0 metres 25

ISO 9001:2000 EQA CERT NO. 2915

METRO NORTH

G20: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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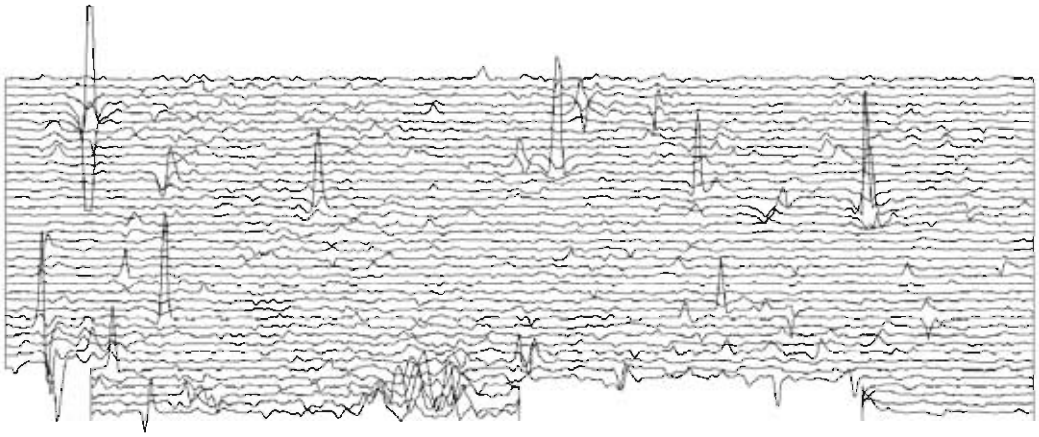
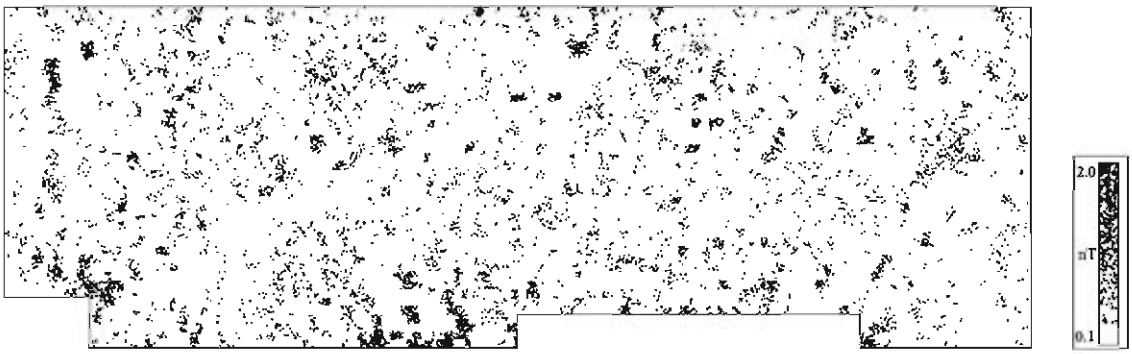
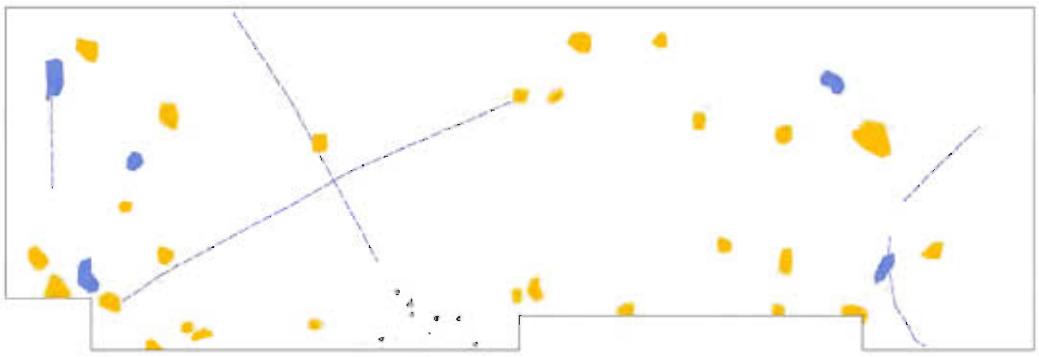
G21: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Area of Increased Magnetic Response Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G21: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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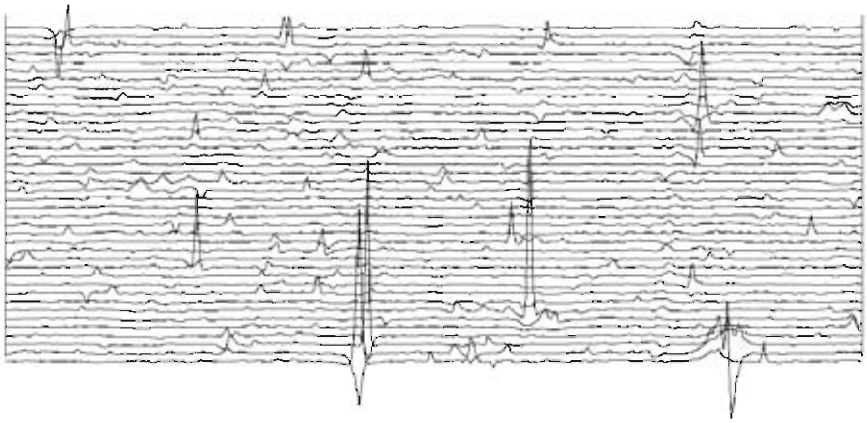
G22: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



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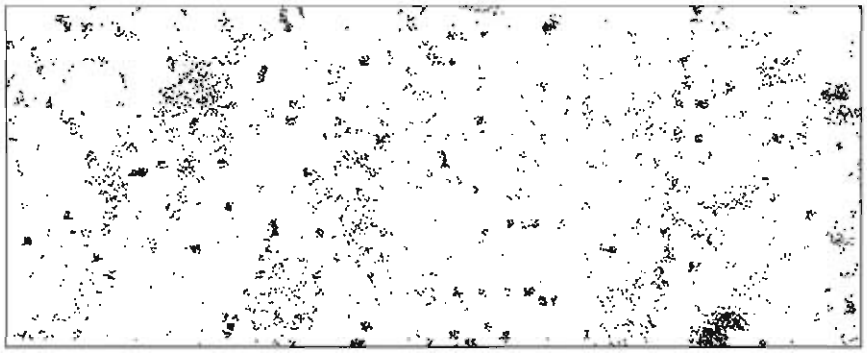

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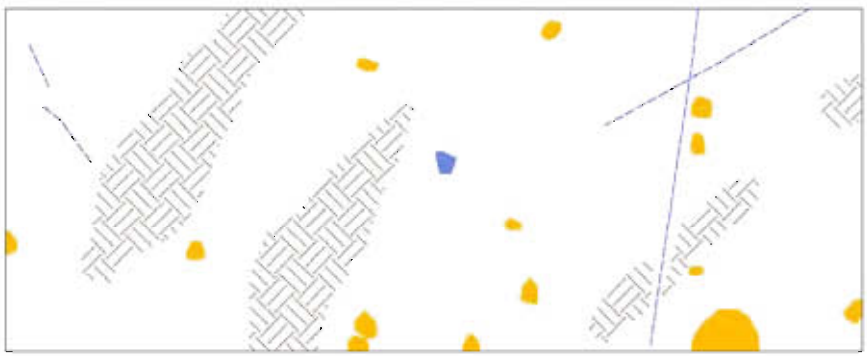

? Archaeology Trend ? Natural Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH
G22: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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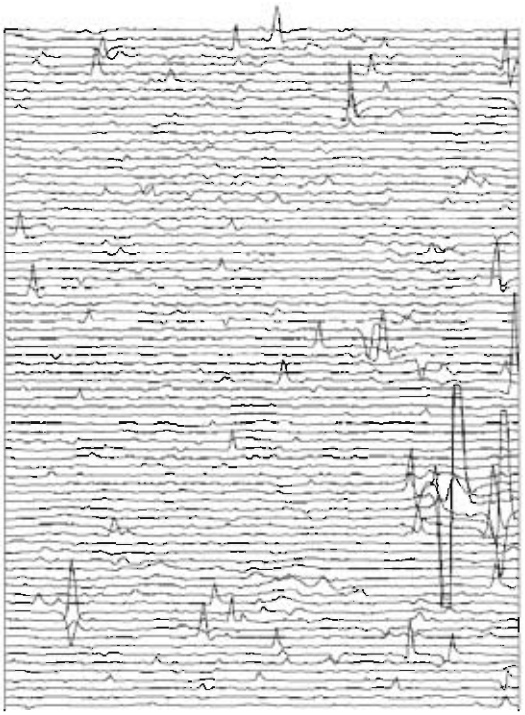
G23: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



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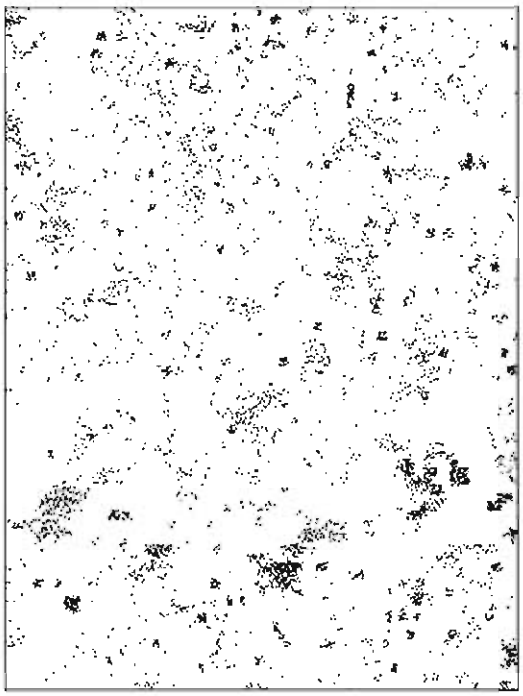

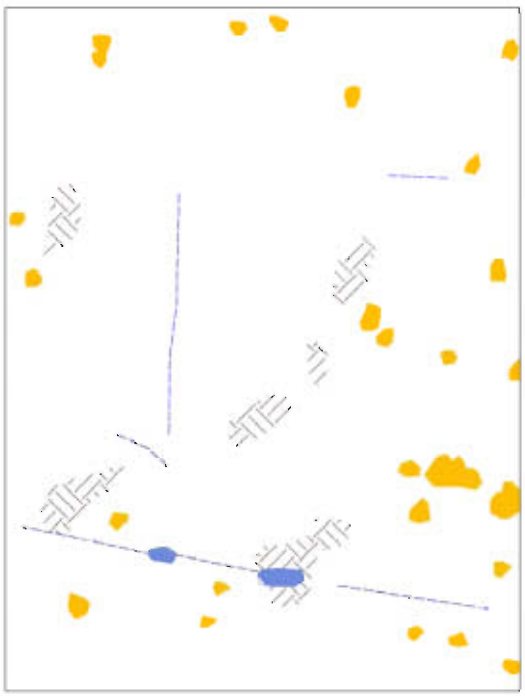

? Archaeology Trend ? Natural Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G23: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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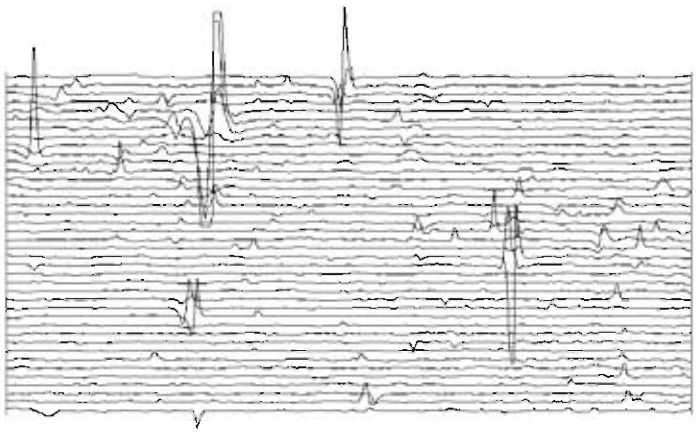
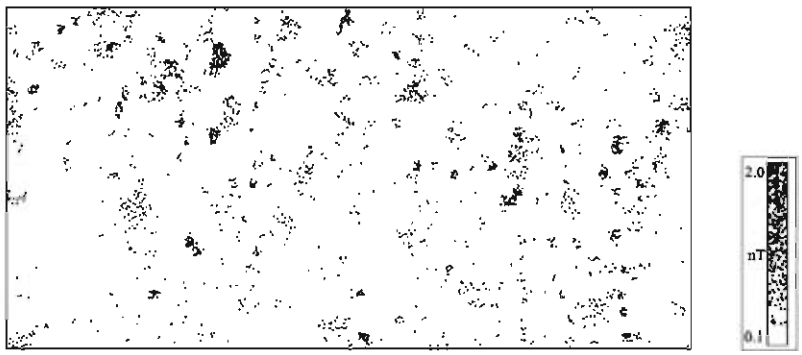
G24: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION





? Archaeology ? Natural Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH
G24: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

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A1.25 1:625 @ A3

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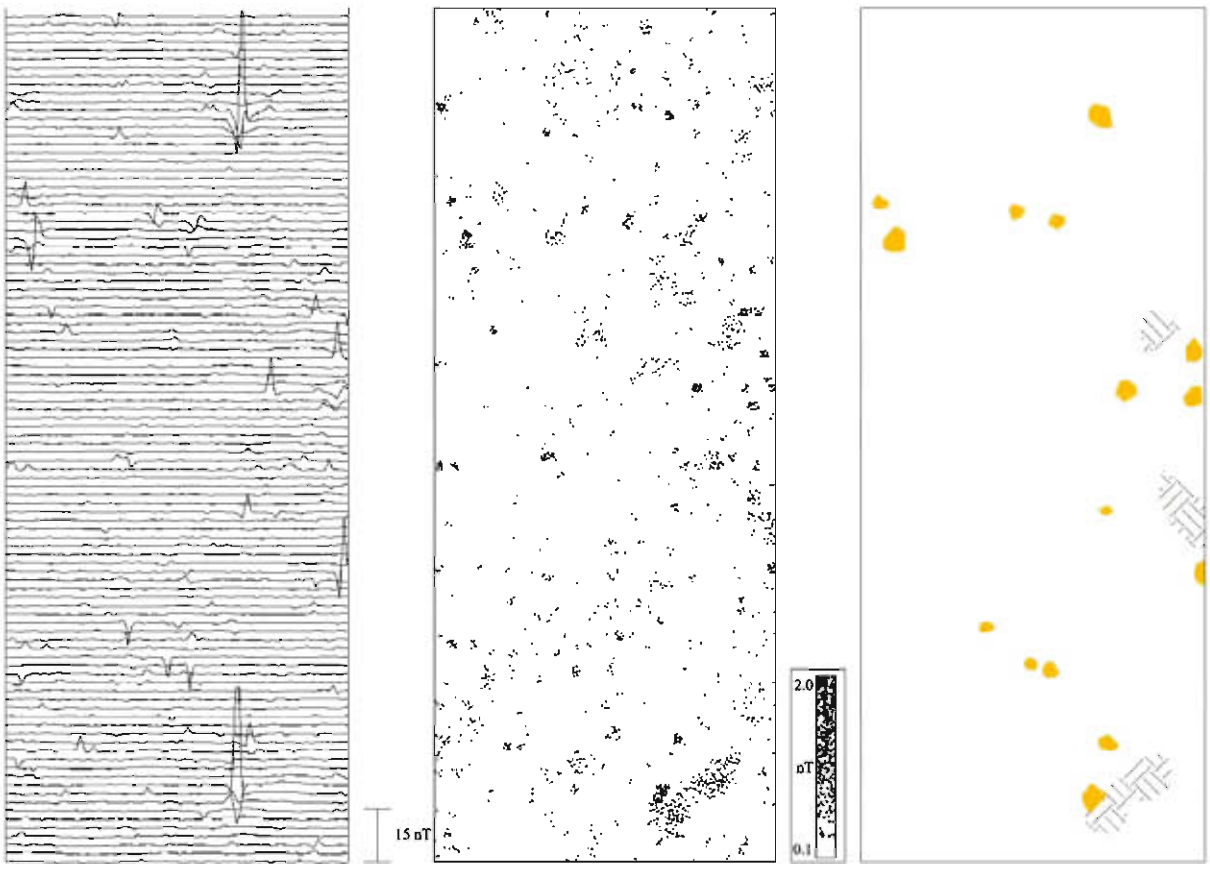
G25: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Natural Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH
G25: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

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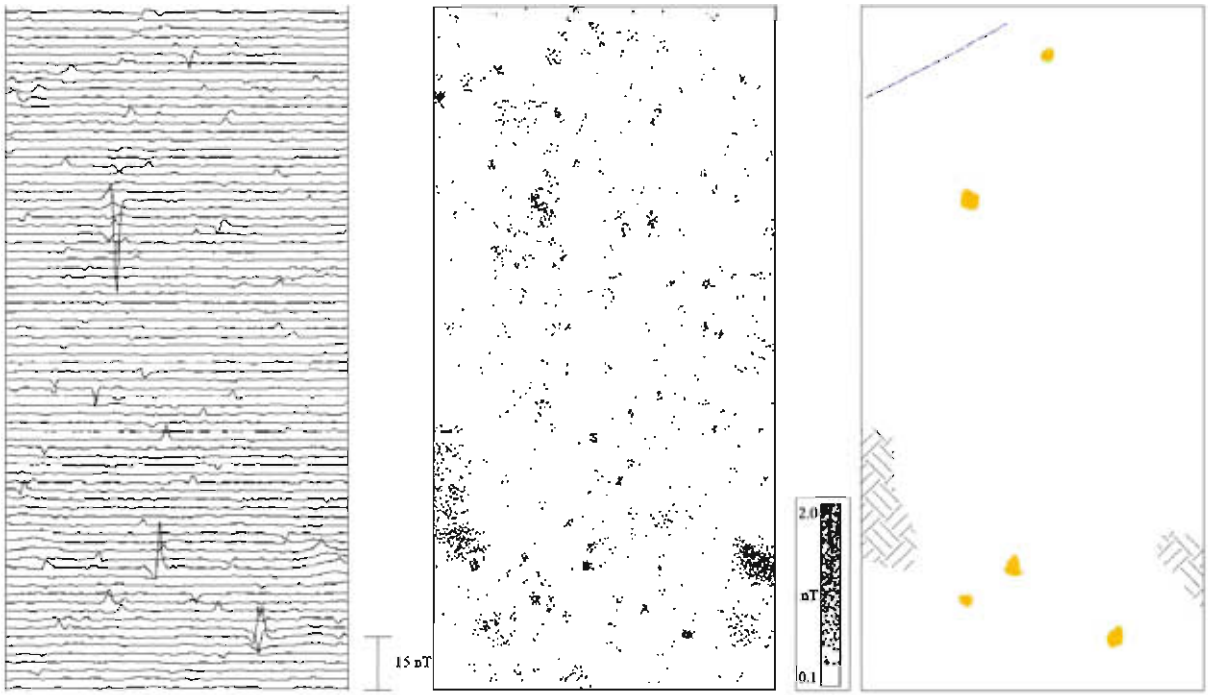
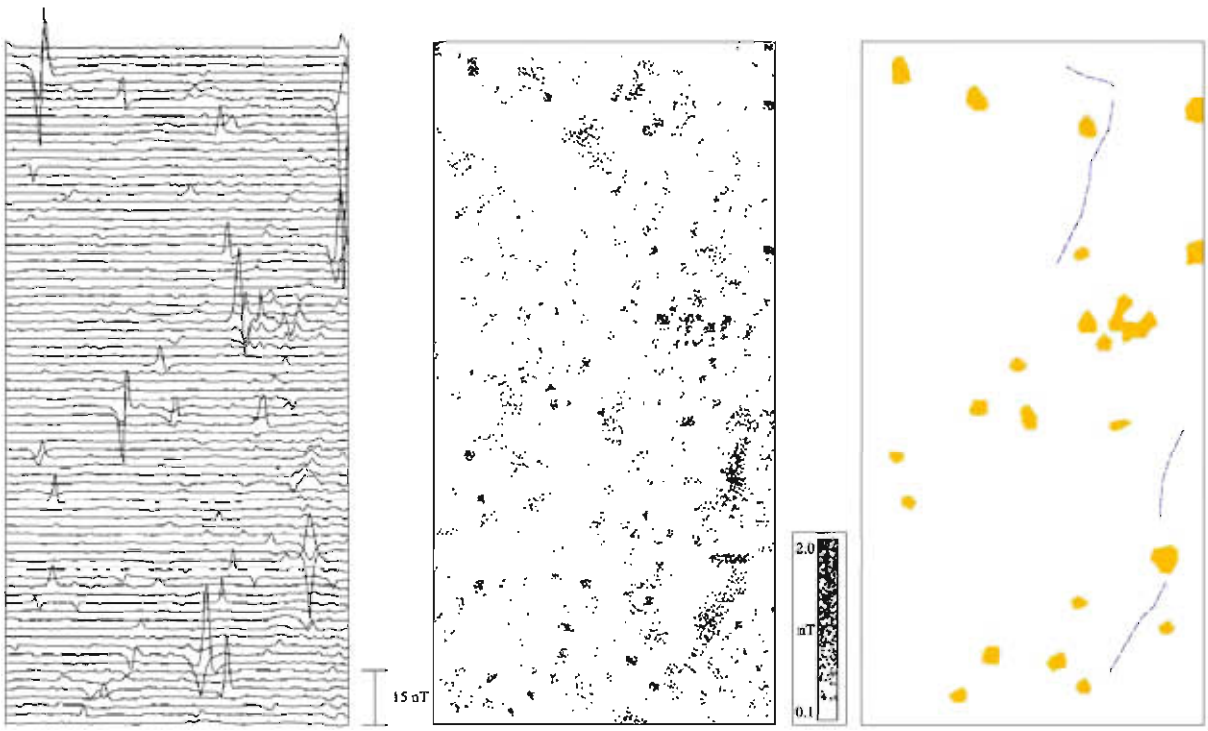
G26: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



G27: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



Trend ? Natural Ferrous

0 metres 25

METRO NORTH
G26 & G27: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

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Archaeological Consultants & Project Managers

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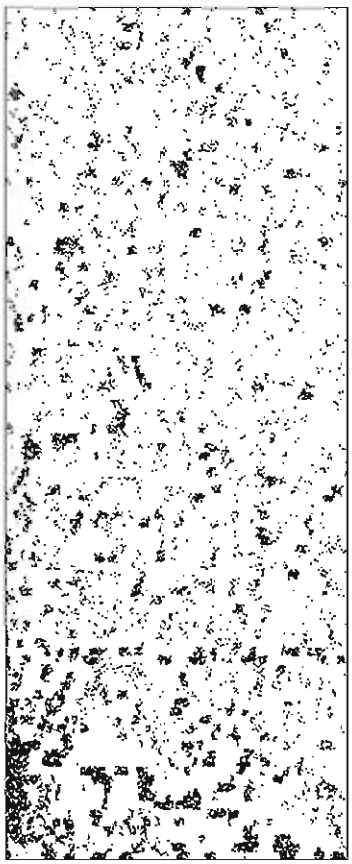
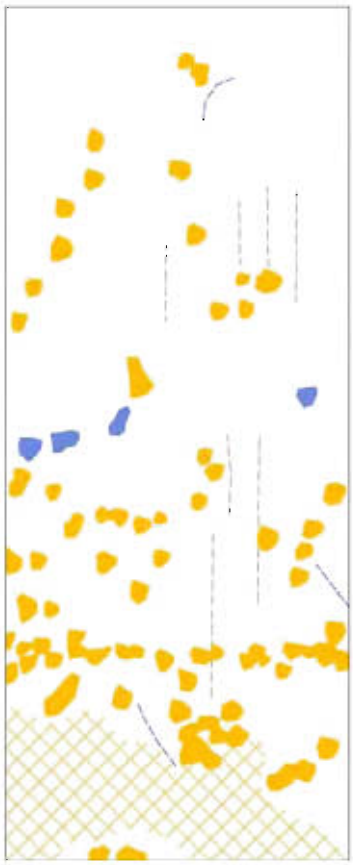
Dublin 2

G28: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

15 nT





? Archaeology Trend Ploughing Trend Ferrous Area of Magnetic Disturbance

0 metres 25

ISO 9001:2000
EQA
CERT NO. 2915

METRO NORTH
G28: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

ARCHAEOLOGICAL LICENCE: 09R0117
PRODUCED BY: BT
DATE SURVEYED: N/A
CHECKED BY: DH
DATE ISSUED: 01/07/2009

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DRAWING NO. 08090_58
PAPER NO. A1.28
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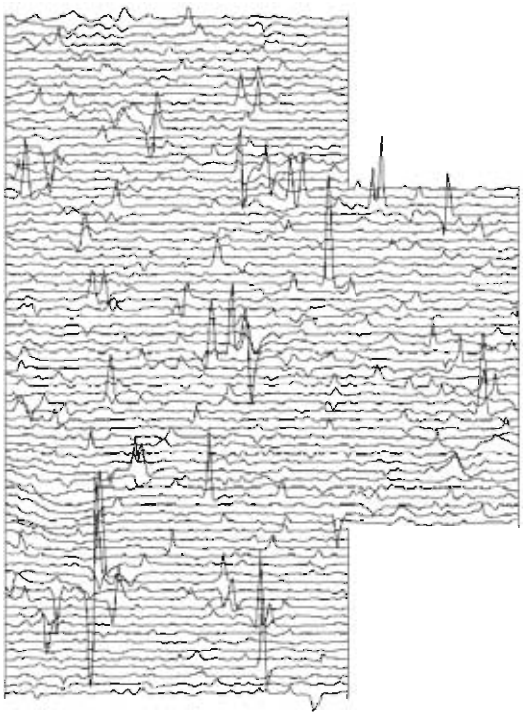
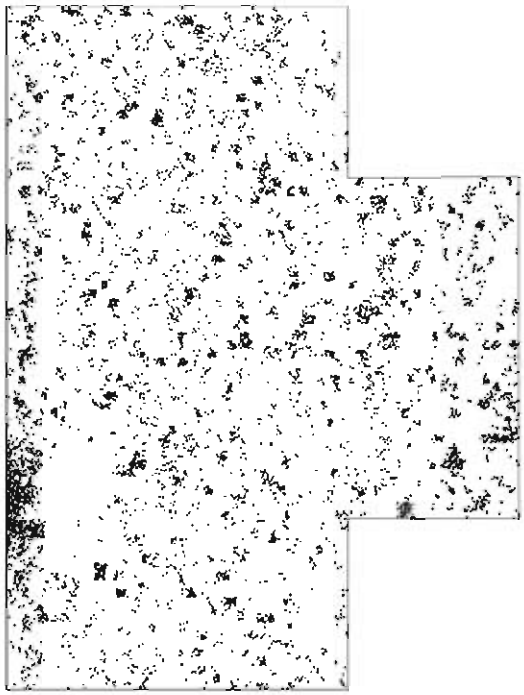
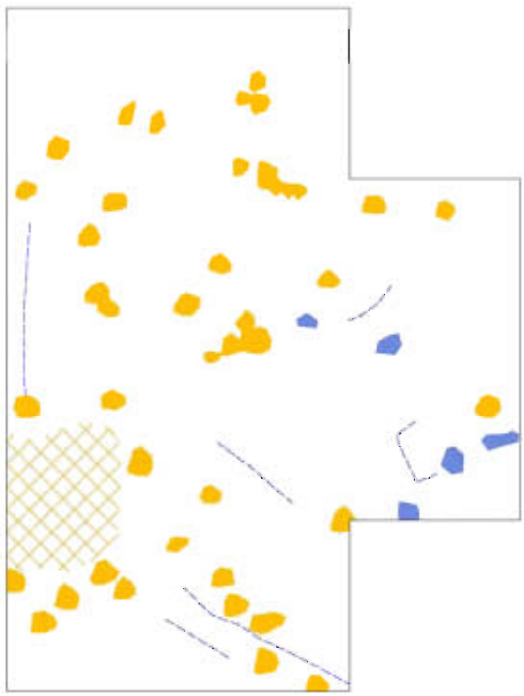
G29: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



15 nT





? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G29: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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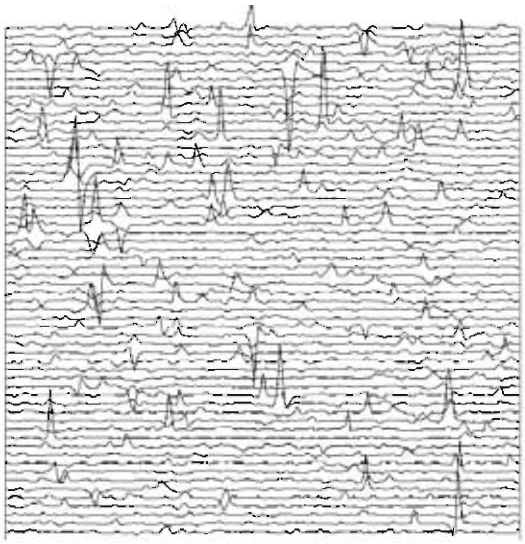
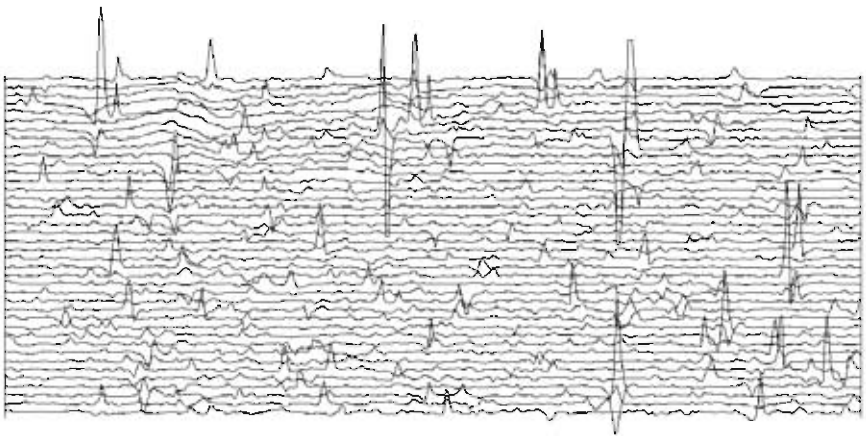
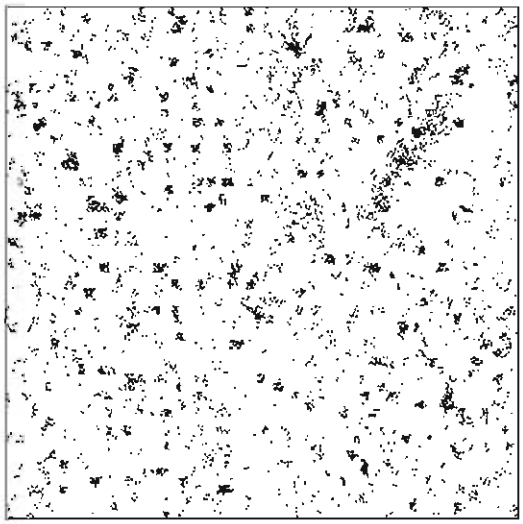
G30: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

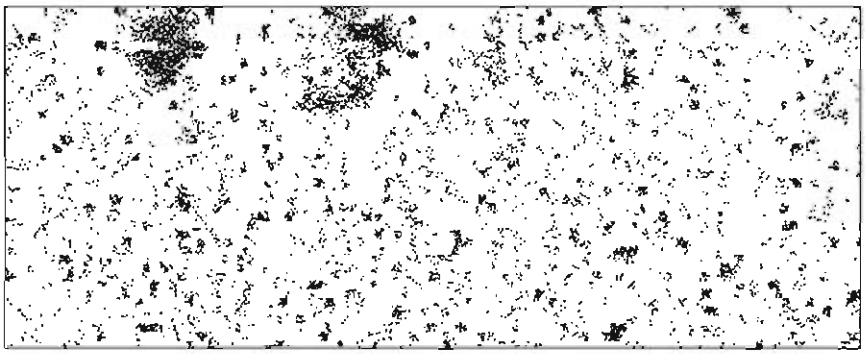


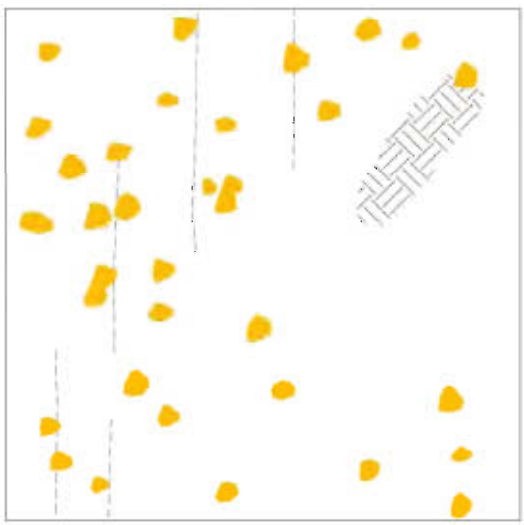
15 nT

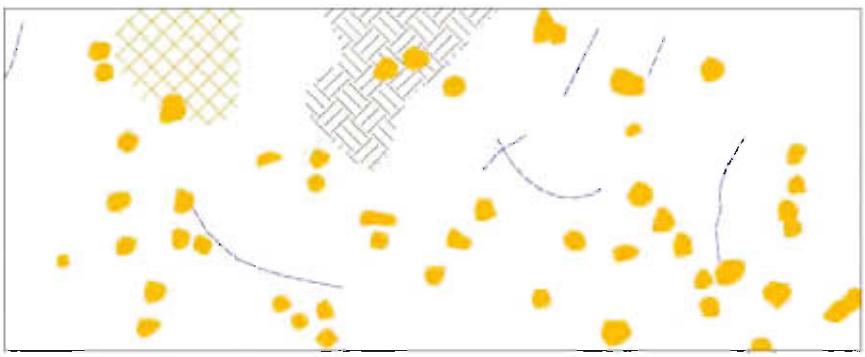
G31: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION











0 metres 25

? Archaeology | Trend | ? Natural | Ploughing Trend | Ferrous | Area of Magnetic Disturbance

ISO 9001:2000 EQA

N

METRO NORTH

G30 & G31: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

BT | N/A | DH | 01/07/2009

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1:625 @ A3

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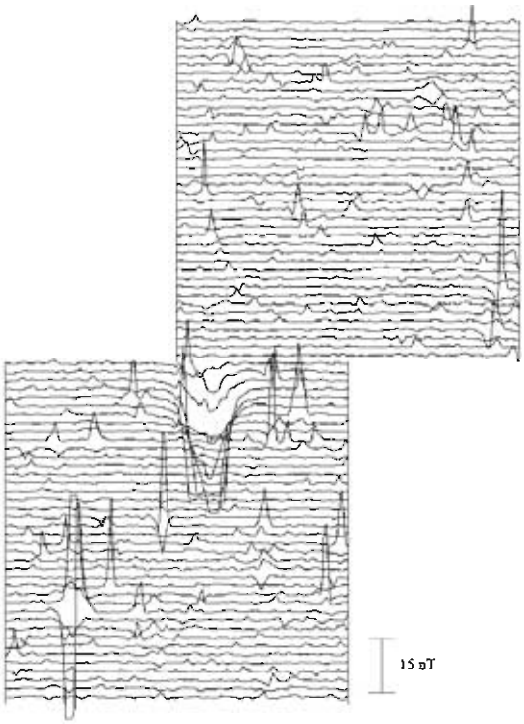
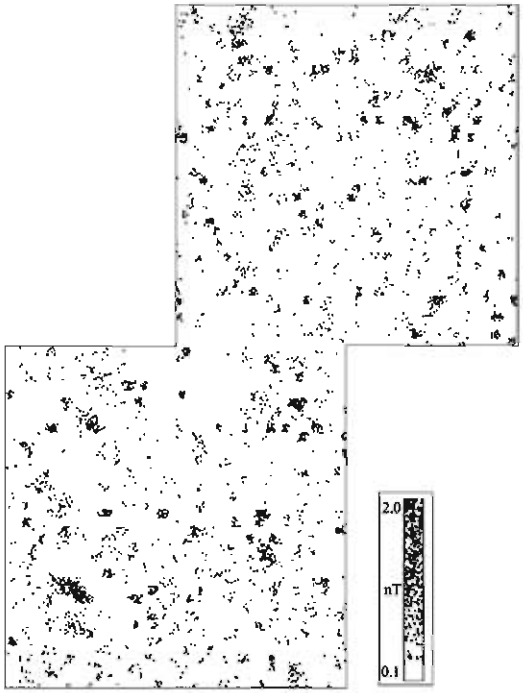
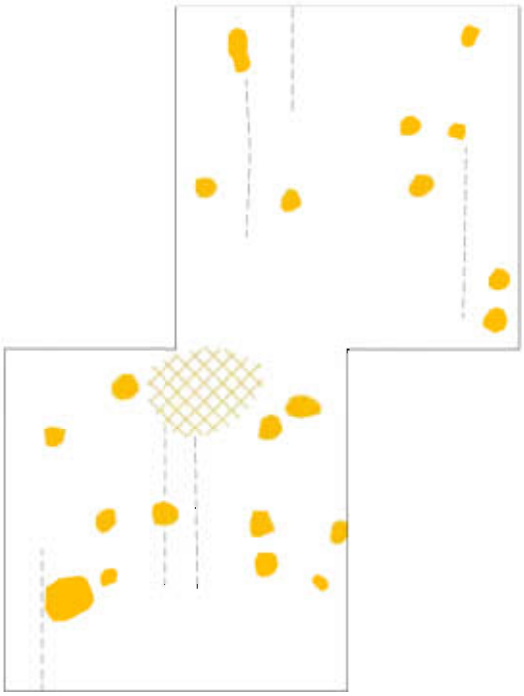
G32: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology

Ploughing Trend

Ferrous

Area of Magnetic Disturbance

0 metres 25

ISO 9001:2000
EQA
CERT NO. 2915

N

METRO NORTH

G32: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

DRAWING NO. 08090_01

FILE NO. A1.31

SCALE 1:625 @ A3

PRODUCED BY: BT

DATE SURVEYED: N/A

CHECKED BY: DH

DATE ISSUED: 01/07/2009

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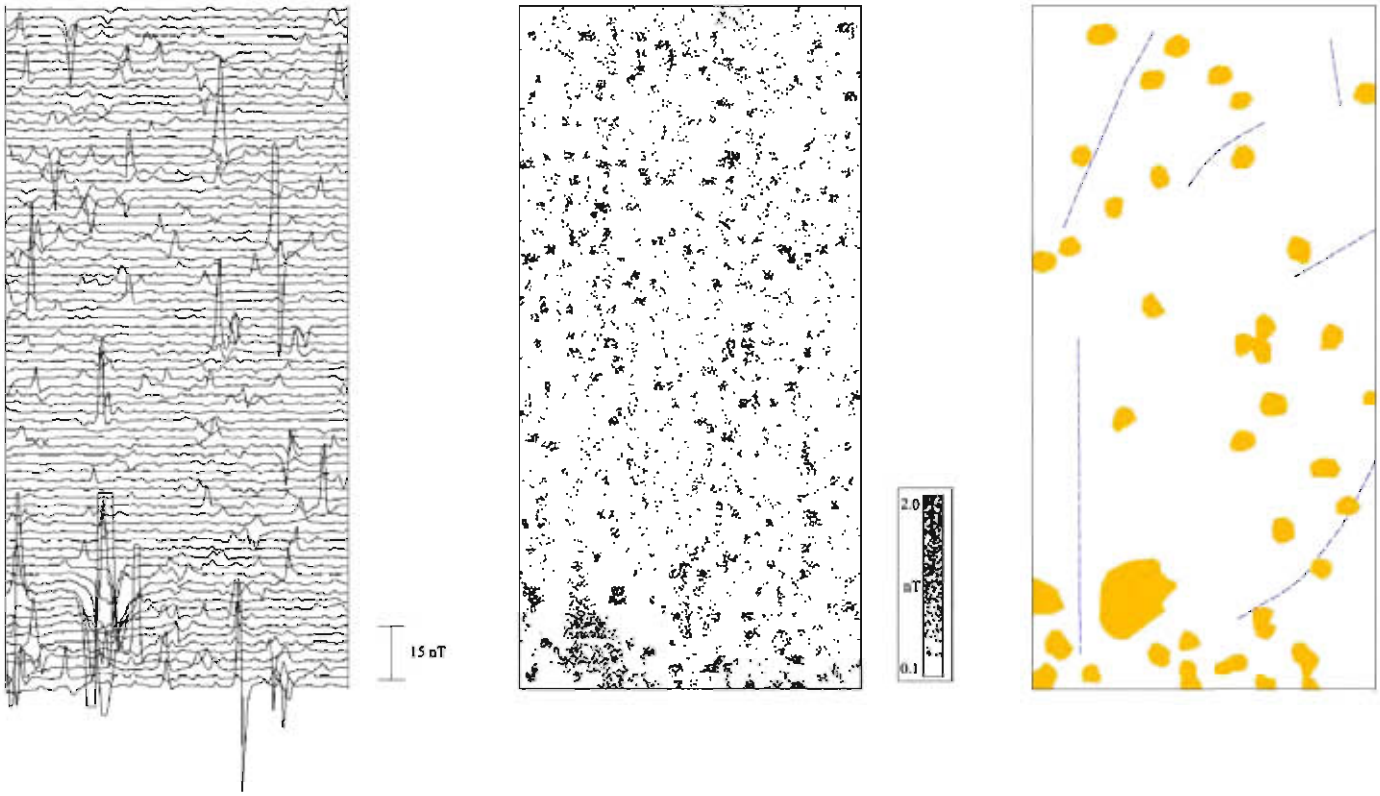
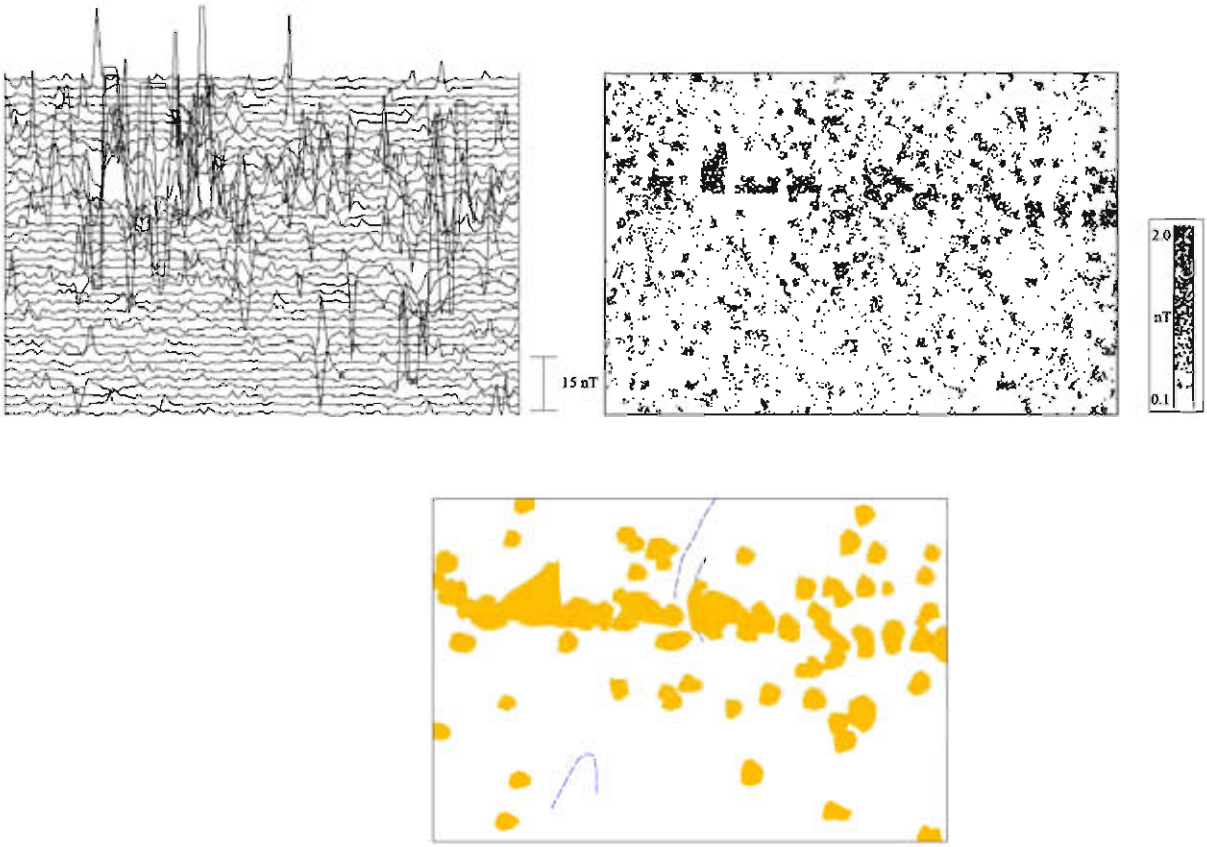
G33: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



G34: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



Trend

Ferrous

0 metres 25

METRO NORTH

G33 & G34: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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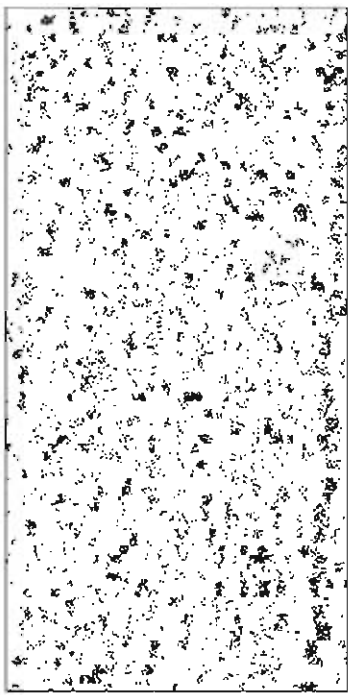
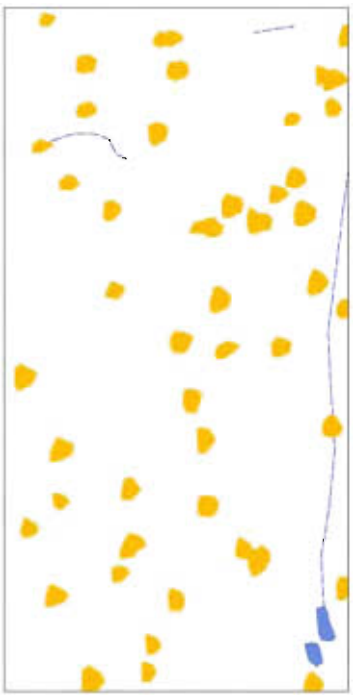
www.mglanc.com

G35: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

15 nT





? Archaeology Trend Ferrous

0 metres 25

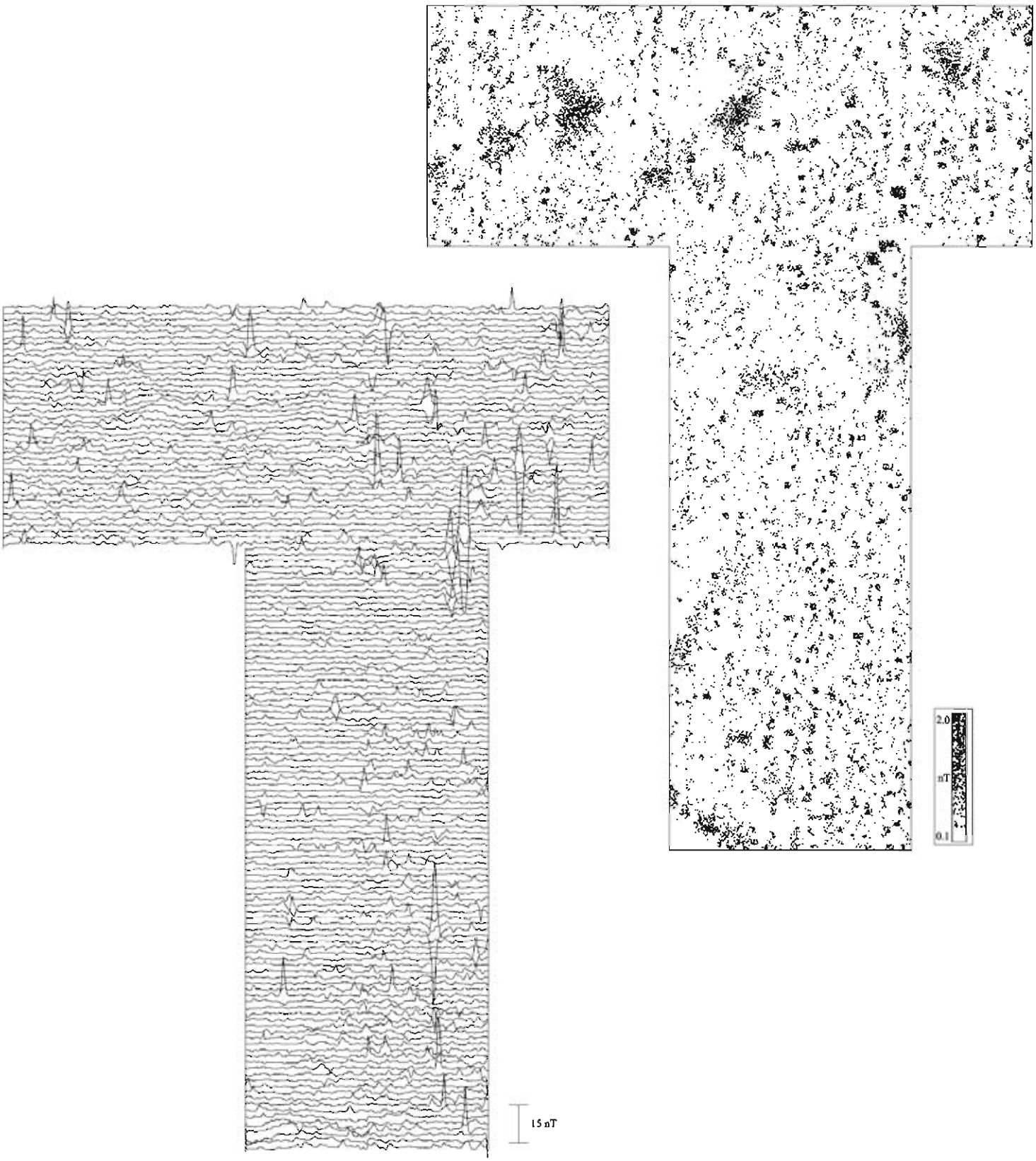
METRO NORTH

G35: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

Archaeological Consultants & Project Managers

G36: XY-TRACE & DOT DENSITY PLOT



0 metres 25

METRO NORTH

G36: XY-TRACE & DOT DENSITY PLOT

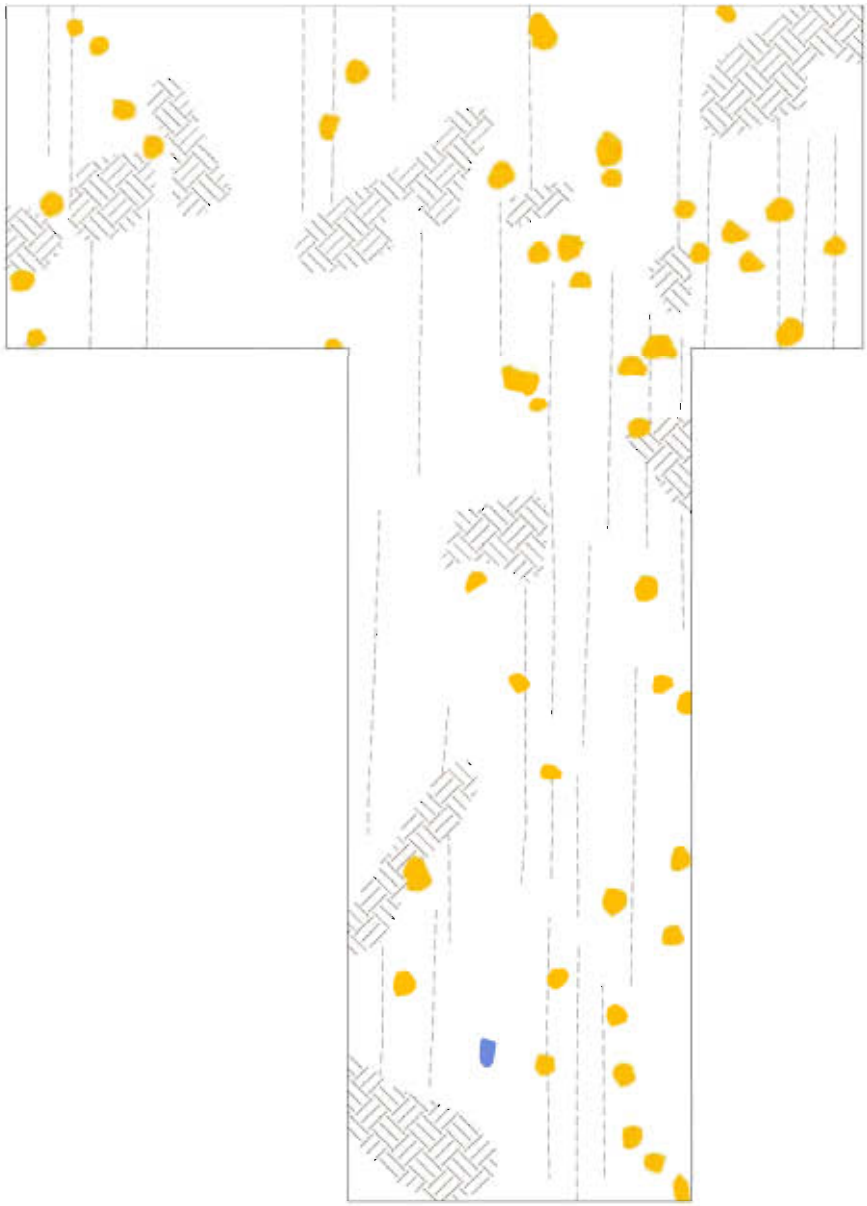
RAILWAY PROCUREMENT AGENCY

Margaret Gowen & Co Ltd

Archaeological Consultants & Project Managers

27 Merrion Square
Dublin 2

G36: INTERPRETATION



? Archaeology ? Natural Ploughing Trend Ferrous

0 metres 25

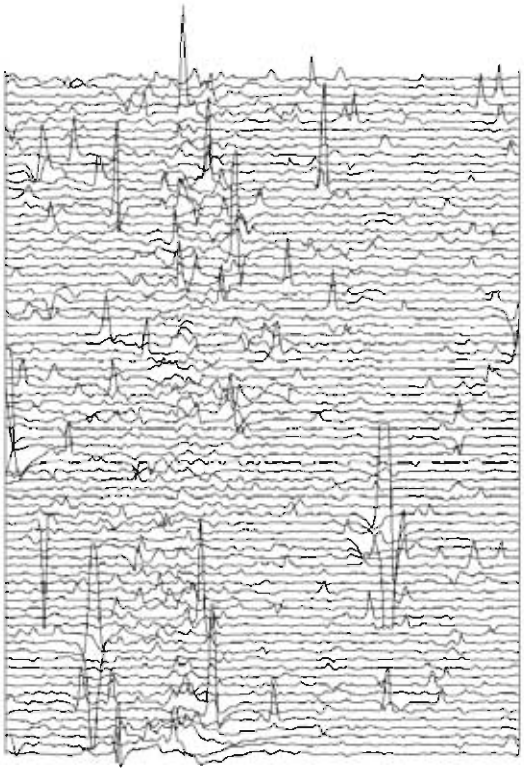
METRO NORTH
G36: INTERPRETATION

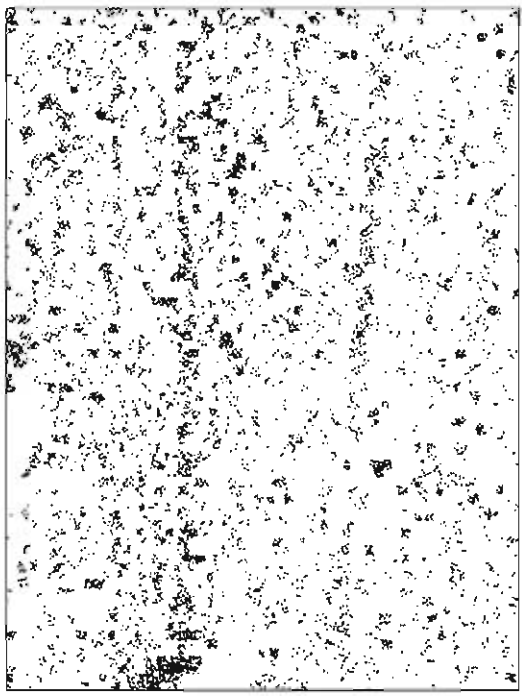
RAILWAY PROCUREMENT AGENCY

Margaret Gowen & Co Ltd
Archaeological Consultants & Project Managers

27 Merrion Square
Dublin 2

G37: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION





Trend Ferrous Area of Magnetic Disturbance

0 metres 25

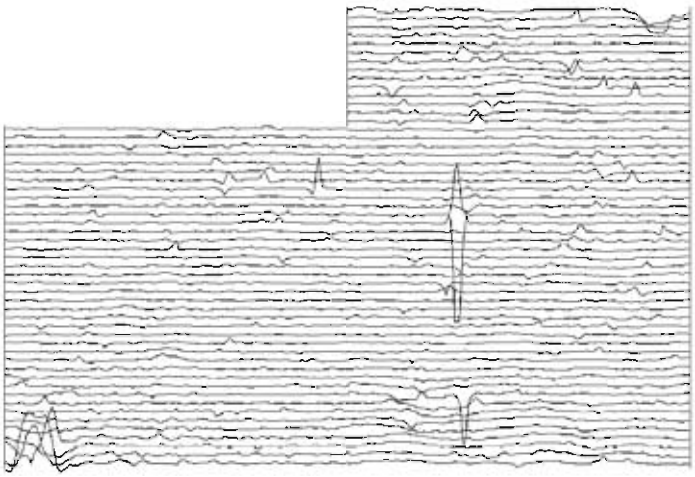
METRO NORTH

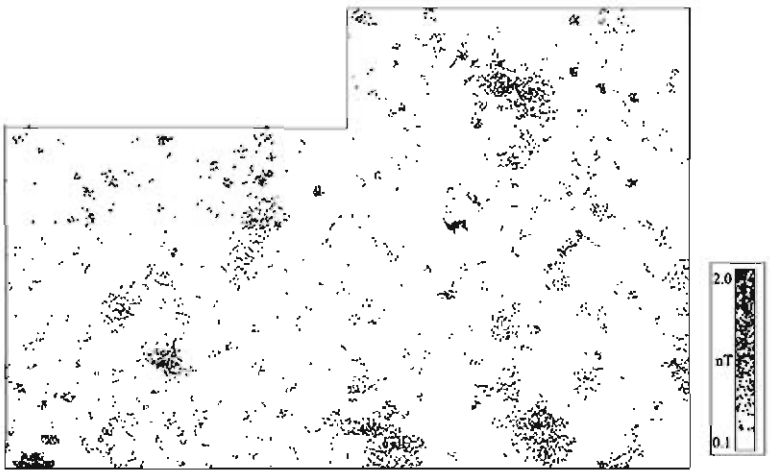
G37: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

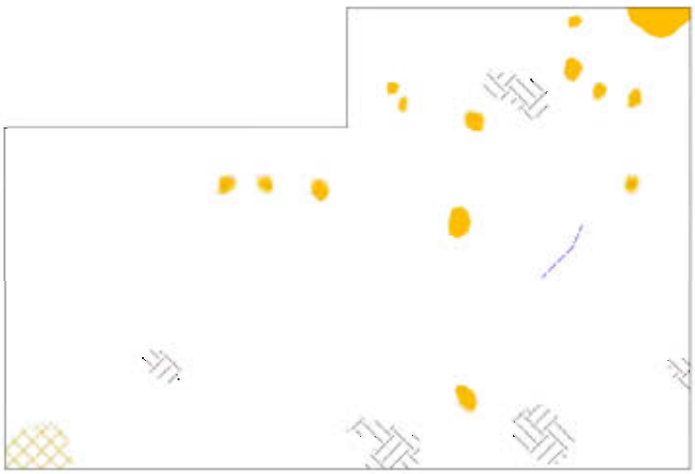
RAILWAY PROCUREMENT AGENCY

Archaeological Consultants & Project Managers

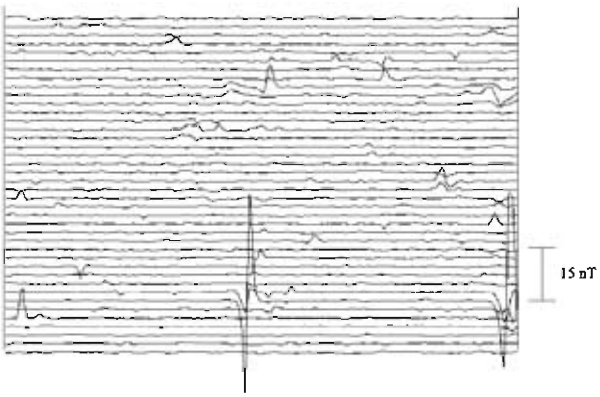
G38: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

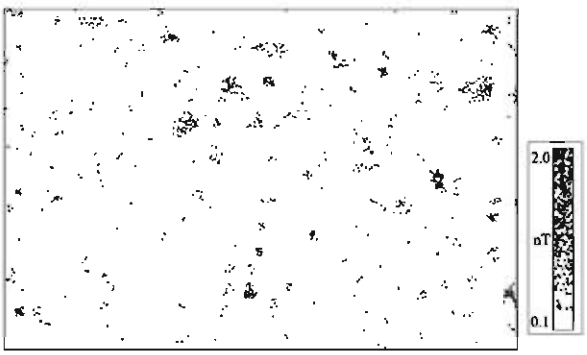






G39: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION





? Archaeology | Trend | ? Natural | Ferrous | Area of Magnetic Disturbance | 0 metres 25

ISO 9001:2000 EQA CERT NO. 2870

N

ARCHAEOLOGICAL LICENCE 09R0037
PRODUCED BY: BT
DATE SURVEYED: N/A
CHECKED BY: DH
DATE ISSUED: 03/07/2009

METRO NORTH
G38 & G39: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

JOB NO. 08090
DRAWING NO. 08090_67
FILE NO. A1_57
SCALE 1:625 @ A3

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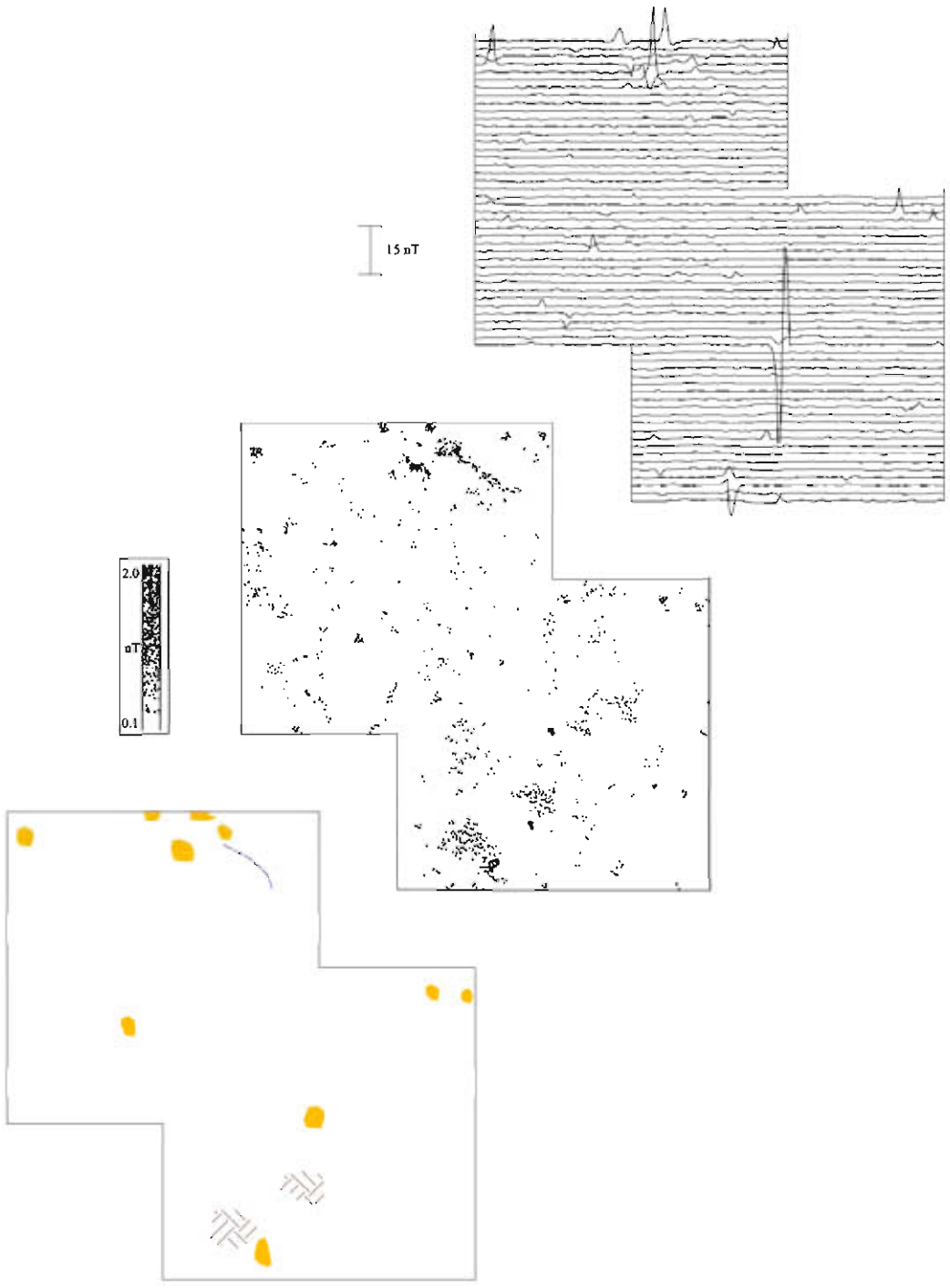
G40: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



Trend ? Natural Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G40: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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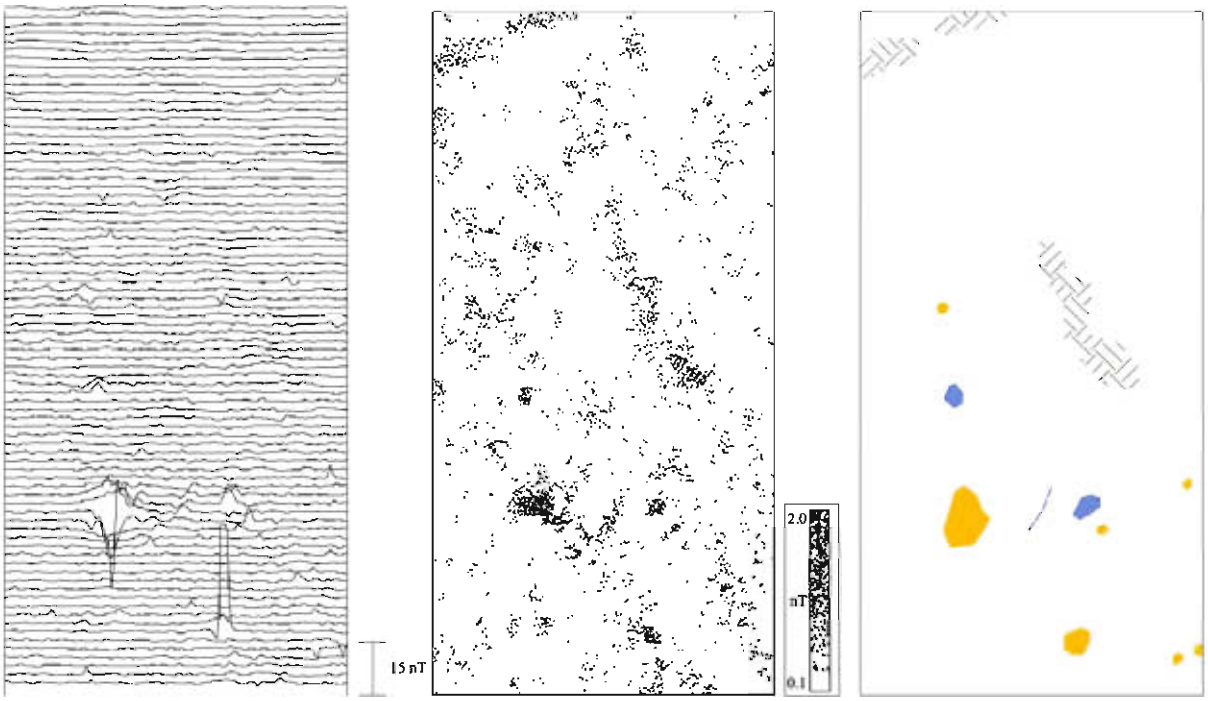
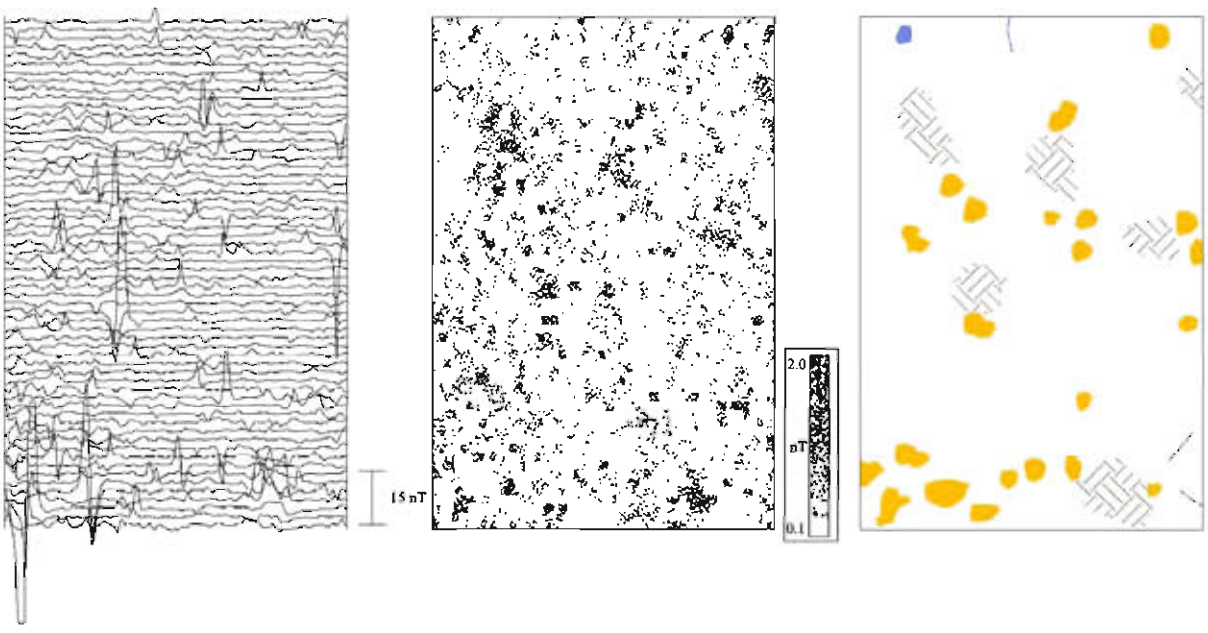
G41: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



G42: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology Trend ? Natural Ferrous

0 metres 25

METRO NORTH

G41 & G42: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

Margaret Gowen & Co Ltd

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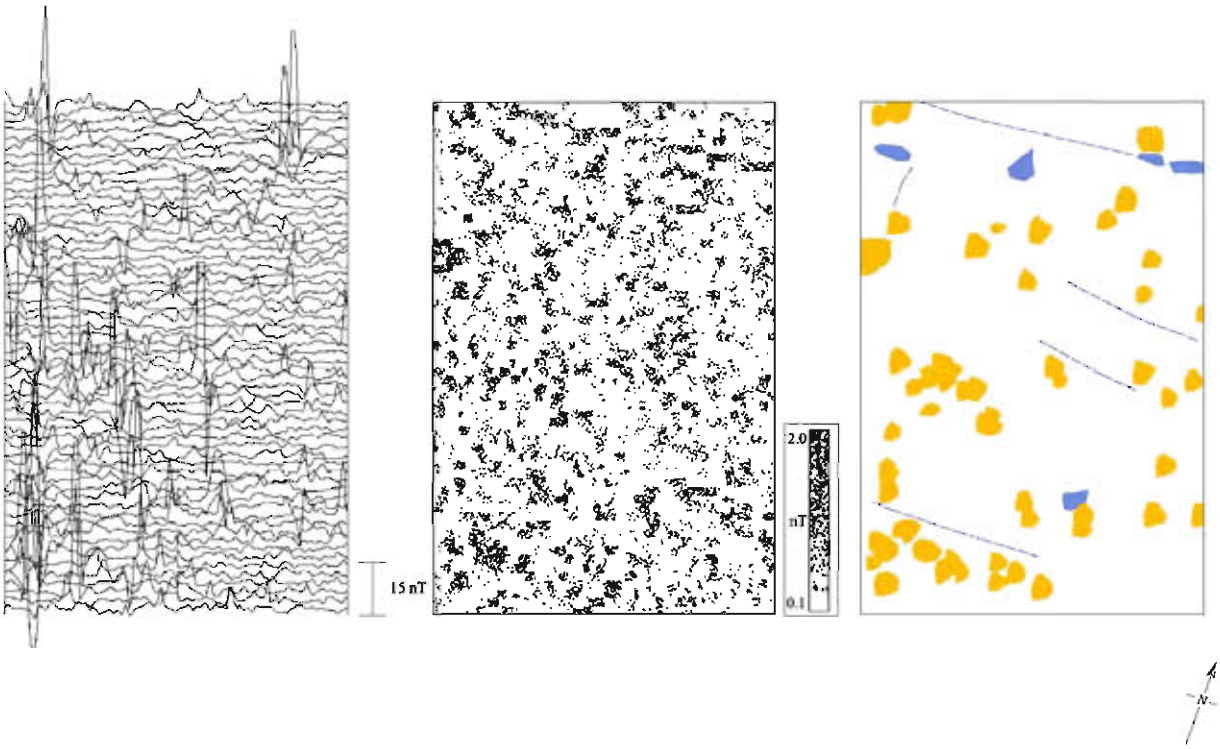
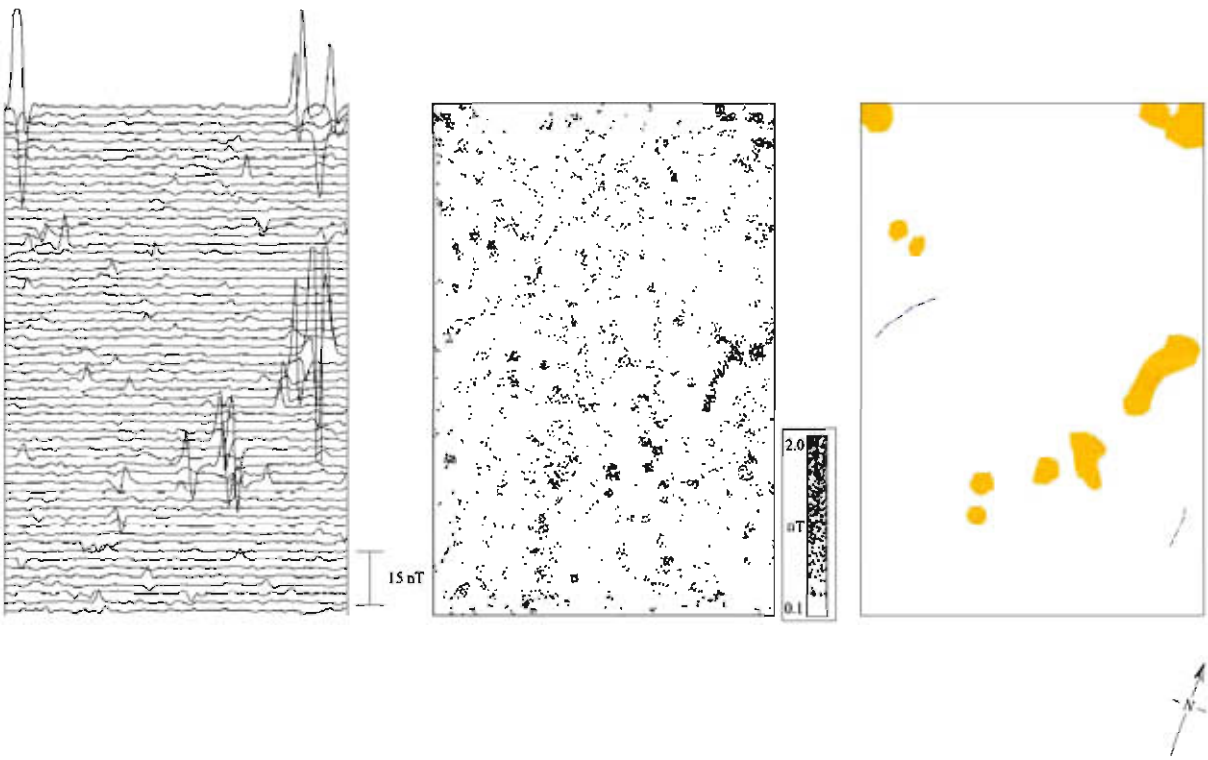
G43: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



G44: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology Trend Ferrous

0 metres 25

ISO 9001:2000 EQA COMPANY NO. 2972

METRO NORTH

G43 & G44: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

DH 01/07/2009

A1,A3

1:625 @ A3

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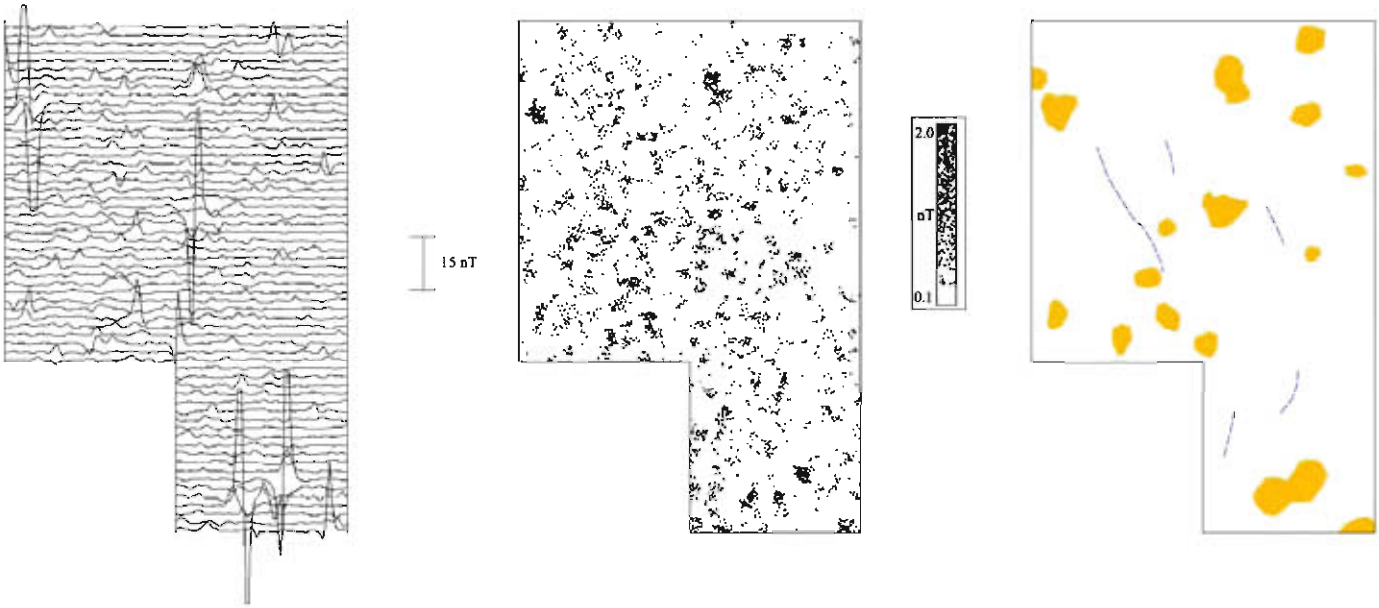
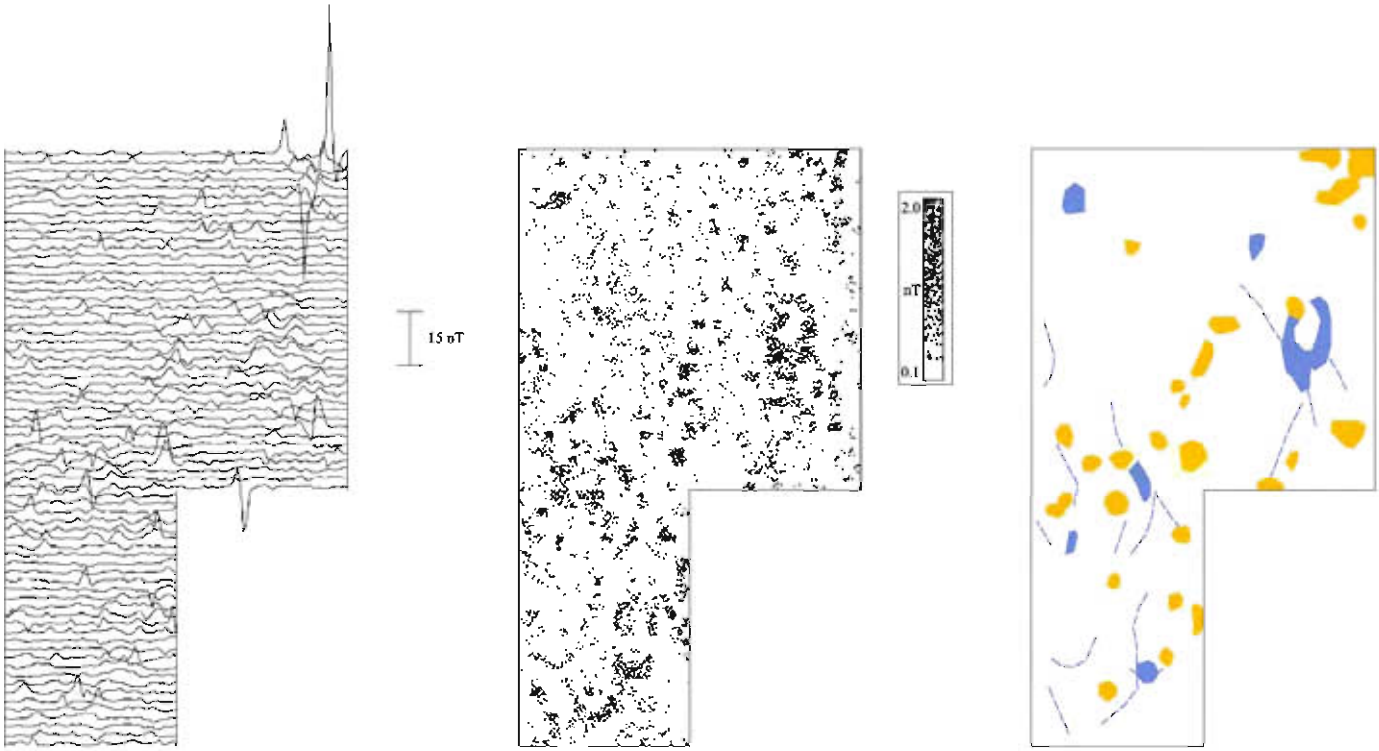
Dublin 2

G45: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



G46: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology Trend Ferrous

0 metres 25

METRO NORTH

G45 & G46: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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Fax: 01-7997201
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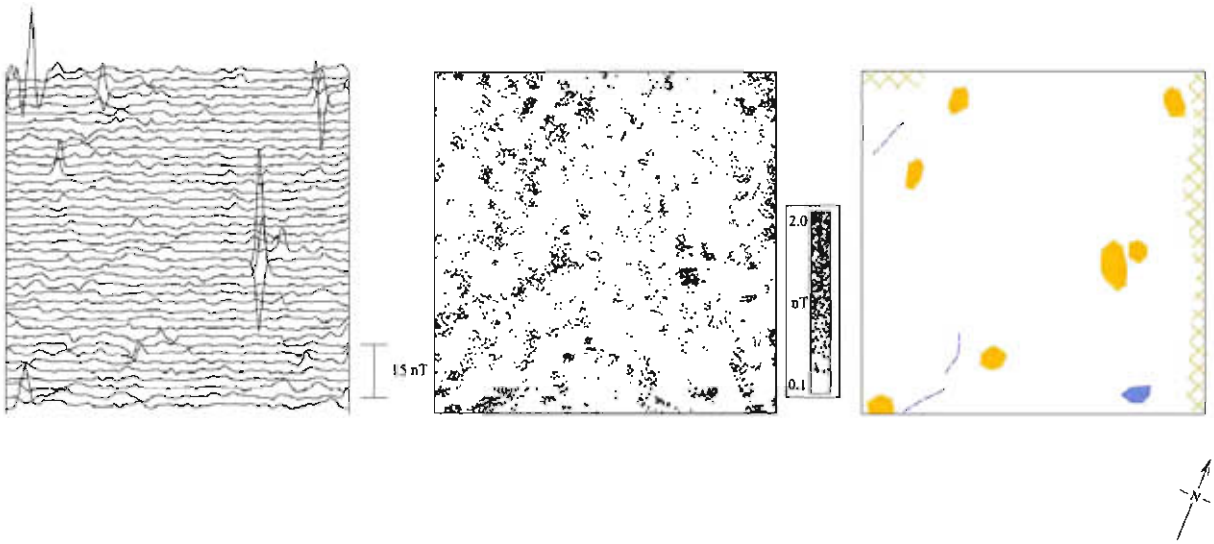
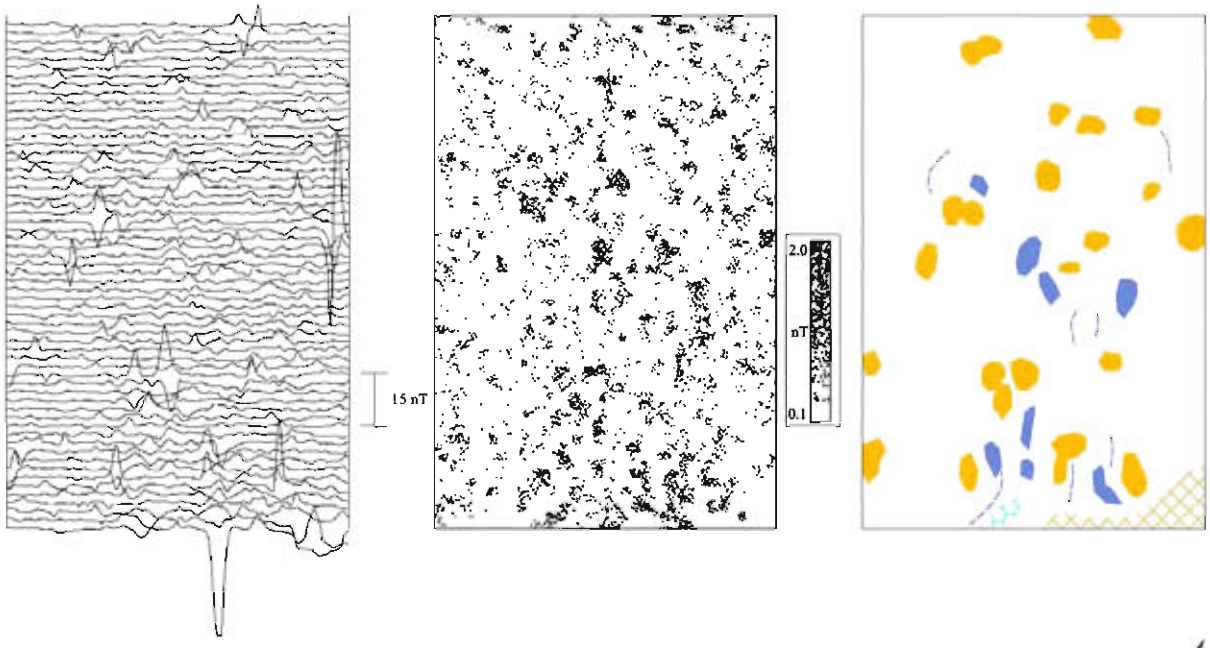
www.mgluhrc.com

G47: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



G48: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology | Trend | Negative response | Ferrous | Area of Magnetic Disturbance

0 metres 25

METRO NORTH

G47 & G48: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

DH 01/07/2009

A1.42

1:625 @ A3

Archaeological Consultants & Project Managers

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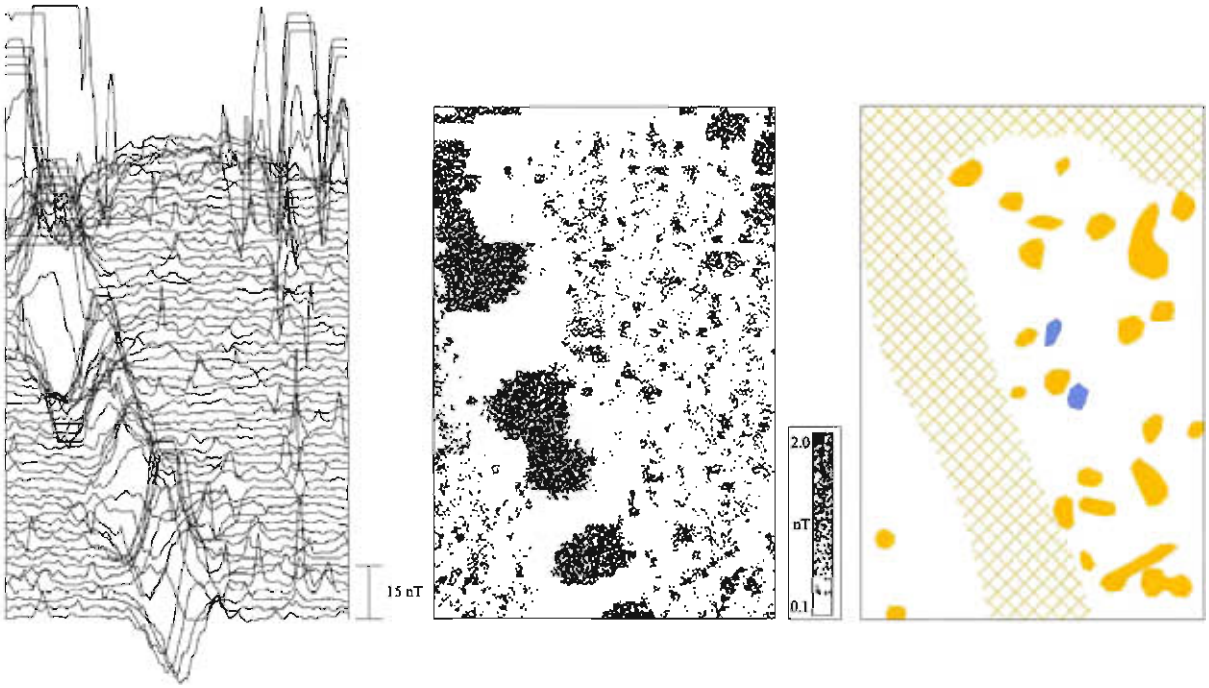
Dublin 2

G49: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology

Ferrous

Area of Magnetic Disturbance

0 metres 25

METRO NORTH

G49: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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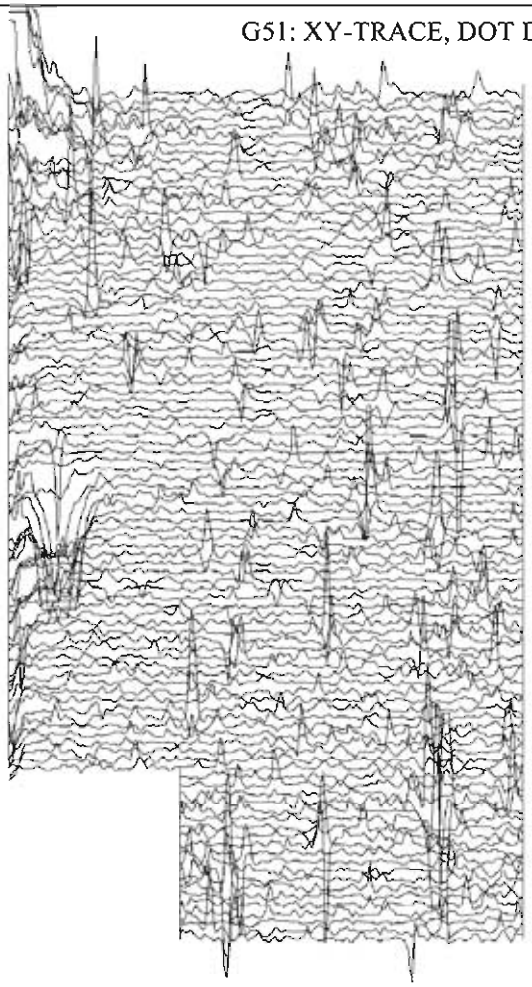
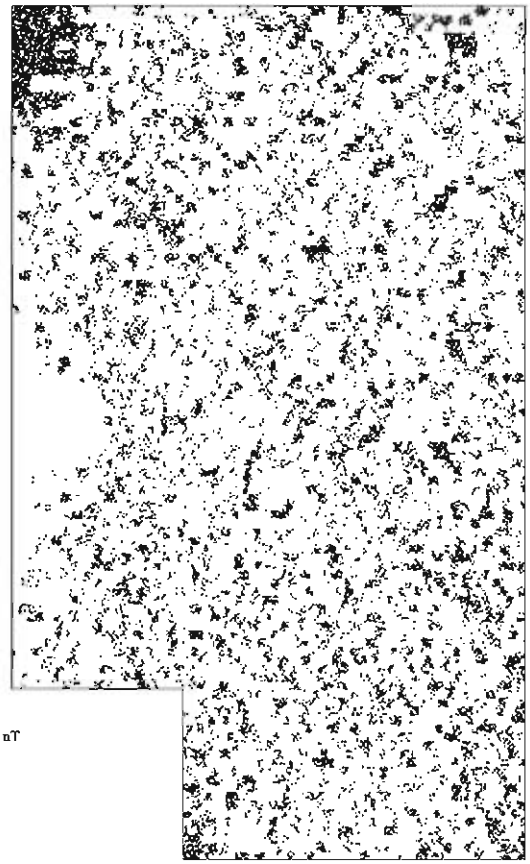
www.mglarc.com

G51: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION





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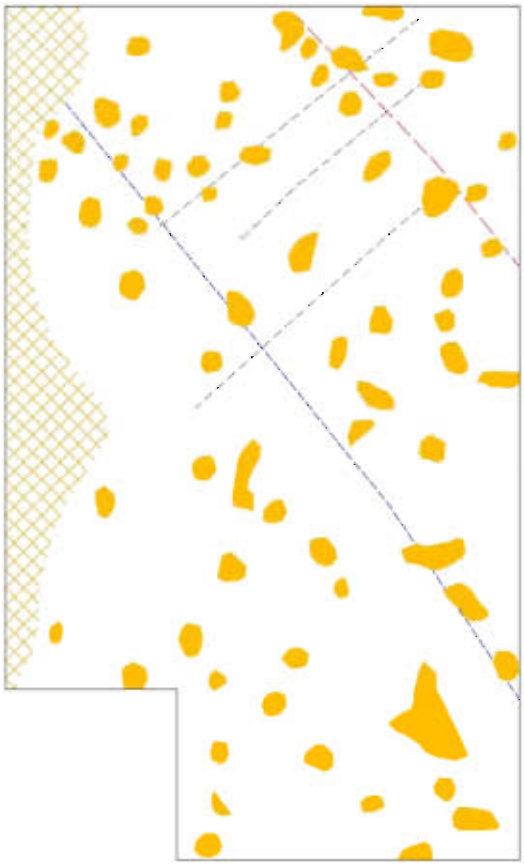

Trend | Negative Trend | Ploughing Trend | Ferrous | Area of Magnetic Disturbance

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G51: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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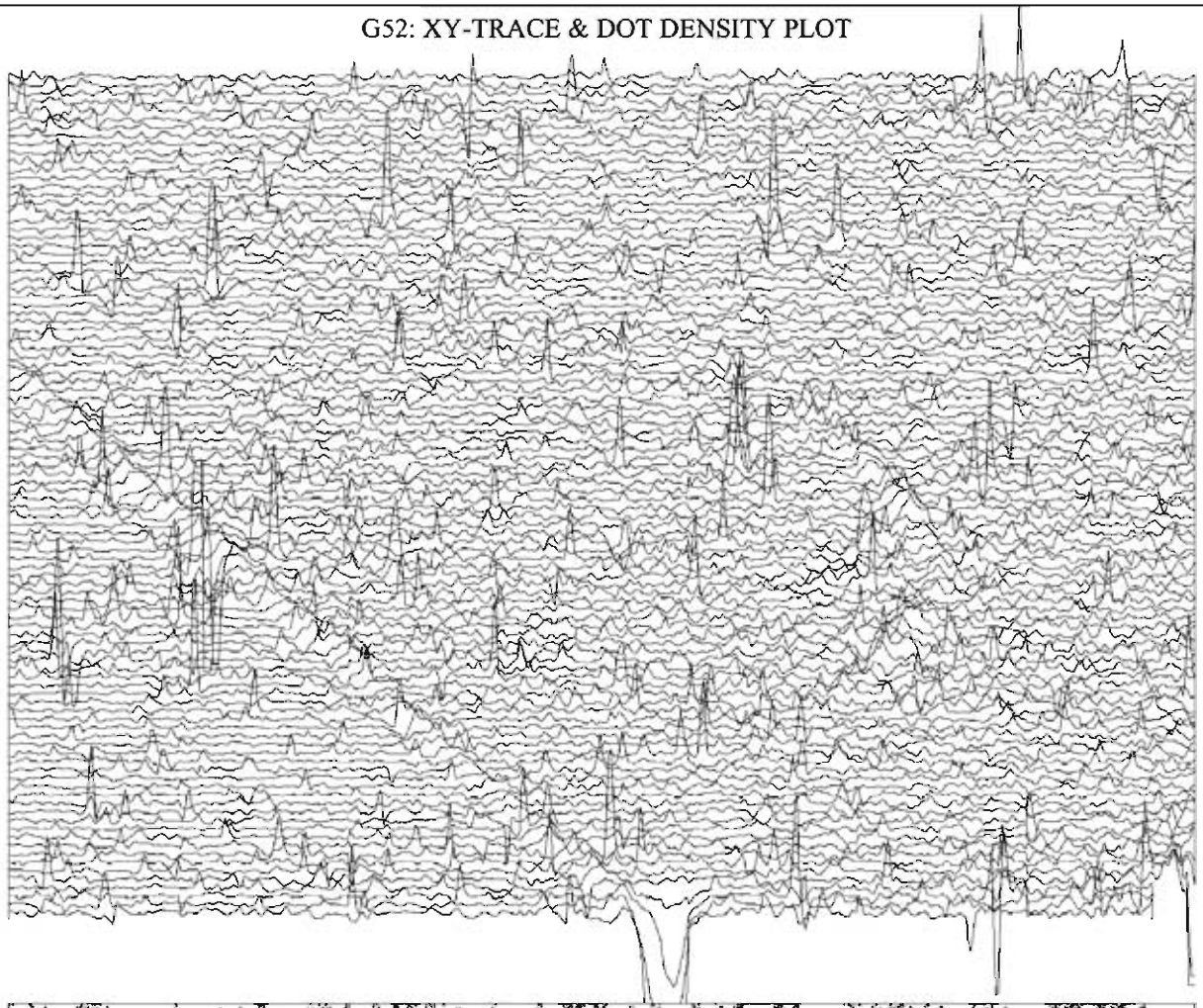
G52: XY-TRACE & DOT DENSITY PLOT



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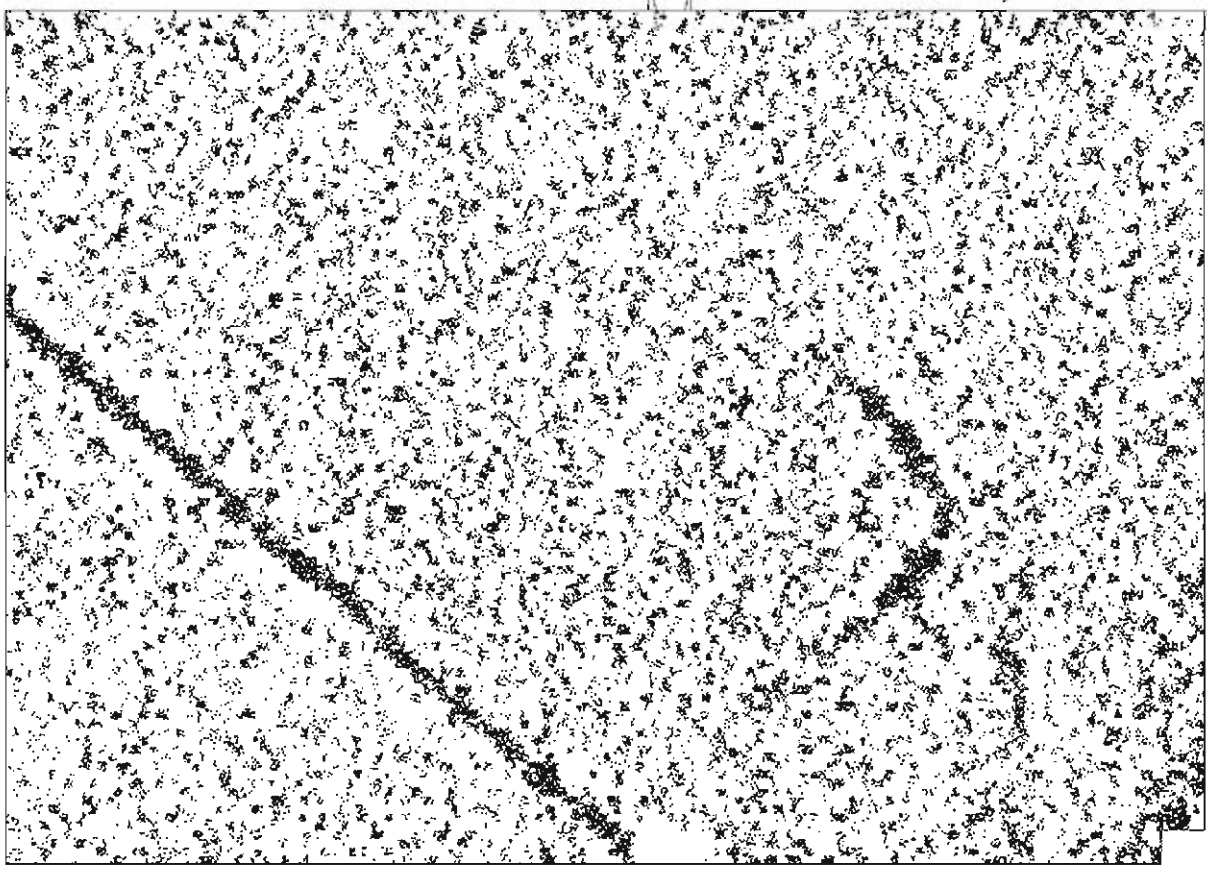

2.0
nT
0.1

0 metres 25

REVISIONS	BY	DATE	REV

ISO 9001:2000 EQA QUALITY ASSURED REGISTER CERT NO. 2915

N

LICENCE NO.	08R0117
PRODUCED BY	BT
DATE SURVEYED	N/A
CHECKED BY	DH
DATE ISSUED	01/07/2009

PROJECT: METRO NORTH

TITLE: G52: XY-TRACE & DOT DENSITY PLOT

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO.	08090
DRAWING NO.	08090_75
PLT. NO.	A1.45
SCALE	1:625 @ A3

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Fax: 01-7997201
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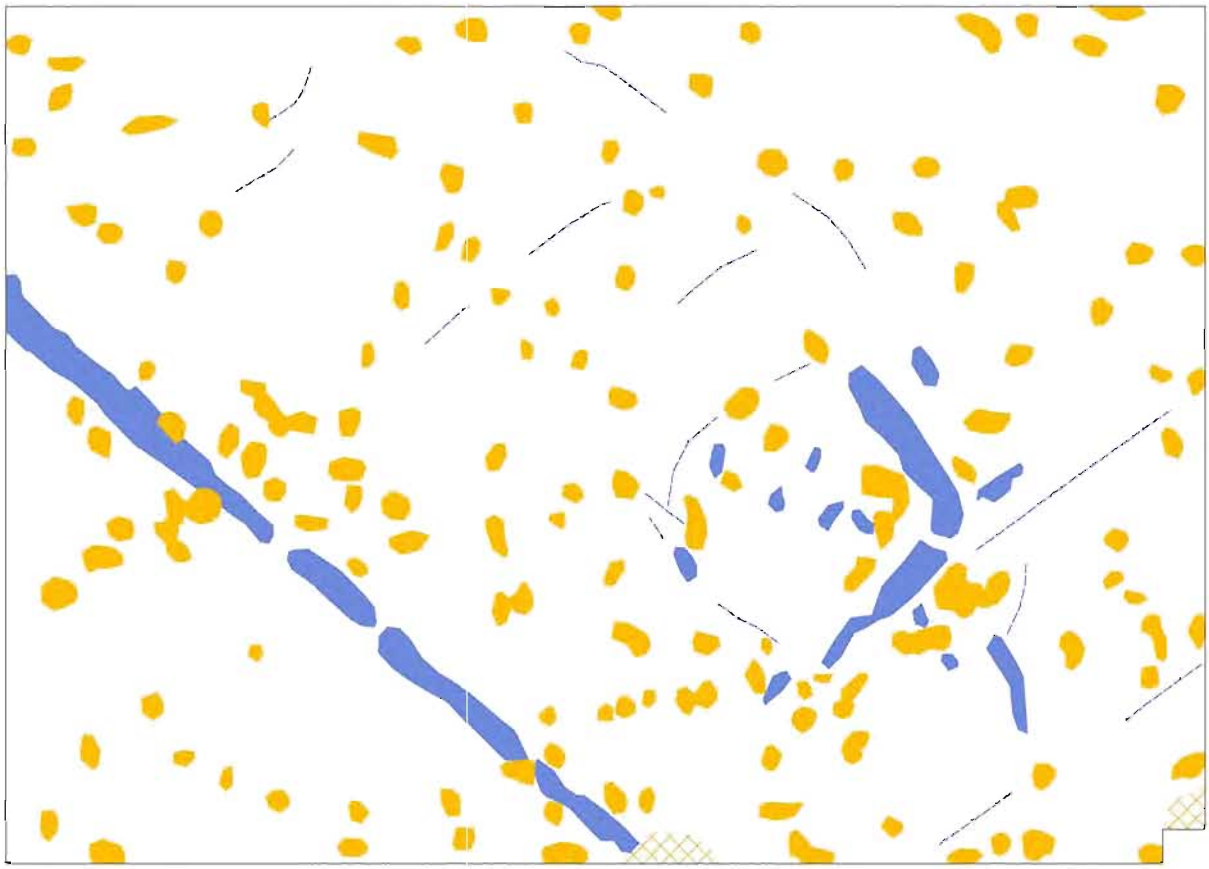
www.mgarc.com

G52: INTERPRETATION



? Archaeology | Trend | Ferrous | Area of Magnetic Disturbance

0 metres 25

METRO NORTH
G52: INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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Dublin 2
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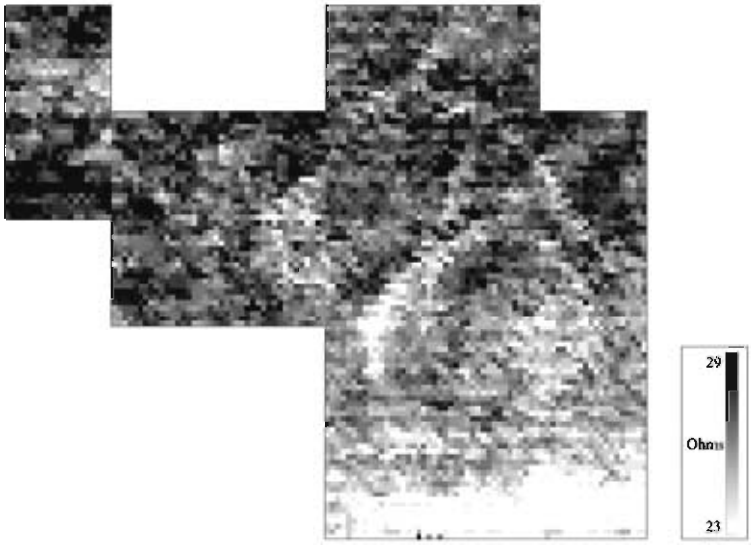
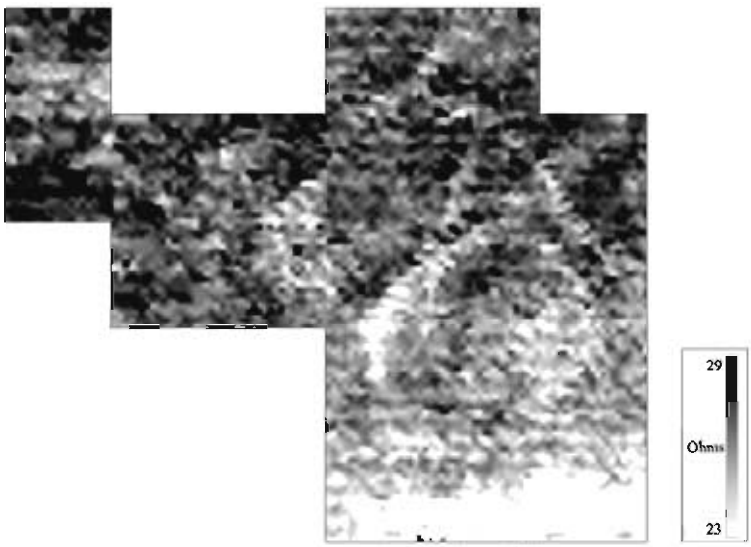
Fax: 01-7997201
Email: archaeology@mgl-arc.com
www.mgl-arc.com

G52: RESISTANCE SURVEY



Raw data



Interpolated data

REVISIONS	BY	DATE	REV

0 metres 40

ISO 9001:2000 EQA CERT NO. 2592

N

ARCHAEOLOGICAL LICENCE	09R0117
PRODUCED BY	BT
DATE SURVEYED	N/A
CHECKED BY	DH
DATE ISSUED	01/07/2009

PROJECT: METRO NORTH
TITLE: G52: RESISTANCE SURVEY
RAW DATA & INTERPOLATED DATA
CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090
DRAWING NO. 08090_77
PAPER SIZE A1,47
SCALE 1:1000 @ A3

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Dublin 2
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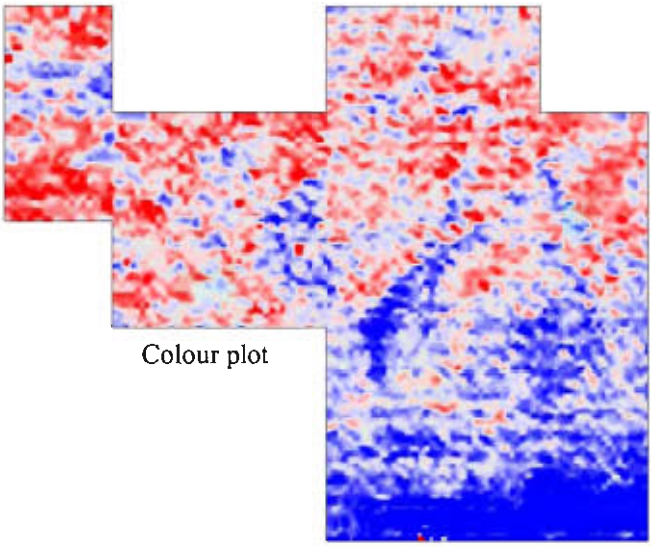
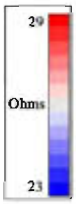
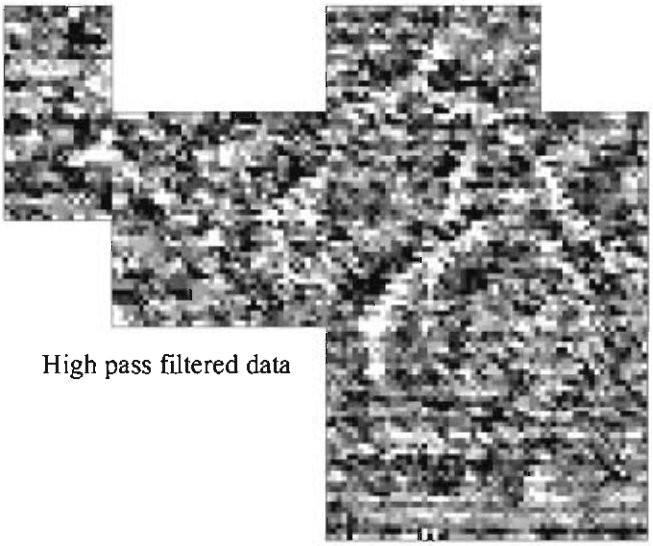
Fax: 01-7667201
Email: archaeology@mgdhrc.com
www.mgdhrc.com

G52: RESISTANCE SURVEY



Colour plot





High pass filtered data

0 metres 40

METRO NORTH
G52: RESISTANCE SURVEY
COLOUR PLOT & HIGH PASS FILTERED DATA

RAILWAY PROCUREMENT AGENCY

Margaret Gowen & Co Ltd
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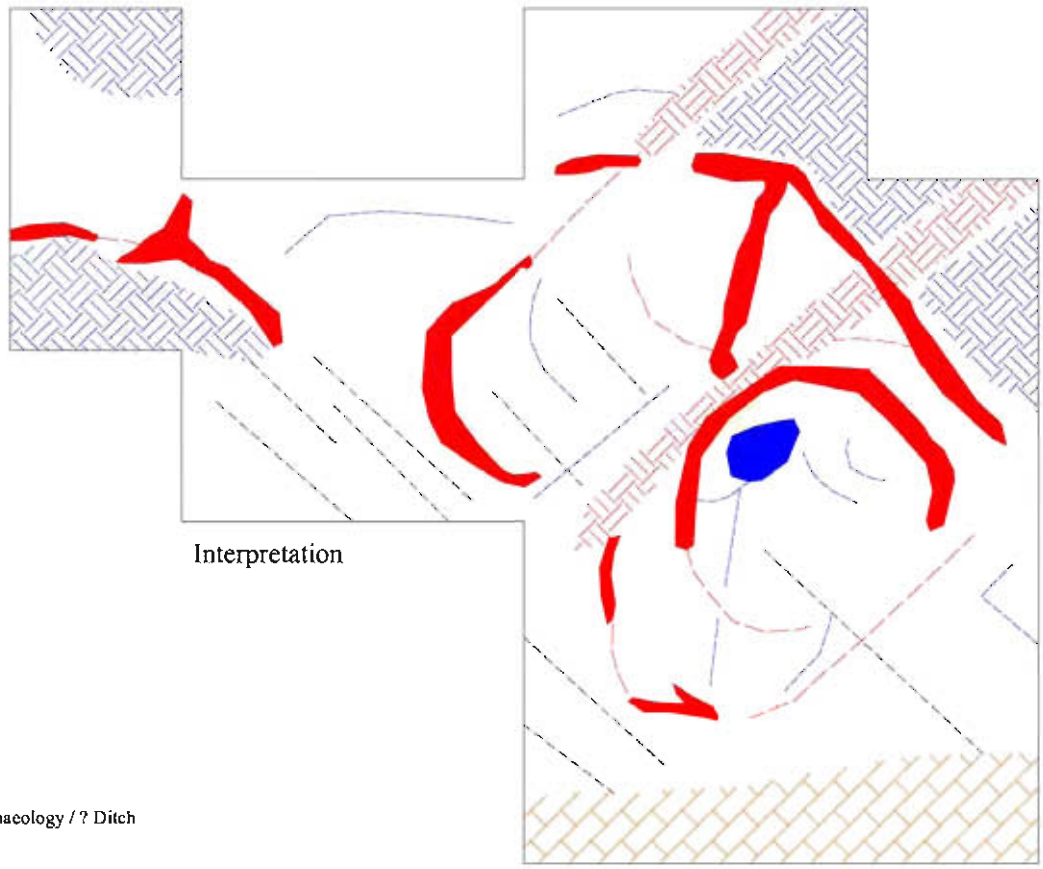
Dublin 2

G52: RESISTANCE SURVEY



Interpretation

Low Resistance

? Archaeology / ? Ditch

? Archaeology / Trend

? Field boundary

? Ditch / ?Drainage

? Modern

High Resistance

? Archaeology

? Archaeology / Trend

? Ploughing Trend

? Natural

0 metres 25

METRO NORTH

G52: RESISTANCE SURVEY
INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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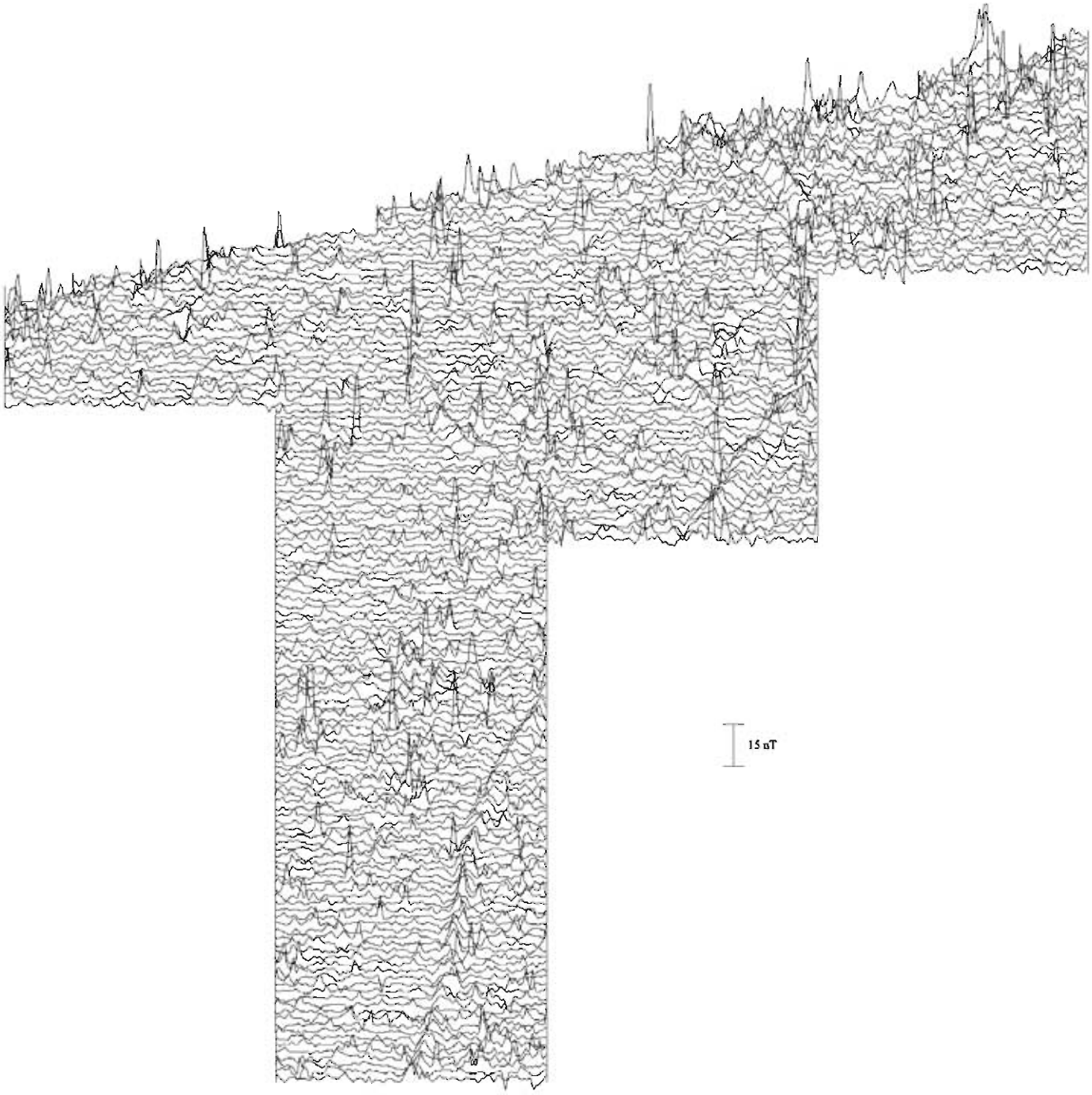
G53: XY-TRACE



0 metres 25

METRO NORTH
G53: XY-TRACE

RAILWAY PROCUREMENT AGENCY

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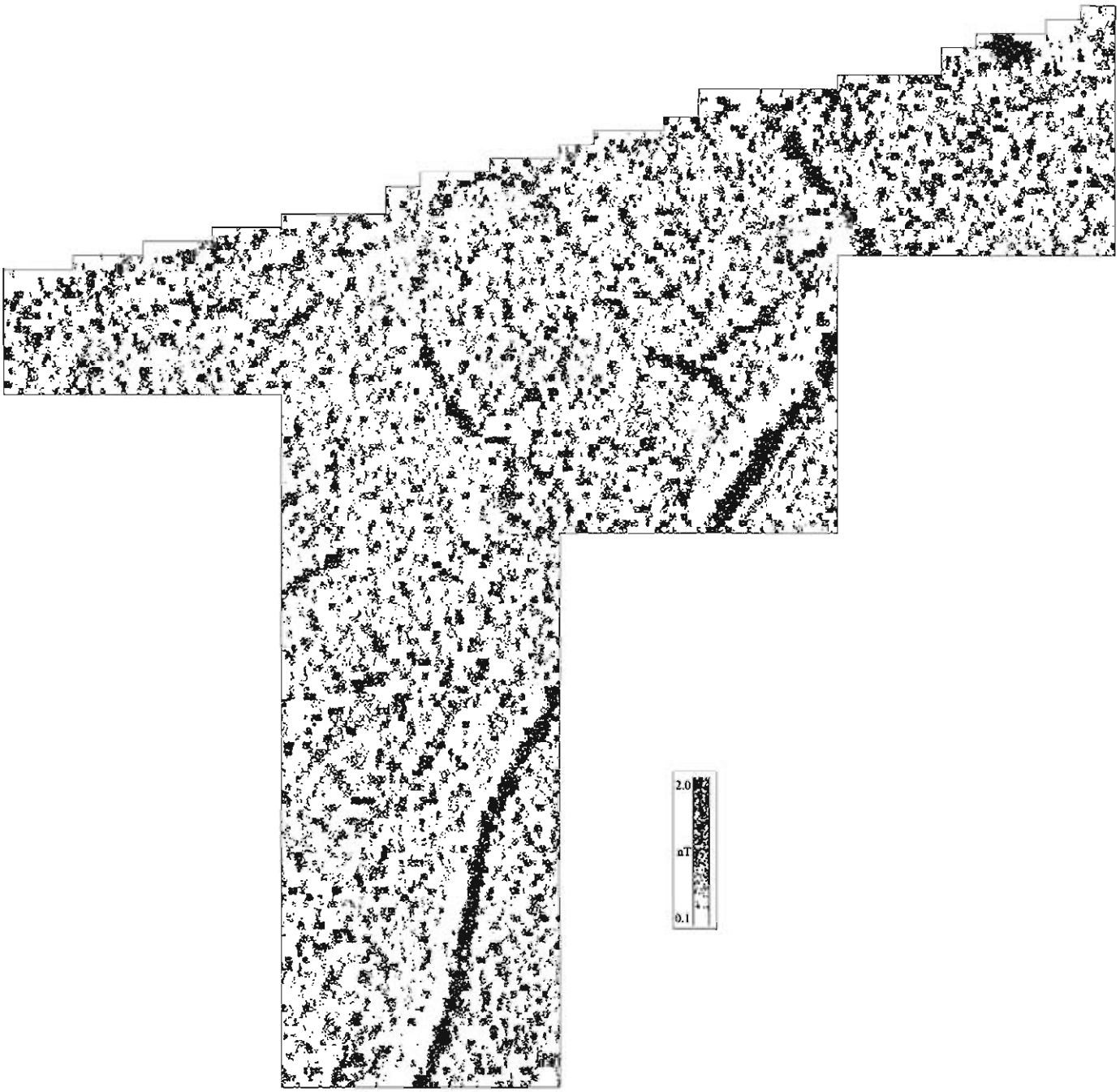
G53: DOT DENSITY PLOT

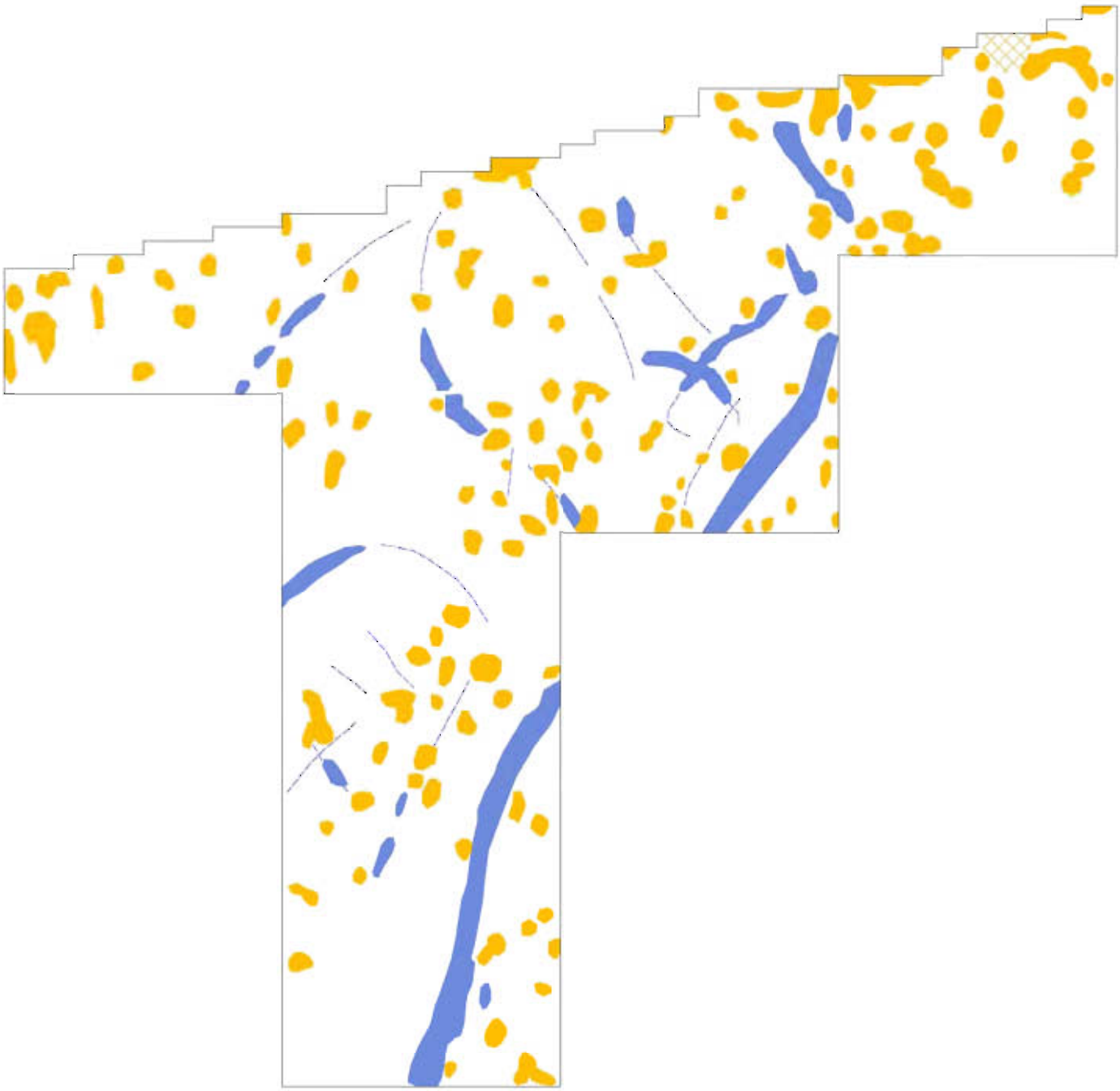


0 metres 25

METRO NORTH
G53: DOT DENSITY PLOT
RAILWAY PROCUREMENT AGENCY

Margaret Gowen & Co Ltd
Archaeological Consultants & Project Managers

G53: INTERPRETATION



? Archaeology | Trend | Ferrous | Area of Magnetic Disturbance

0 metres 25

REVISIONS | BY | DATE | REV

ISO 9001:2000 EQA CERT NO. 2892

ARCHAEOLOGICAL LICENCE 09R0017

PRODUCED BY: BT | DATE SURVEYED: N/A

CHECKED BY: DH | DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH

TITLE: G53: INTERPRETATION

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090

DRAWING NO. 08090_02

FILE NO. A1.52

SCALE 1:625 @ A3

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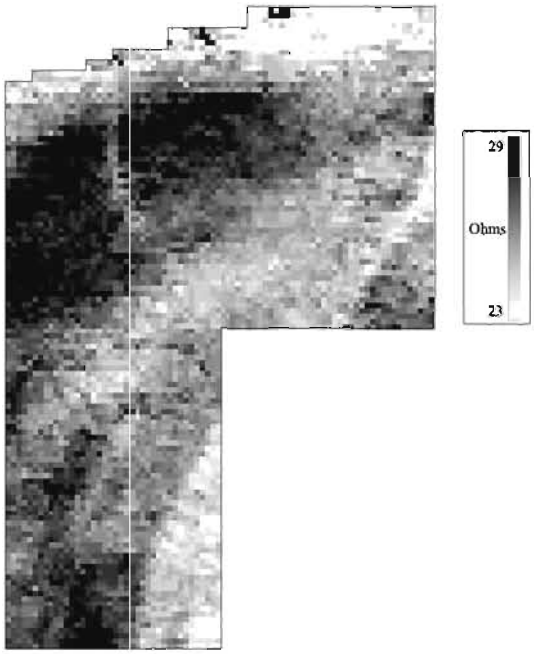
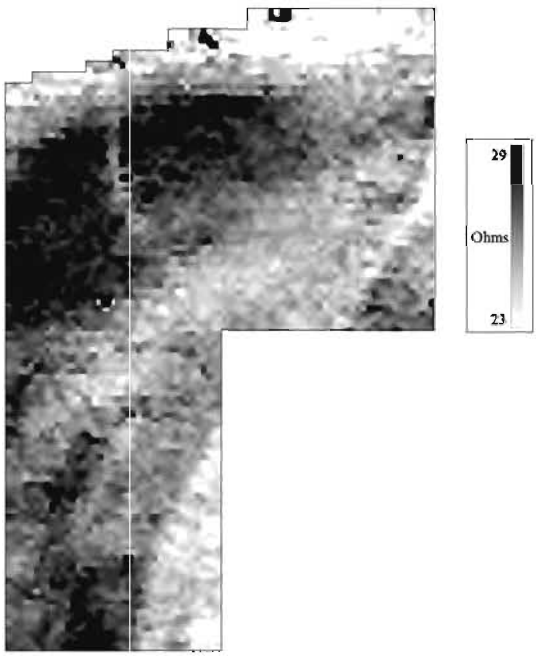
www.mgluc.com

G53: RESISTANCE SURVEY



Raw data



Interpolated data

0 metres 40

METRO NORTH
G53: RESISTANCE SURVEY
RAW DATA & INTERPOLATED DATA
RAILWAY PROCUREMENT AGENCY

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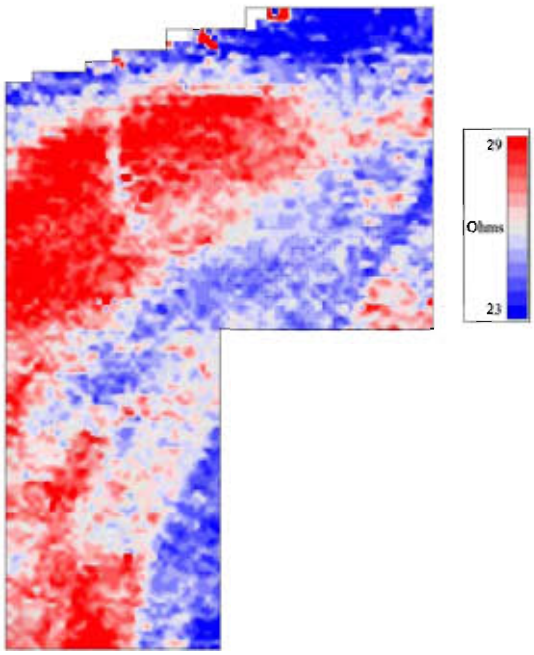
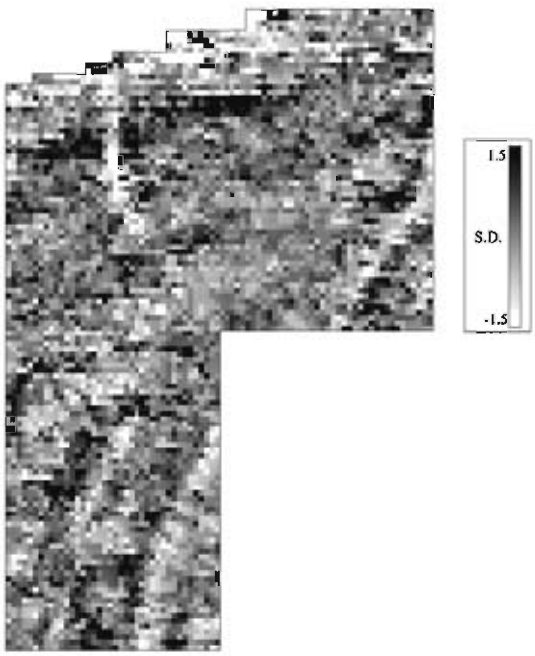
G53: RESISTANCE SURVEY



Colour plot



High pass filtered data

REVISIONS	BY	DATE	REV

0 metres 40

ISO 9001:2000 EQA CERT NO. 2892

ARCHAEOLOGICAL LICENCE 08R0117

PRODUCED BY: BT DATE SURVEYED: N/A

CHECKED BY: DH DATE ISSUED: 01/07/2009

PROJECT: METRO NORTH

TITLE: G53: RESISTANCE SURVEY
COLOUR PLOT & HIGH PASS FILTERED DATA

CLIENT: RAILWAY PROCUREMENT AGENCY

JOB NO. 08090

DRAWING NO. 08090_04

FIG. NO. A1.54

SCALE 1:1000 @ A3

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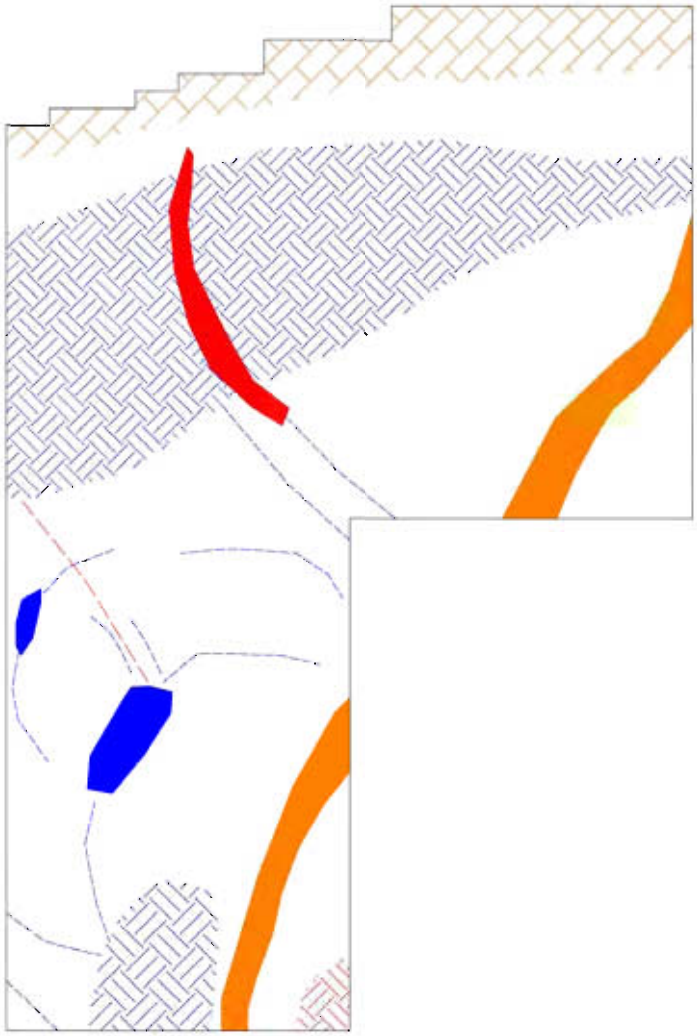
G53: RESISTANCE SURVEY



Interpretation

Low Resistance

? Archaeology / ? Ditch

? Archaeology / Trend

? Field boundary

? Ditch / ?Drainage

? Modern

High Resistance

? Archaeology

? Archaeology / Trend

? Ploughing Trend

? Natural

0 metres 25

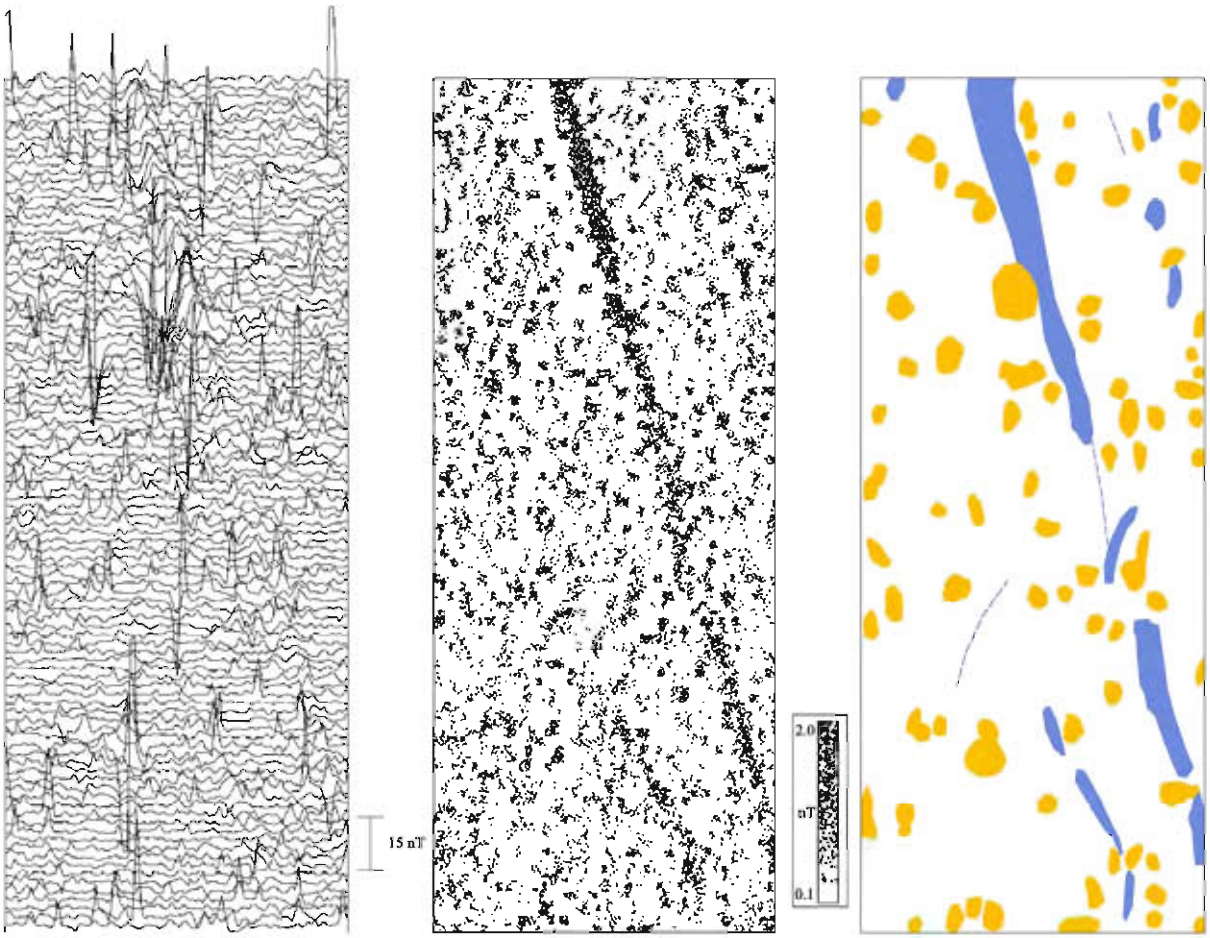
METRO NORTH

G53: RESISTANCE SURVEY
INTERPRETATION

RAILWAY PROCUREMENT AGENCY

Archaeological Consultants & Project Managers

G54: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology Trend Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G54: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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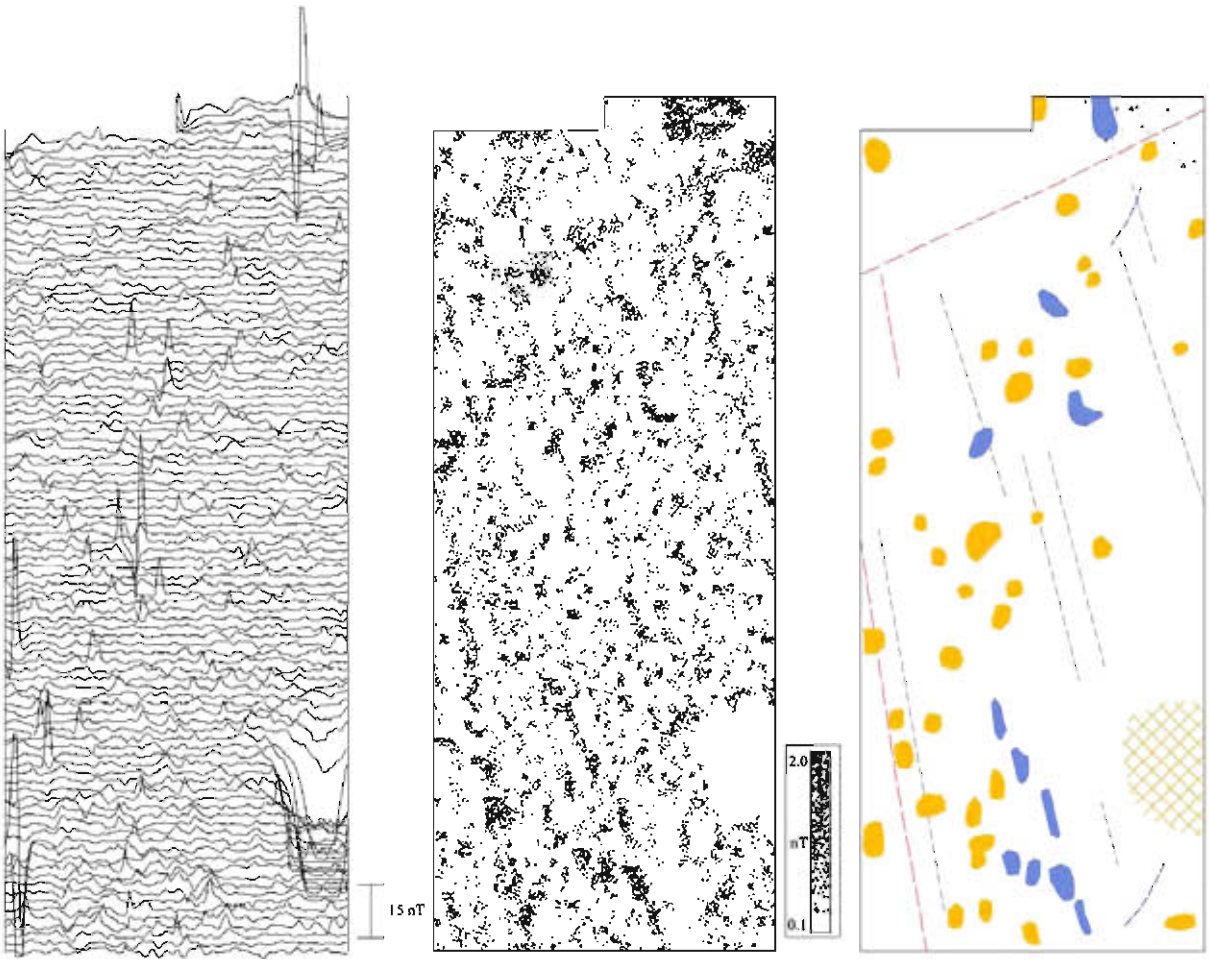
G55: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



? Archaeology
Trend
Area of Increased Magnetic Response
Negative Trend
Ploughing Trend
Ferrous
Area of Magnetic Disturbance
0 metres 25

METRO NORTH
G55: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

BT | N/A
DH | 03/07/2009

A1.57
1:625 @ A3

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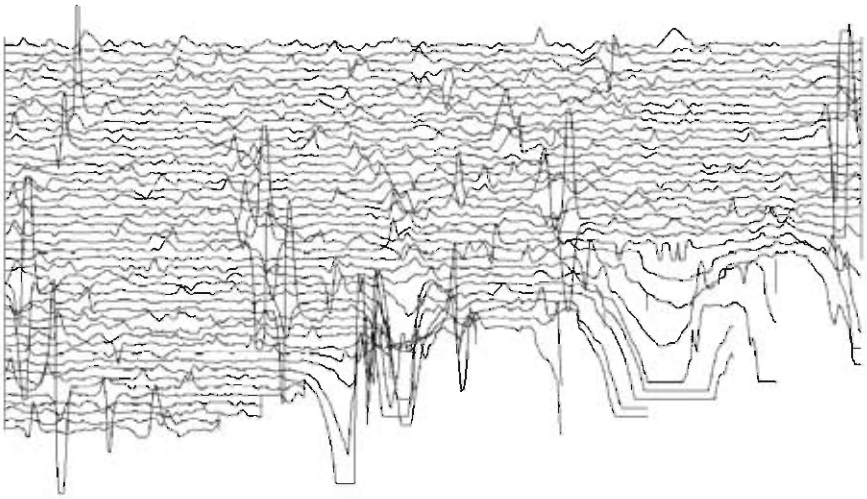
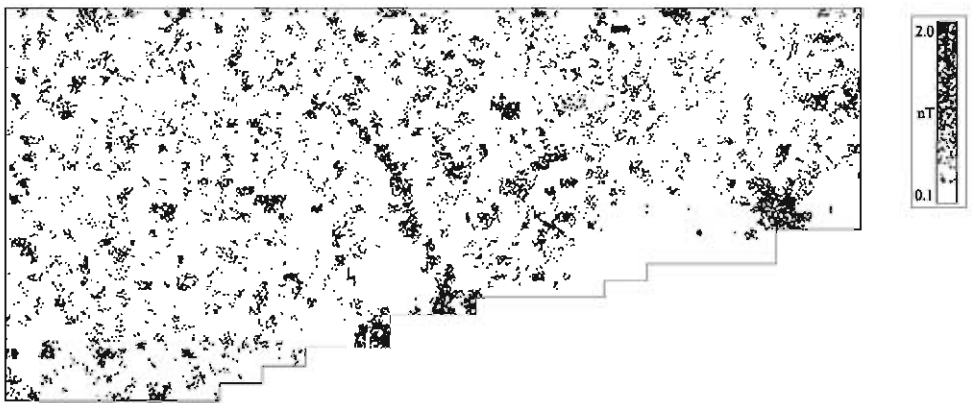
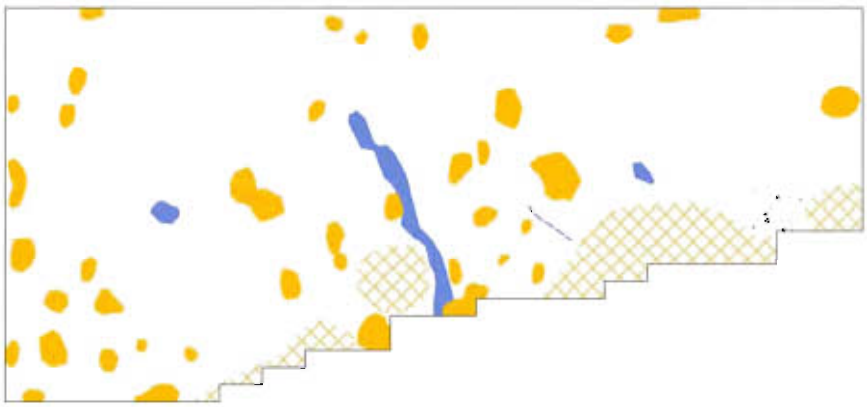
G56: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Area of Increased Magnetic Response Ferrous Area of Magnetic Disturbance 0 metres 25

METRO NORTH

G56: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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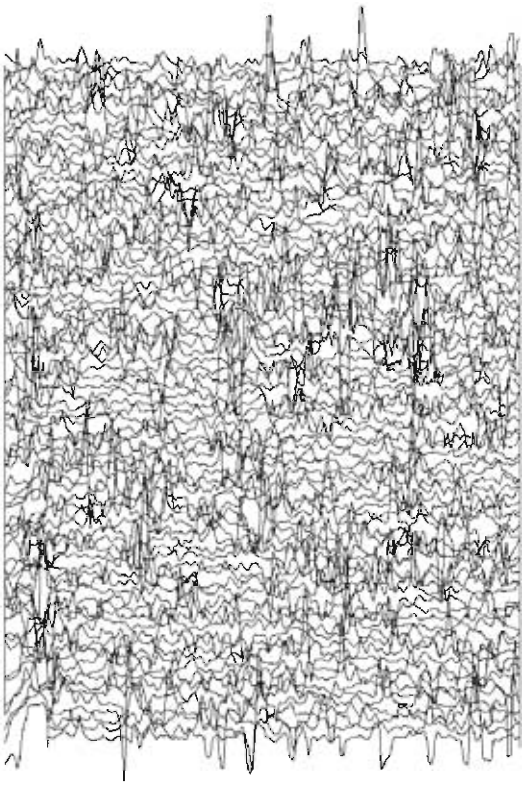
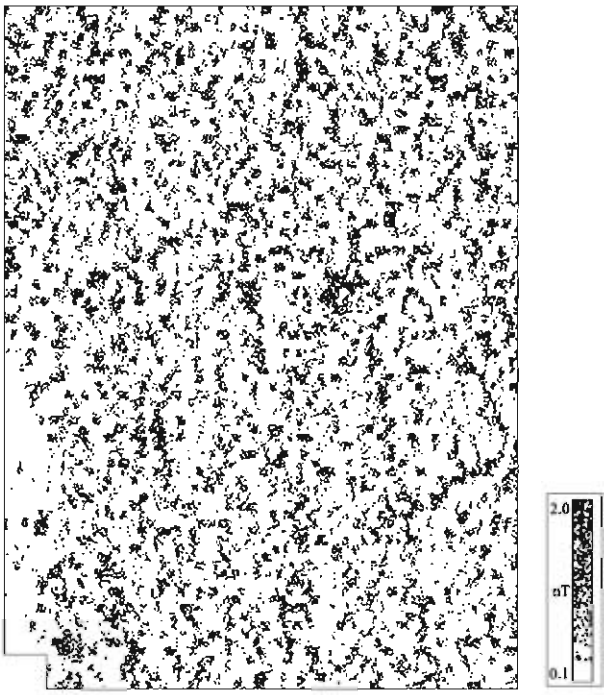
G57: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION





? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

METRO NORTH

G57: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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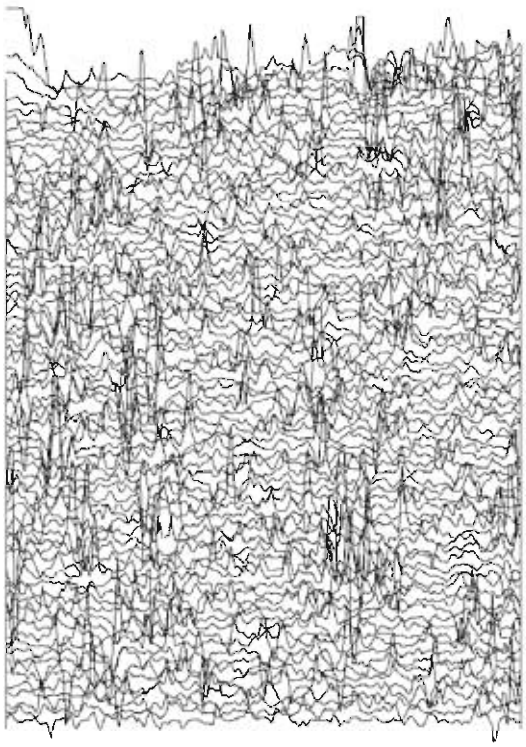
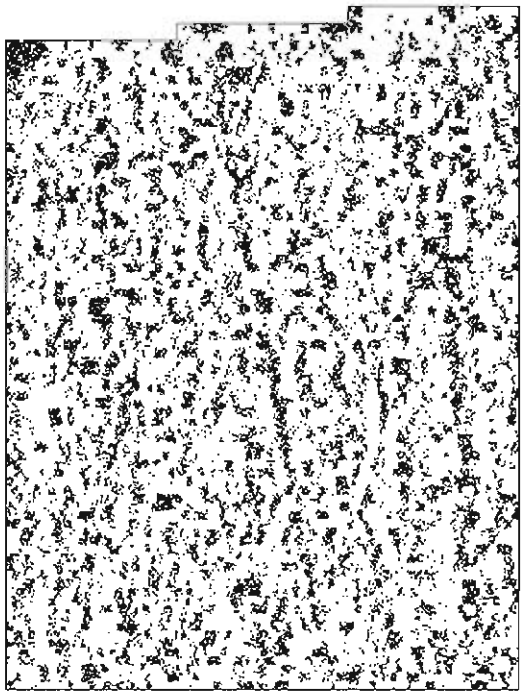
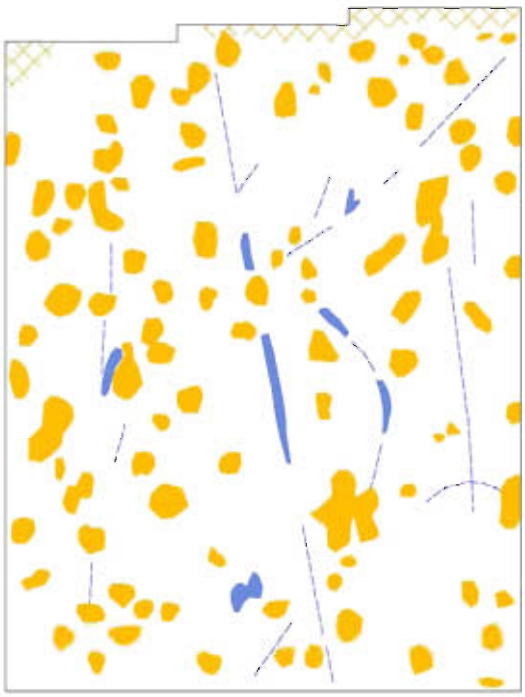
G58: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

METRO NORTH

G58: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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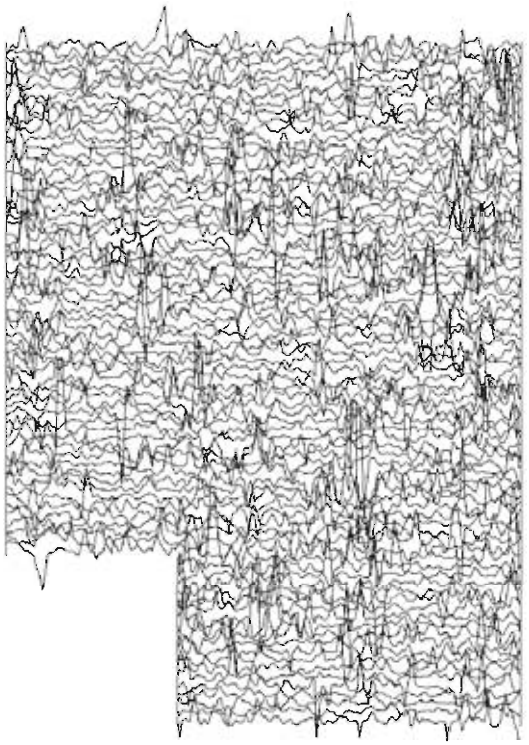
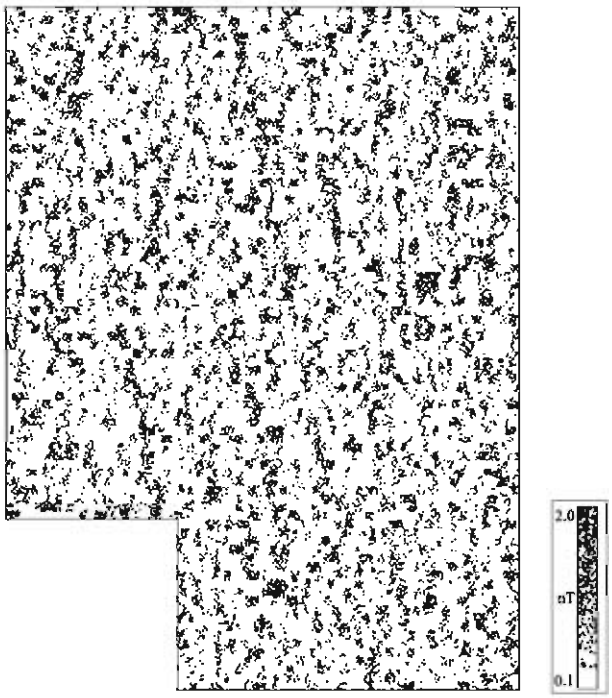
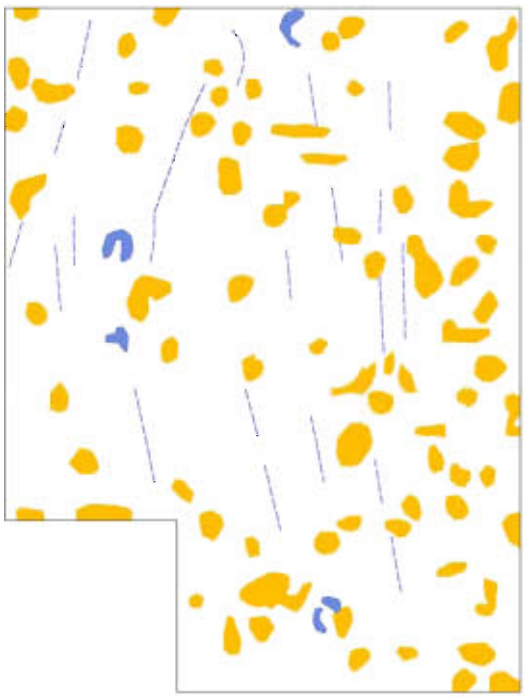
G59: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous

0 metres 25

METRO NORTH

G59: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

BT | N/A | DH | 01/07/2009

A1.61

1:625 @ A3

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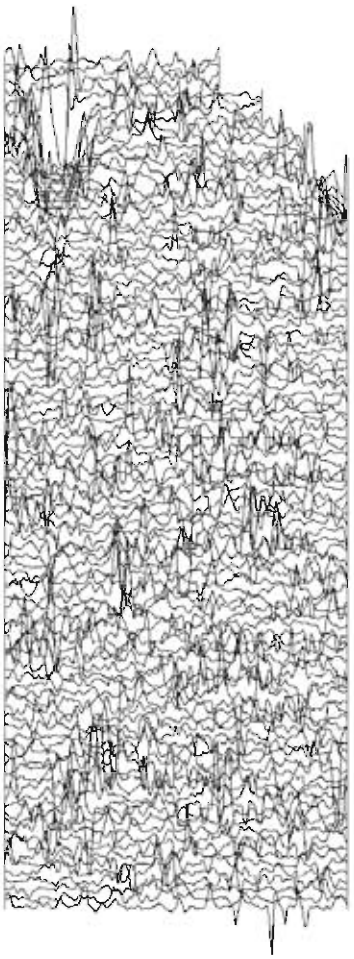
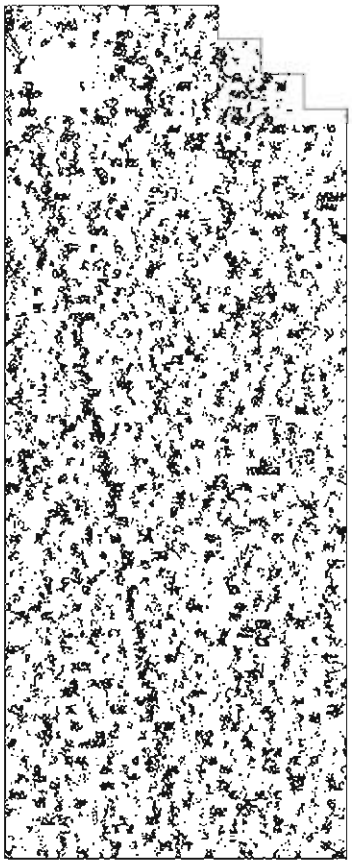
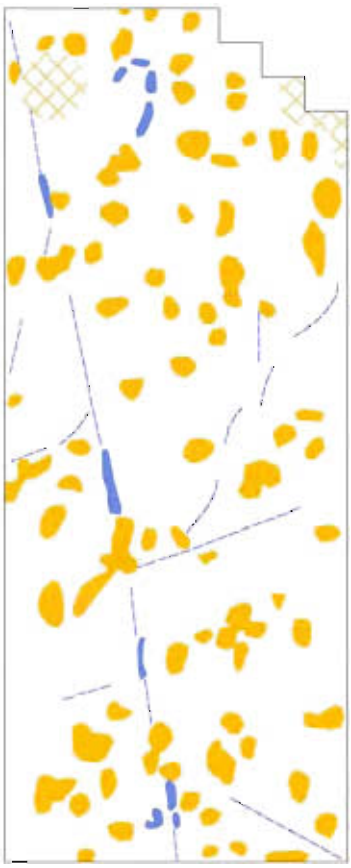
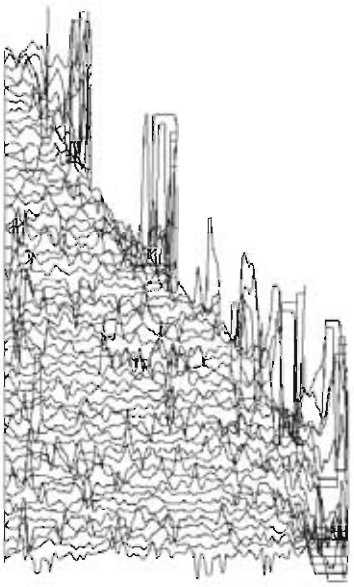
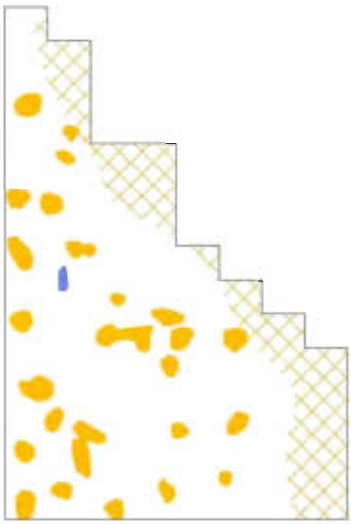
G60 & G61: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION











? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G60 & G61: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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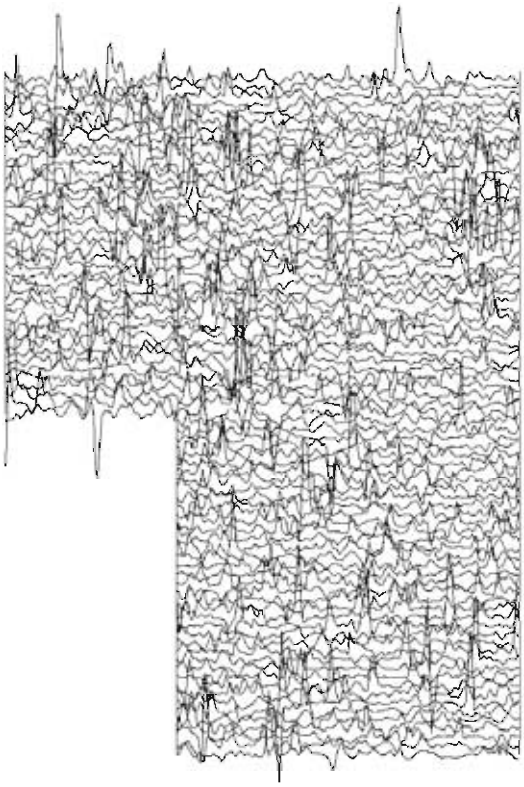
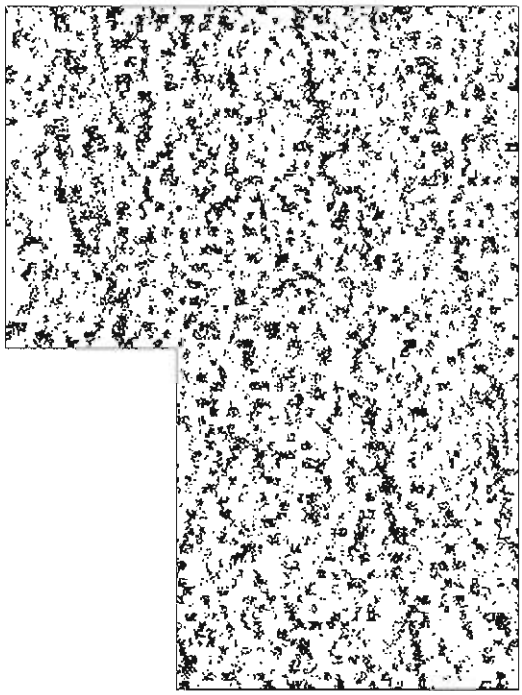
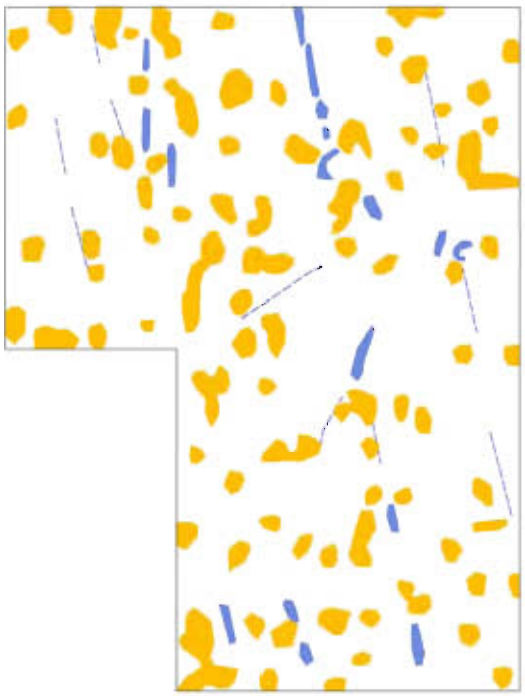
G62: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous

0 metres 25

ISO 9001:2000 EQA CERT NO. 2915

METRO NORTH
G62: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

DH 01/07/2009

A1.63
1:625 @ A3

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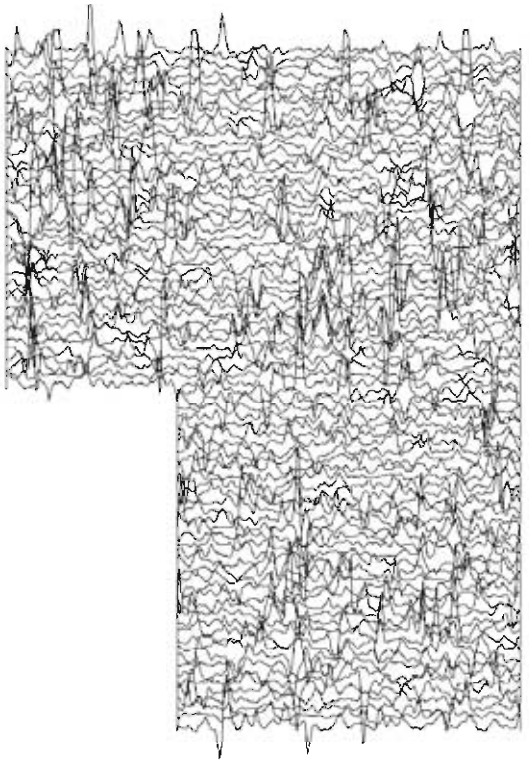
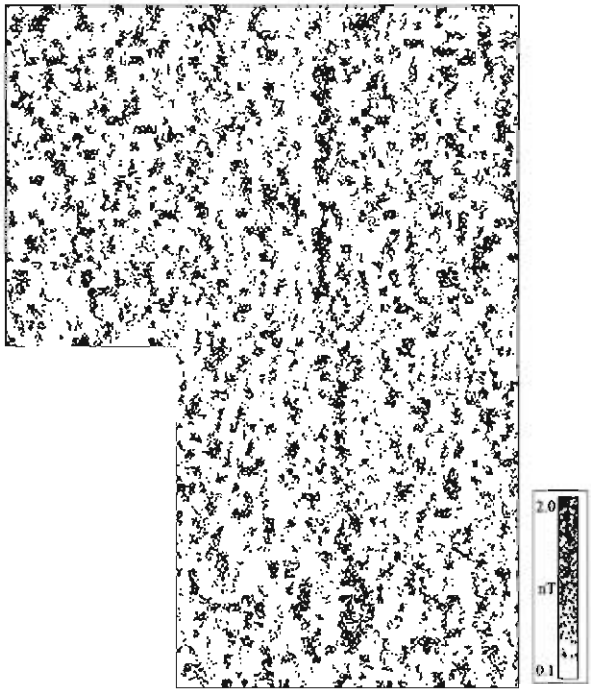
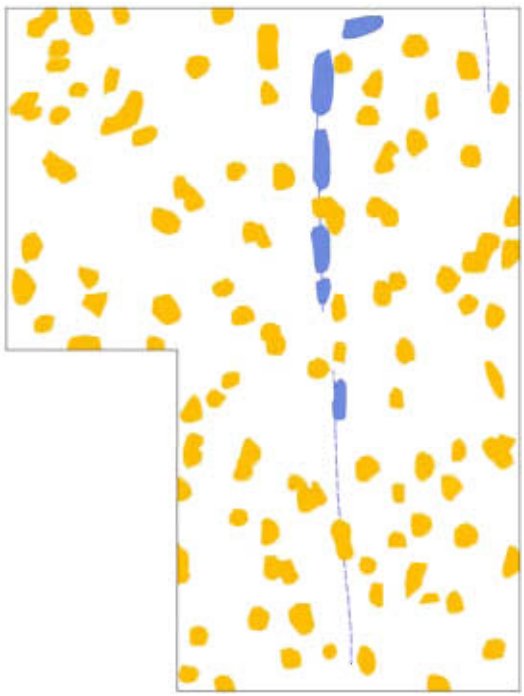
Dublin 2

G63: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G63: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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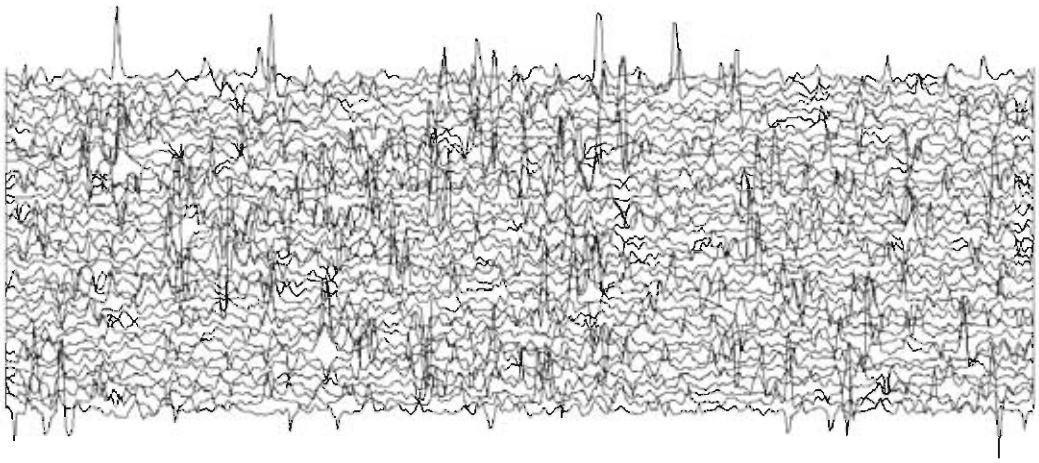
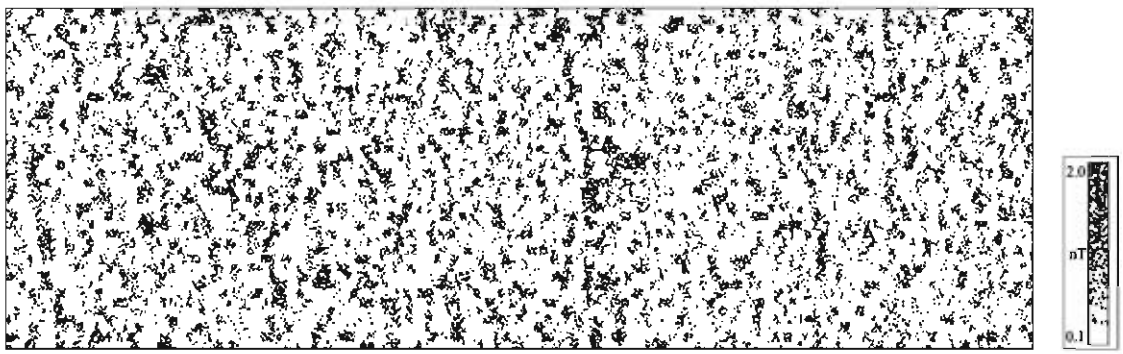
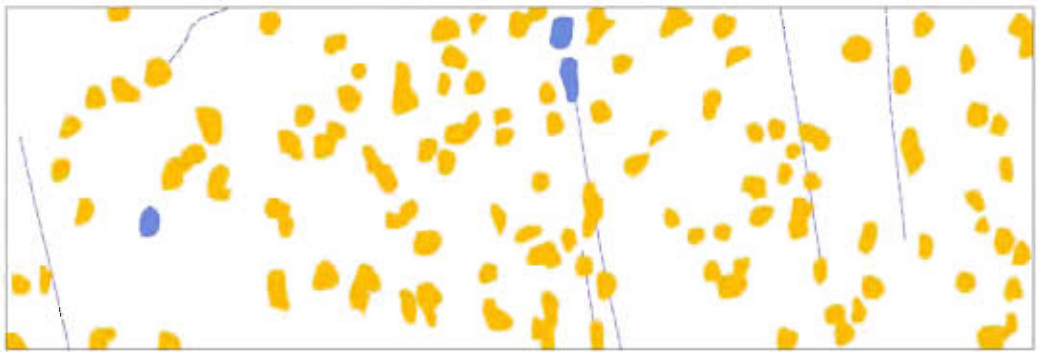
G64: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous

0 metres 25

ISO 9001:2000 EQA CERT NO. 2915

METRO NORTH
G64: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
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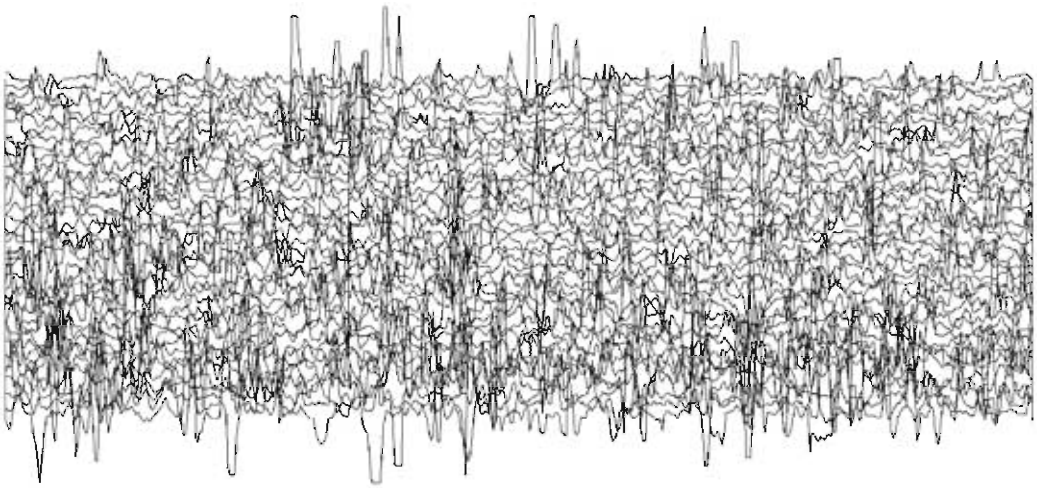
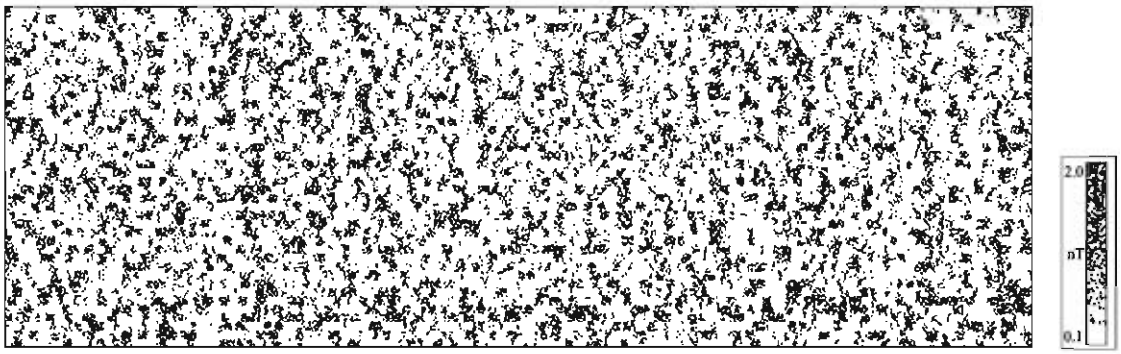
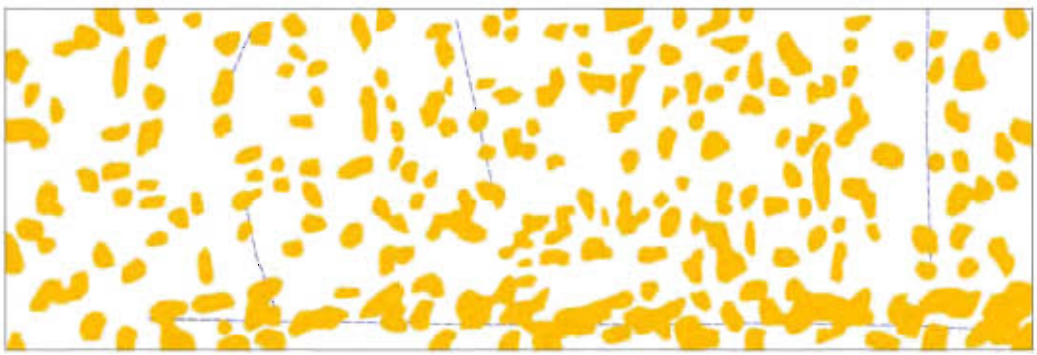
G65: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







Trend Ferrous

0 metres 25

METRO NORTH
G65: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

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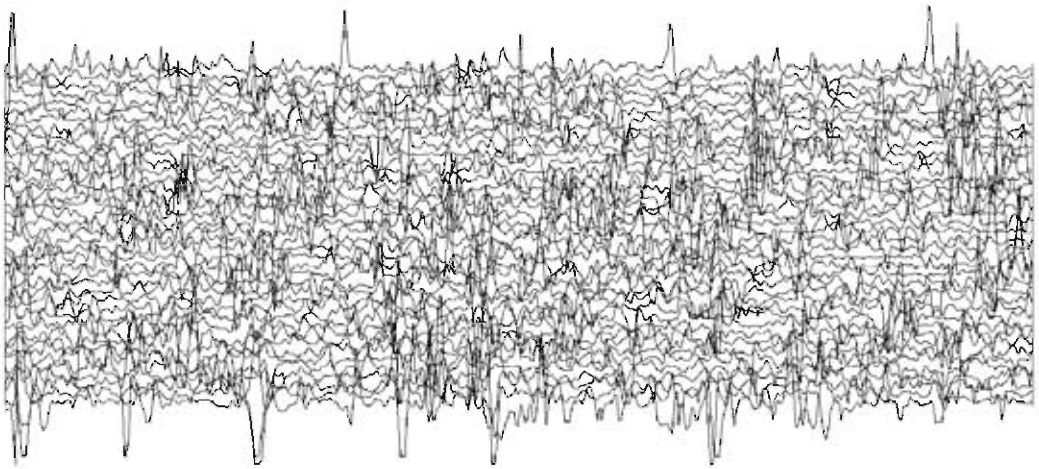
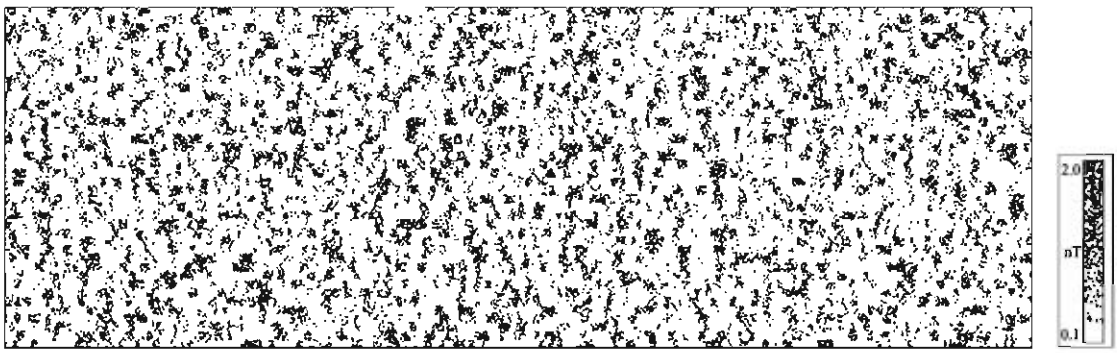
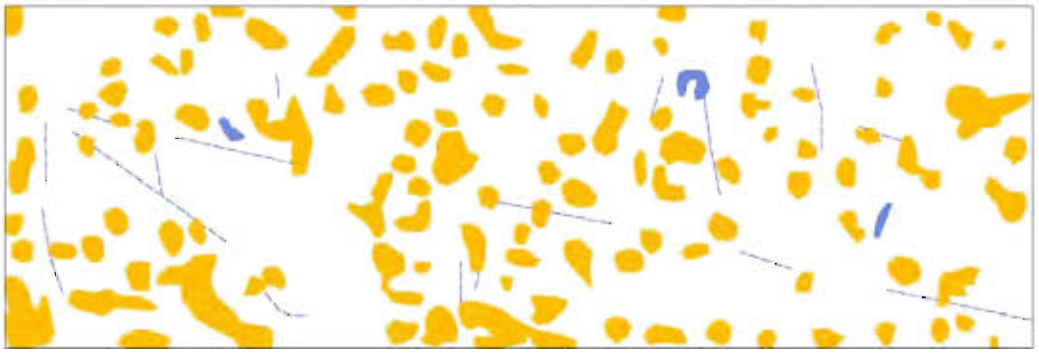
G66: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous

0 metres 25

ISO 9001:2000 EQA CERT NO. 2915

N

ARCHAEOLOGICAL LICENCE 09R0117
PRODUCED BY BT
DATE SURVEYED N/A
CHECKED BY DH
DATE ISSUED 01/07/2009

PROJECT METRO NORTH
TITLE G66: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
CLIENT RAILWAY PROCUREMENT AGENCY

JOB NO. 08090
DRAWING NO. 08090_97
PAPER SIZE A1/A3
SCALE 1:625 @ A3

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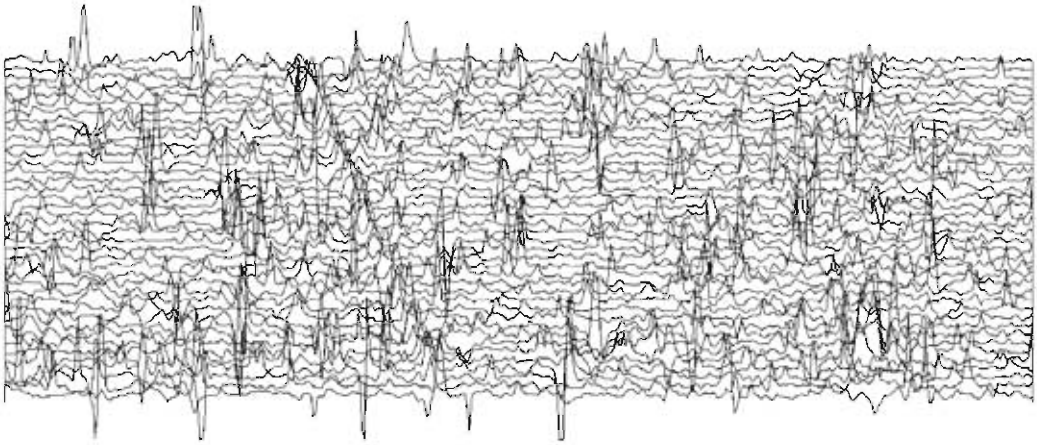
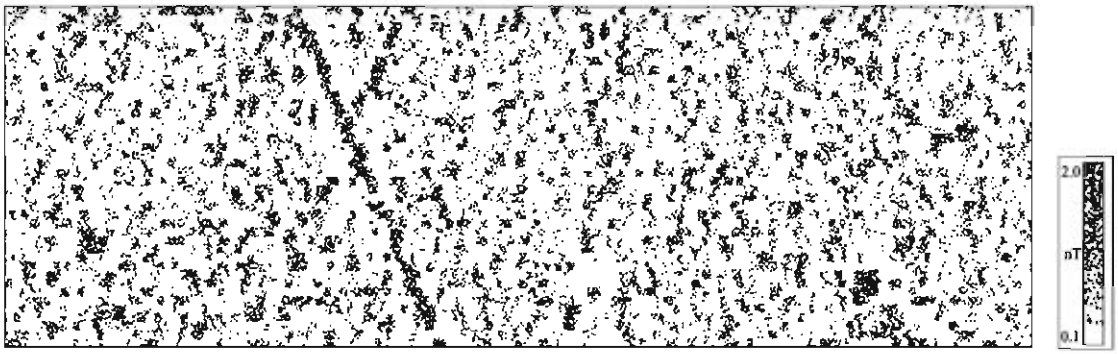
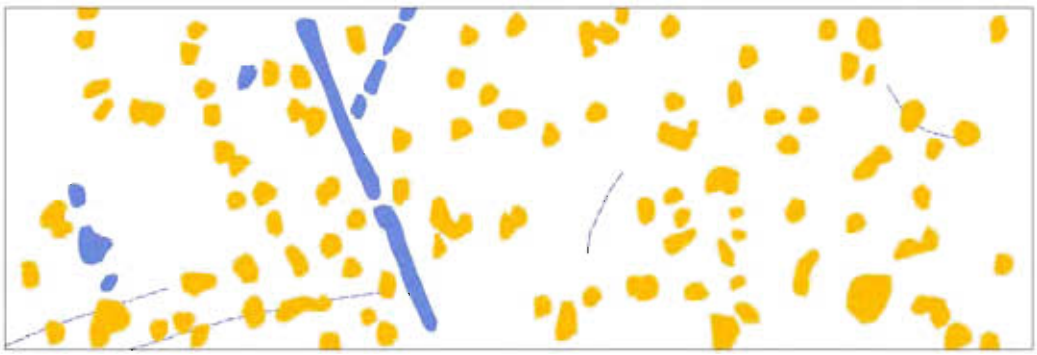
G67: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous

0 metres 25

EQA

METRO NORTH

G67: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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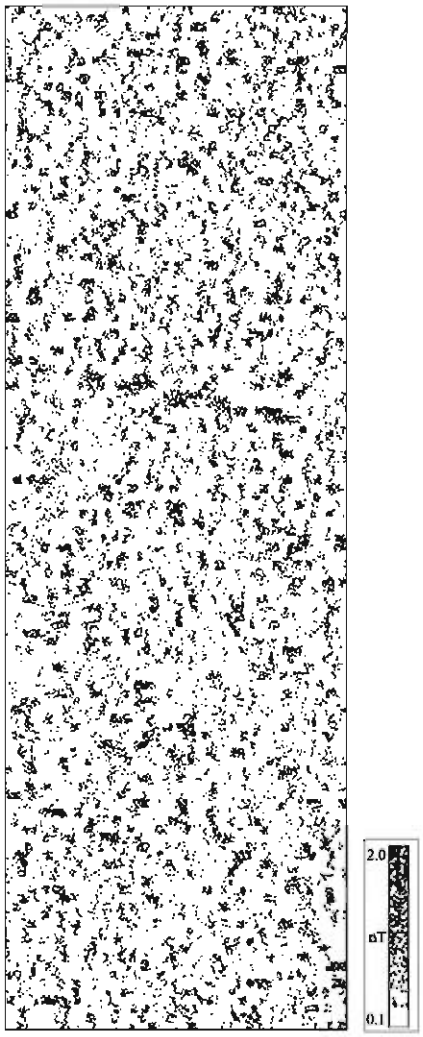
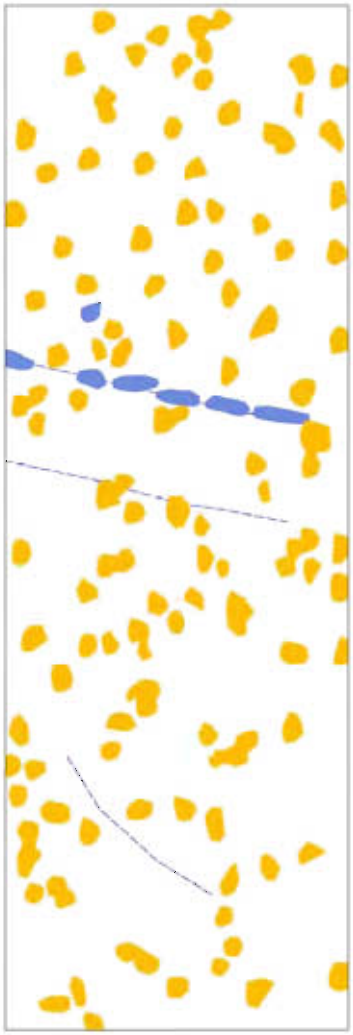
G68: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION





? Archaeology Trend Ferrous

0 metres 25

METRO NORTH

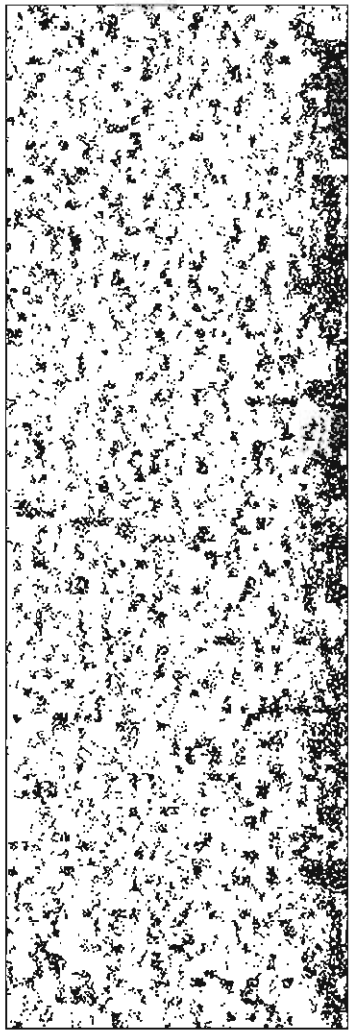
G68: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

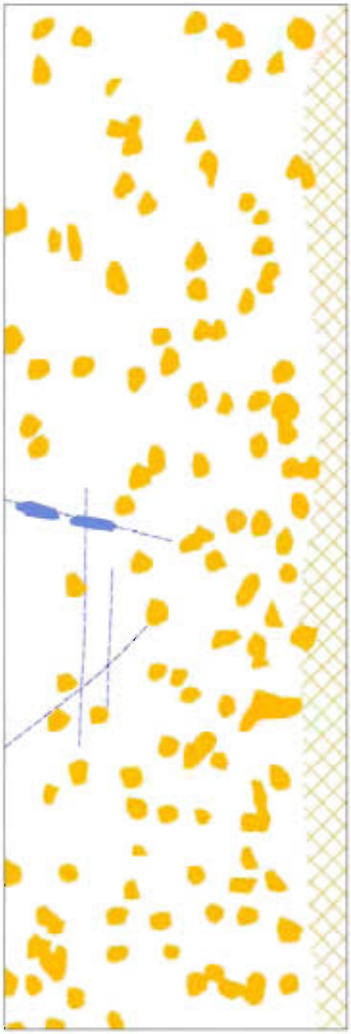
RAILWAY PROCUREMENT AGENCY

Archaeological Consultants & Project Managers

G69: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

15 nT





? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

METRO NORTH

G69: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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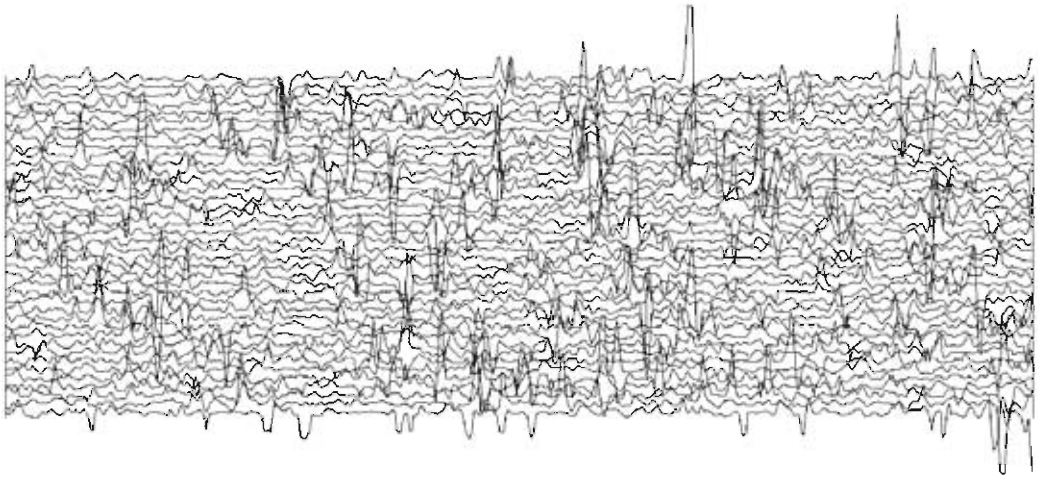
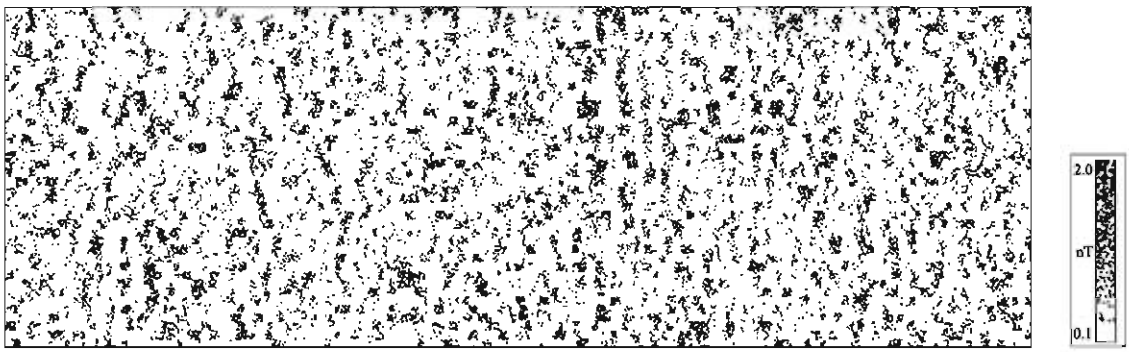
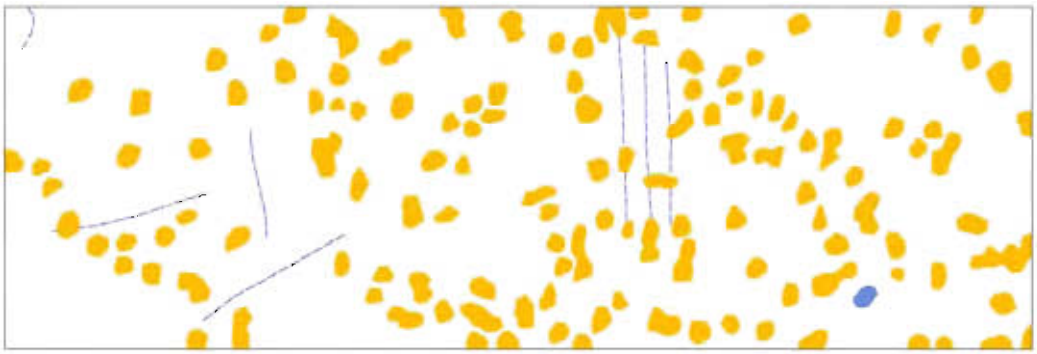
G70: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous

0 metres 25

METRO NORTH

G70: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

BT | N/A | DH | 01/07/2009

A1,71

1:625 @ A3

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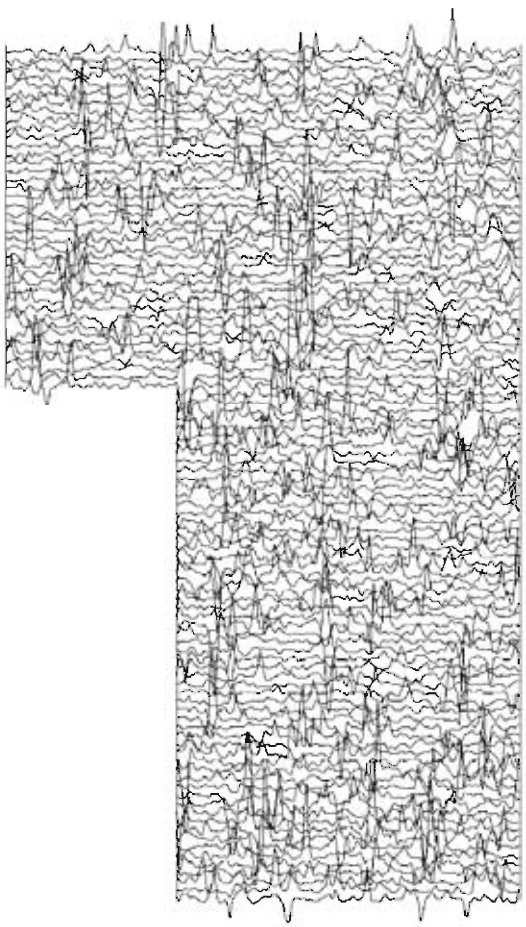
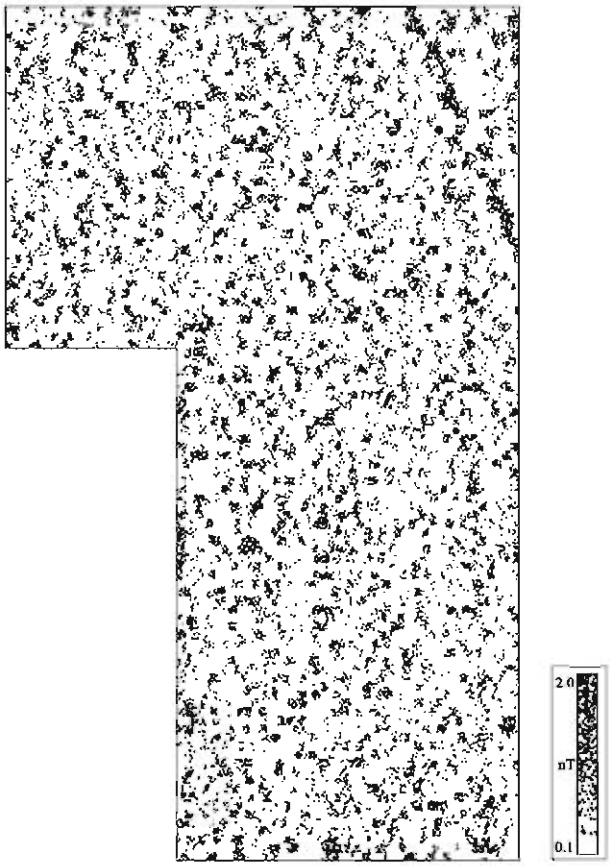
G71: XY-TRACE & DOT DENSITY PLOT





0 metres 25

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PRODUCED BY	BT
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CHECKED BY	DH
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DRAWING NO.	08090_102
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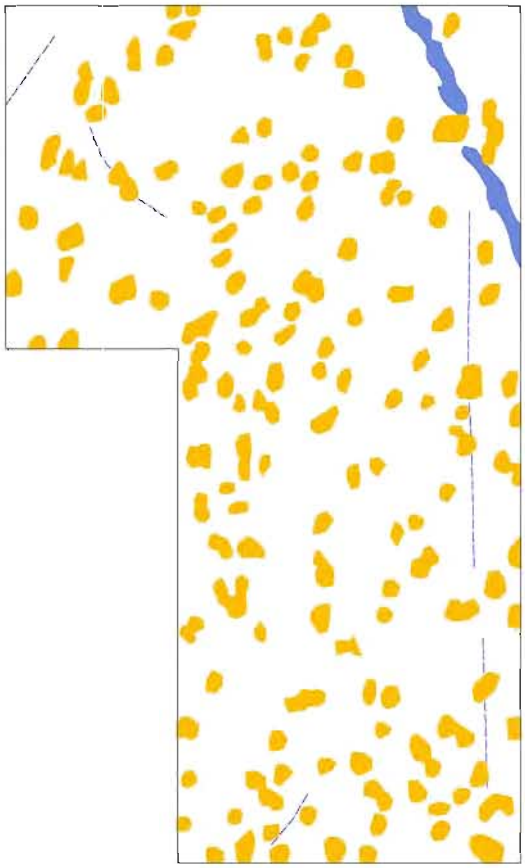
G71: INTERPRETATION



? Archaeology Trend Ferrous

0 metres 25

METRO NORTH
G71: INTERPRETATION

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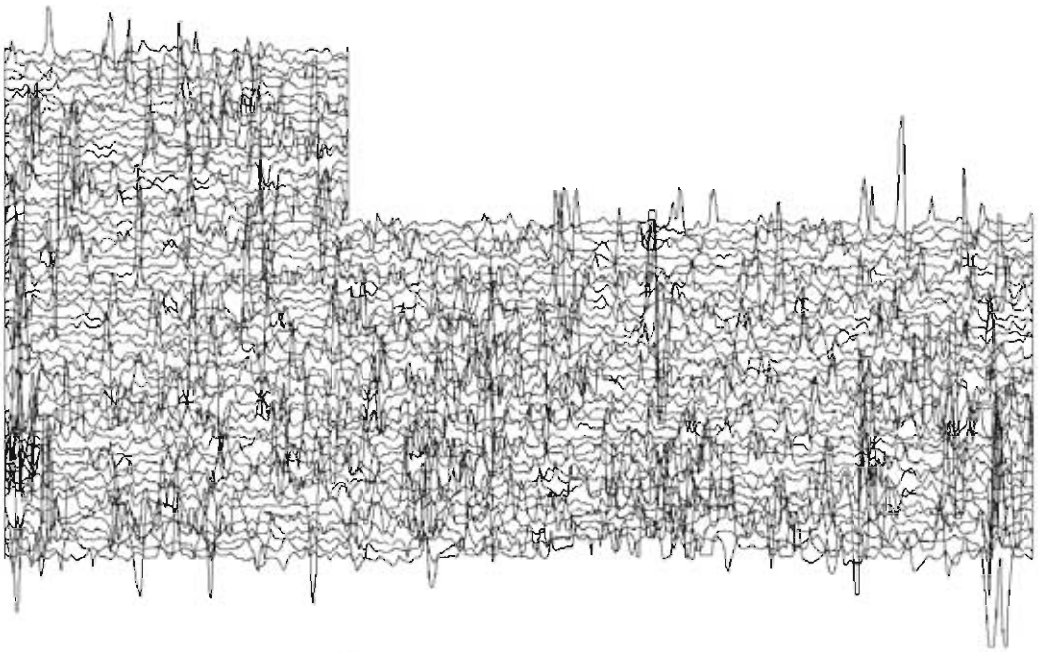
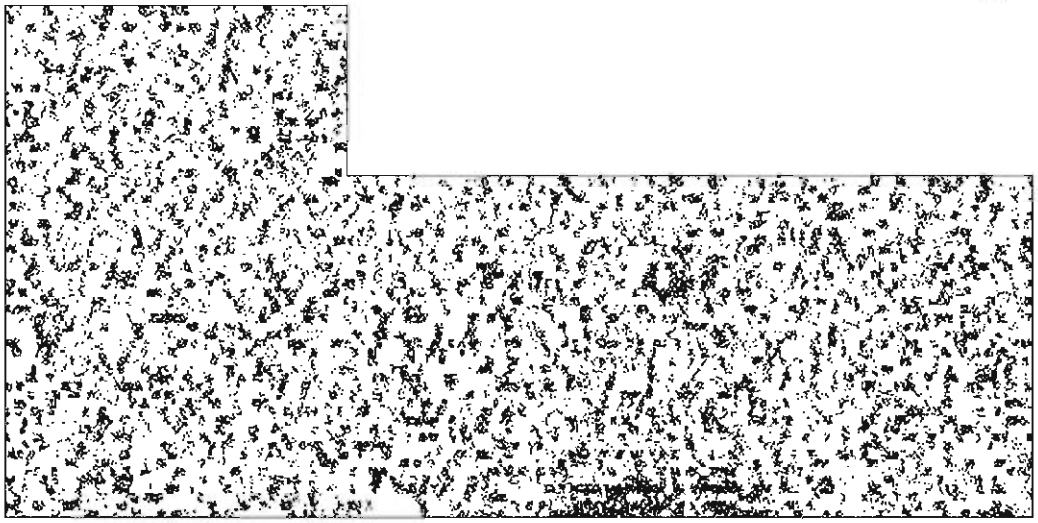
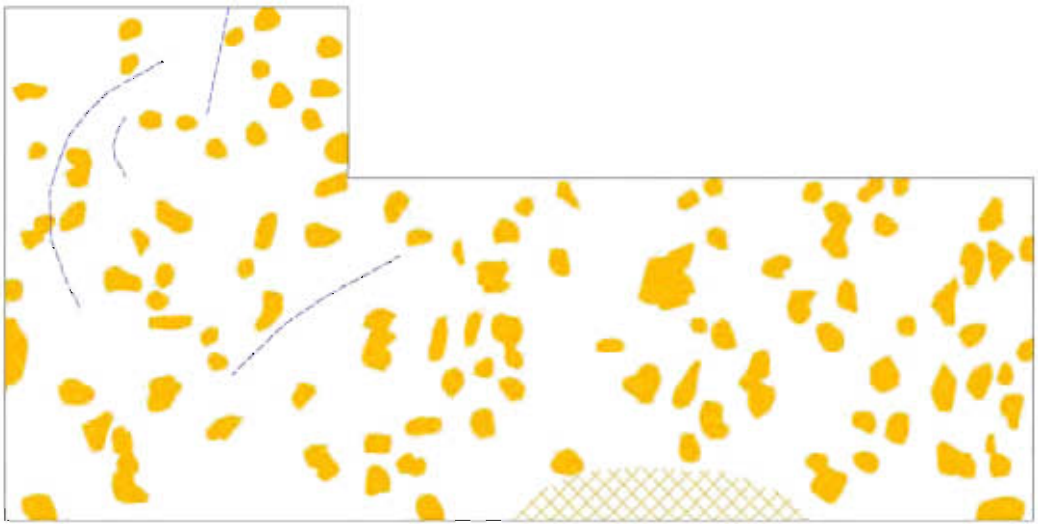
G72: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







Trend Ferrous Area of Magnetic Disturbance

0 metres 25

METRO NORTH

G72: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

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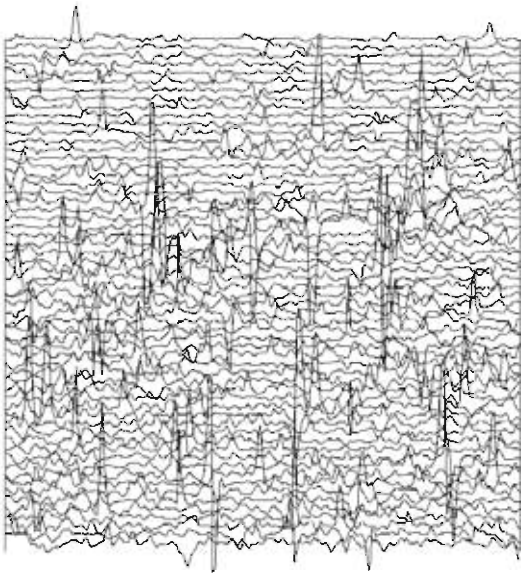
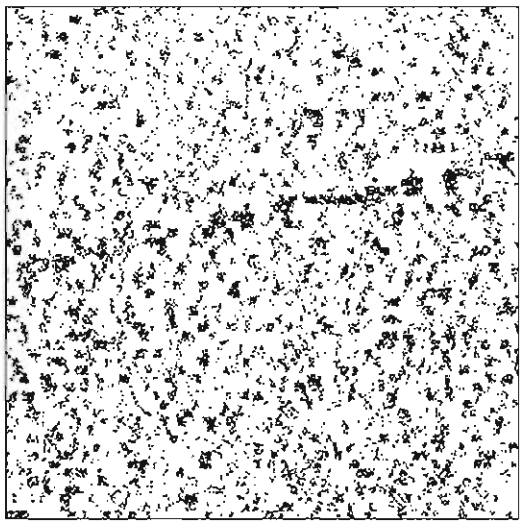
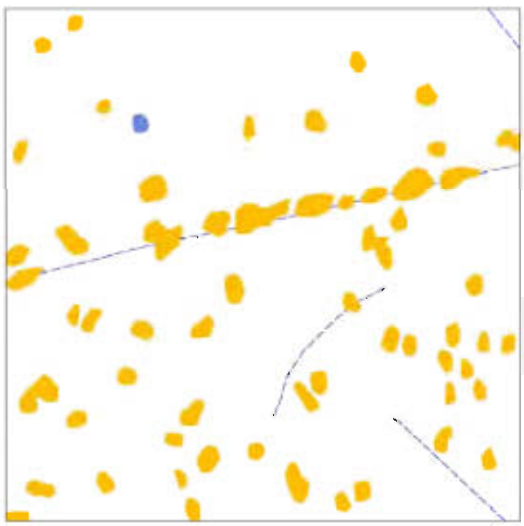
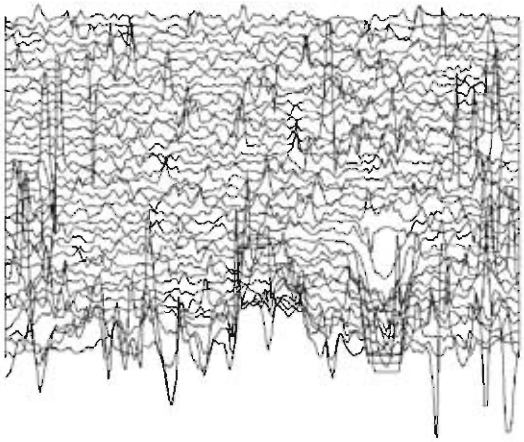
G73: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

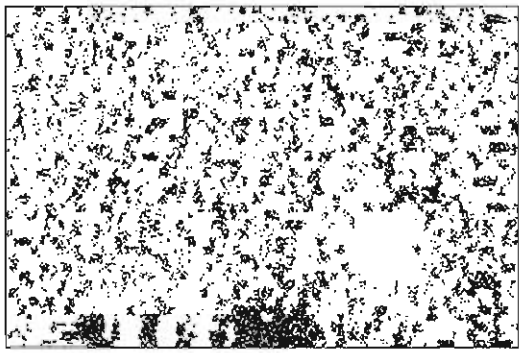






G74: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION





? Archaeology Trend Negative Trend Ferrous Area of Magnetic Disturbance 0 metres 25

EQA

METRO NORTH

G73 & G74: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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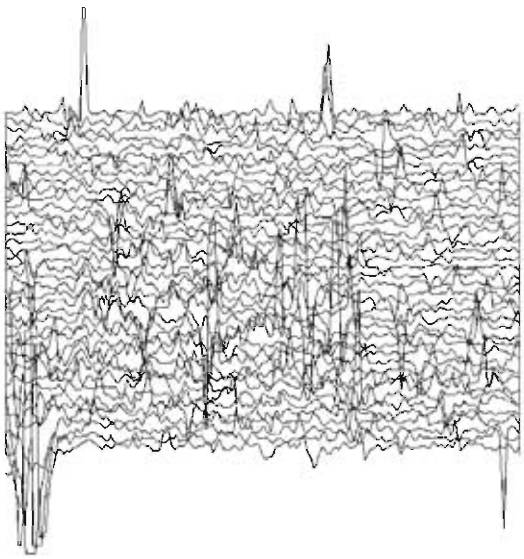
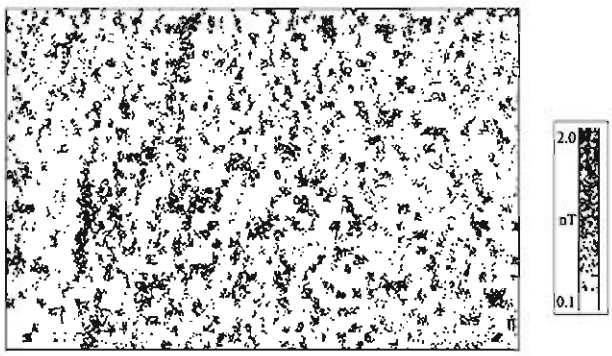
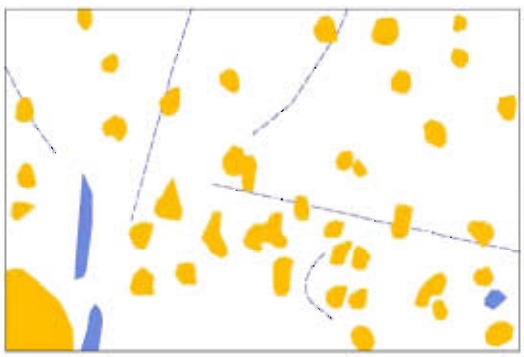
G75: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous

0 metres 25

ISO 9001:2000 EQA

METRO NORTH
G75: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
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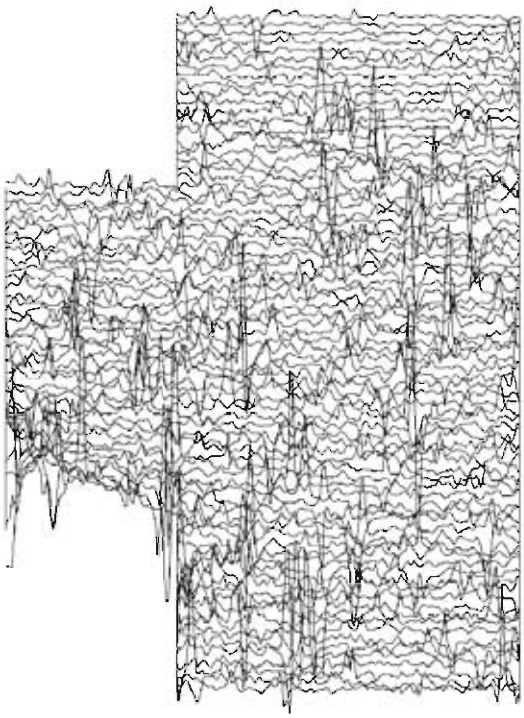
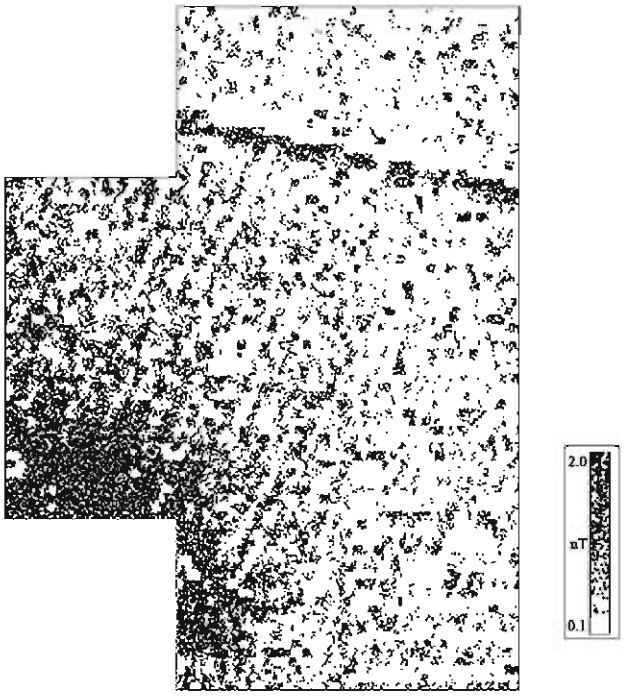
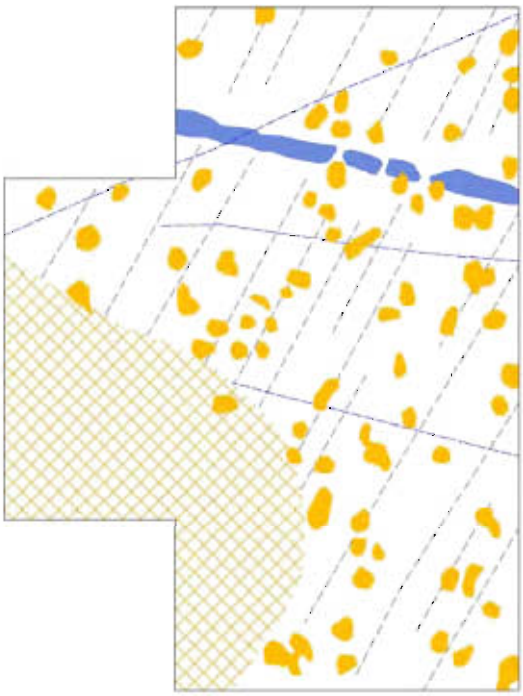
G76: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology | Trend | Ploughing Trend | Ferrous | Area of Magnetic Disturbance | 0 metres 25

METRO NORTH

G76: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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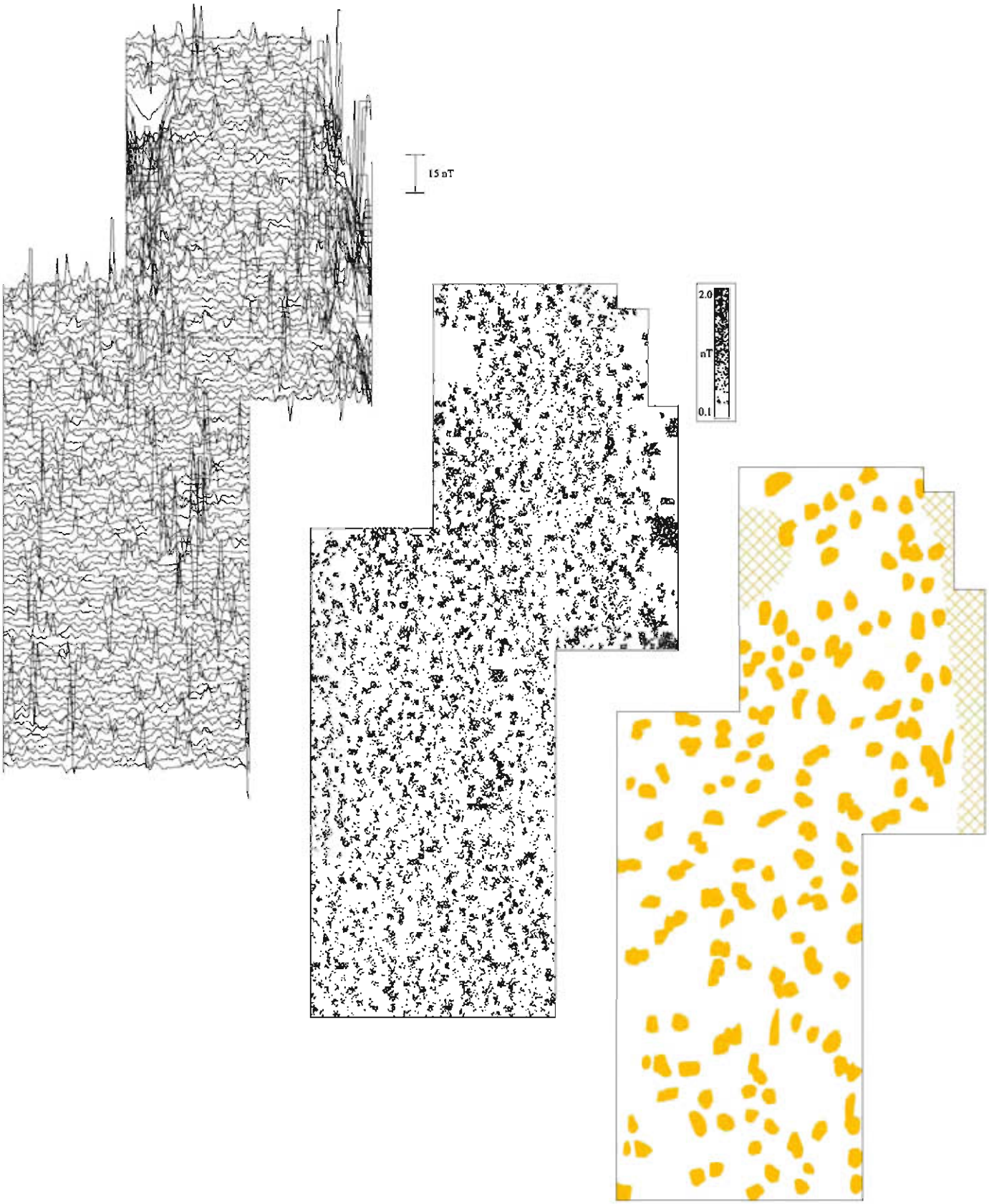
G77: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



Ferrous

Area of Magnetic Disturbance

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G77: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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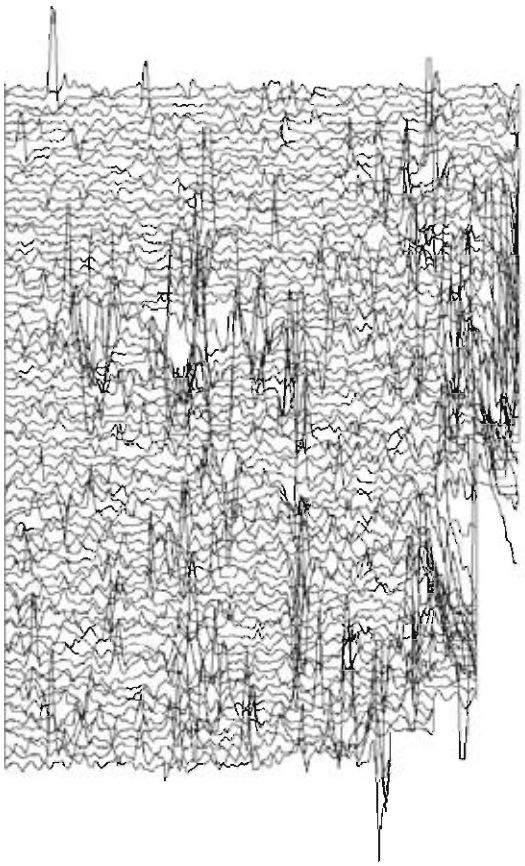
G78: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



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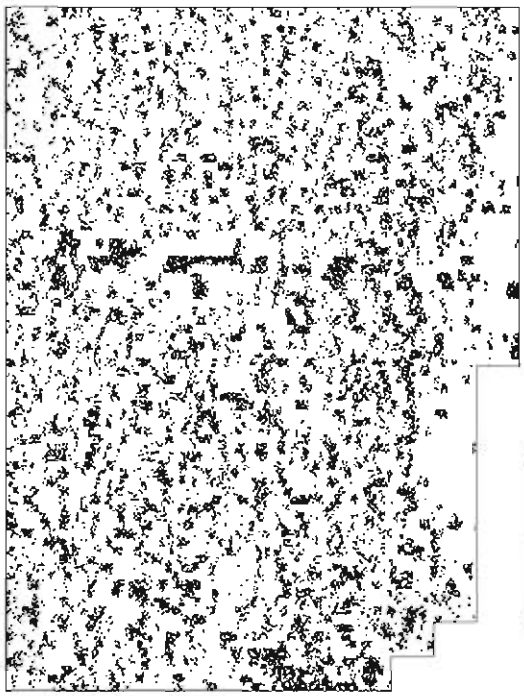

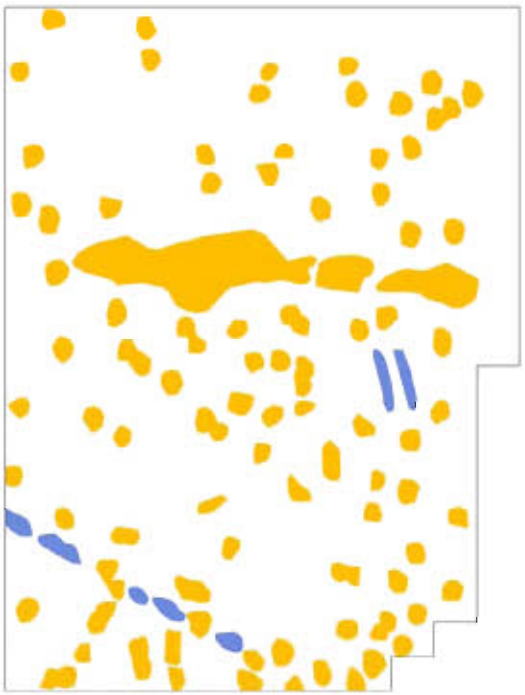

? Archaeology Ferrous

0 metres 25

PROJECT	METRO NORTH
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PRODUCED BY	BT
DATE SURVEYED	N/A
CHECKED BY	DH
DATE ISSUED	01/07/2009
JOB NO.	08090
DRAWING NO.	08090_09
FILE NO.	A1.79
SCALE	1:625 @ A3

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G79: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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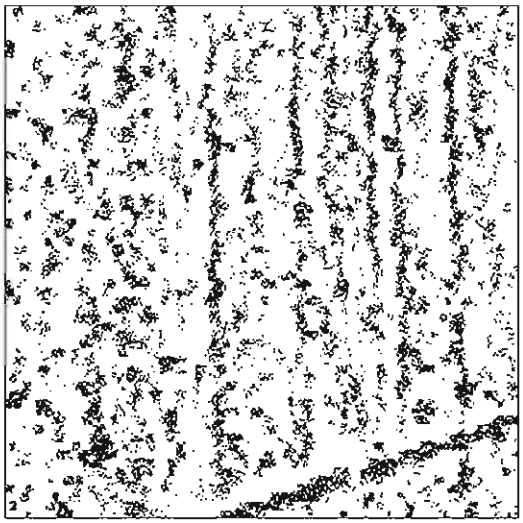

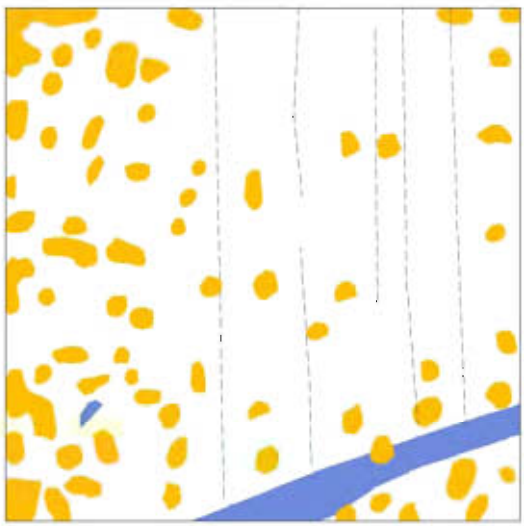

? Archaeology Ploughing Trend Ferrous

0 metres 25

METRO NORTH

G79: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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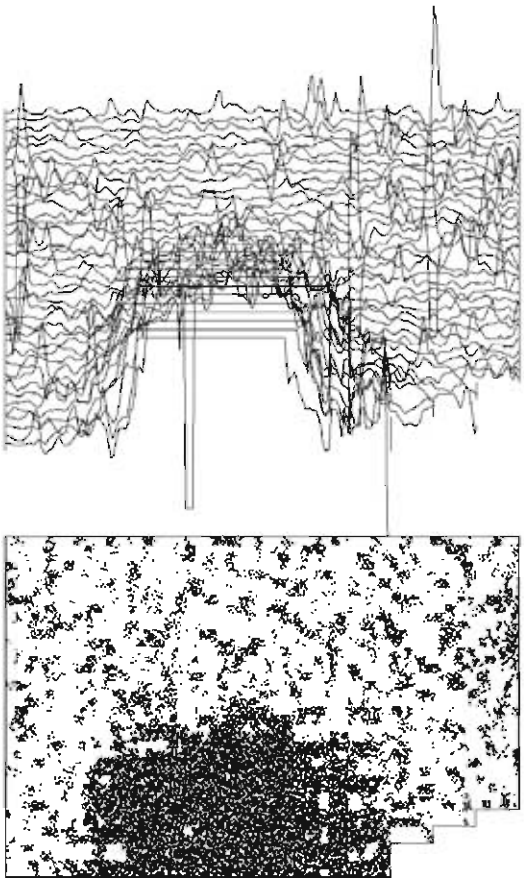
G80: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



Ploughing Trend Ferrous Area of Magnetic Disturbance

0 metres 25

ISO 9001:2000 EQA

METRO NORTH

G80: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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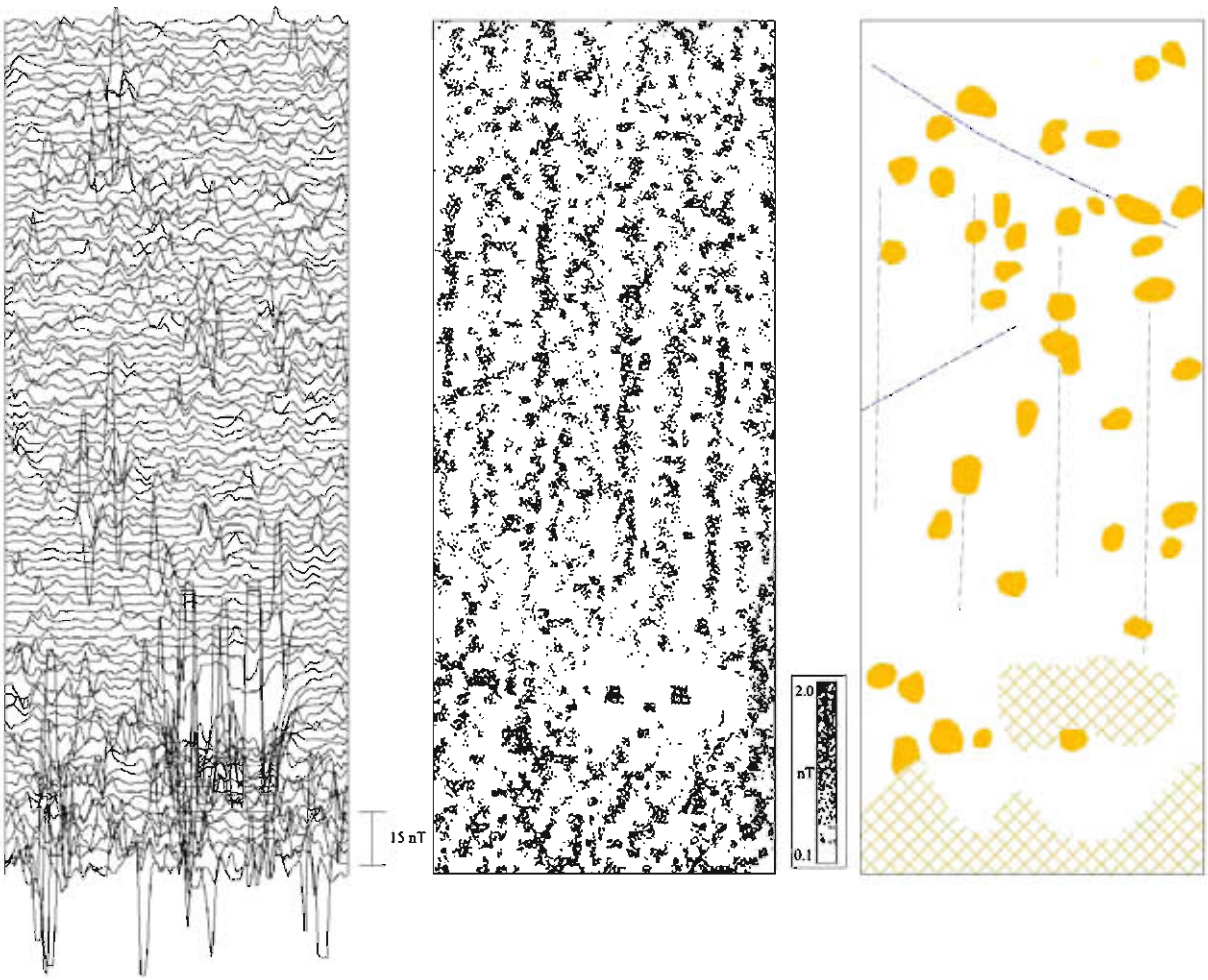
G81: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



Trend Ploughing Trend Ferrous Area of Magnetic Disturbance

0 metres 25

- N -

METRO NORTH

G81: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

RAILWAY PROCUREMENT AGENCY

BT | N/A | DH | 03/07/2009

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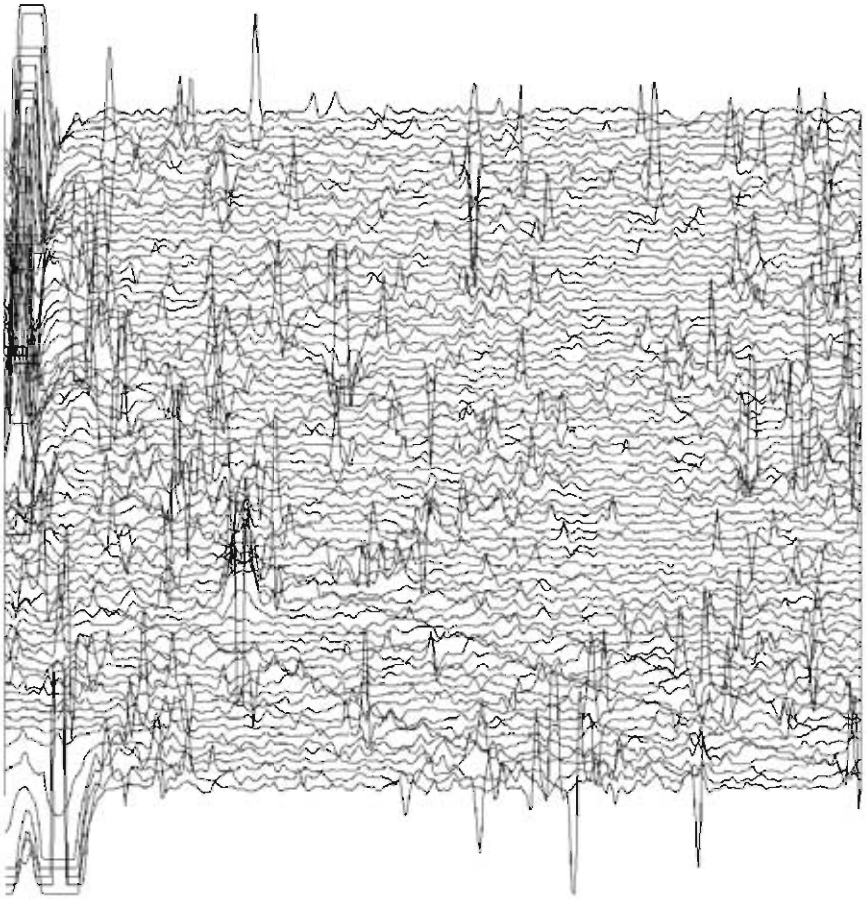
G82: XY-TRACE & DOT DENSITY PLOT



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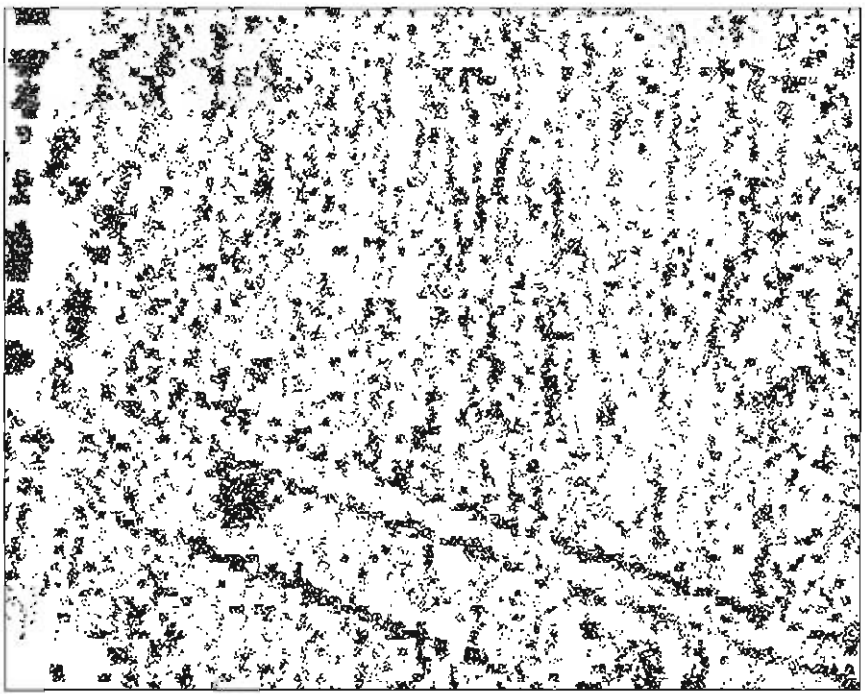

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REVISIONS	BY	DATE	REV

ISO 9001:2000 EQA CERT N.O. 2975

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ARCHAEOLOGICAL LICENCE	09R0117
PRODUCED BY	BT
DATE SURVEYED	N/A
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DATE ISSUED	01/07/2009

PROJECT: METRO NORTH

TITLE: G82: XY-TRACE & DOT DENSITY PLOT

CLIENT: RAILWAY PROCUREMENT AGENCY

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DRAWING NO.	08090_113
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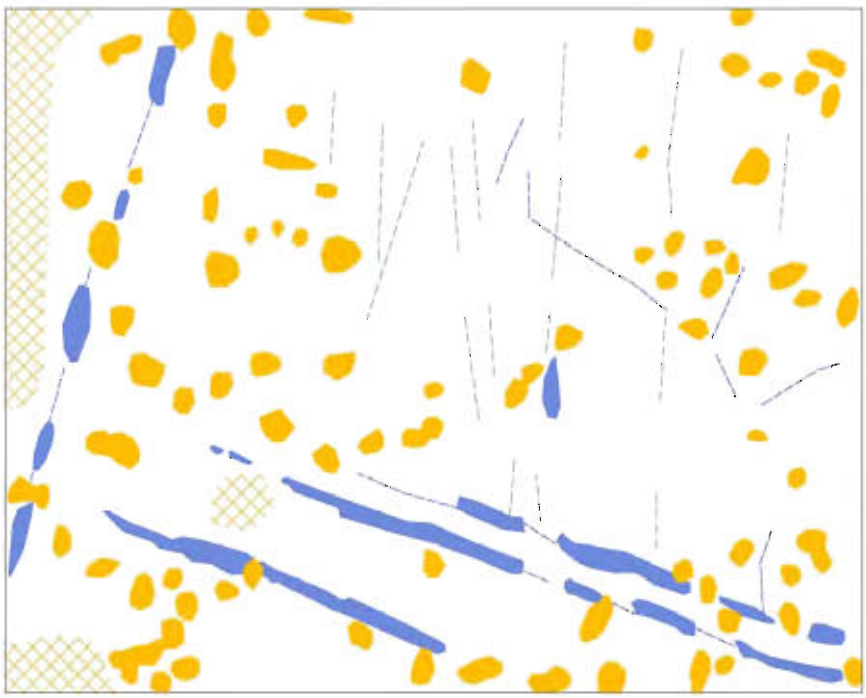
G82: INTERPRETATION



? Archaeology | Trend | Ploughing Trend | Ferrous | Area of Magnetic Disturbance

0 metres 25

N

METRO NORTH

G82: INTERPRETATION

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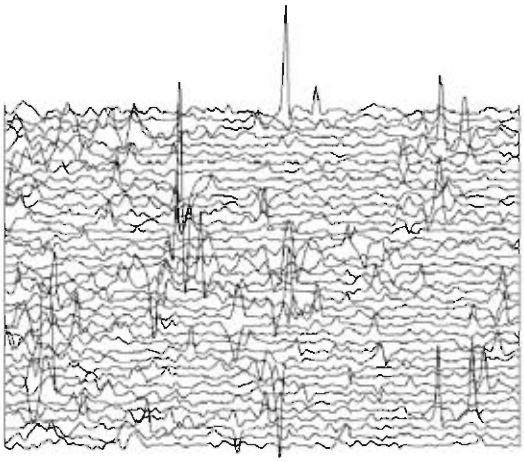
G83: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION



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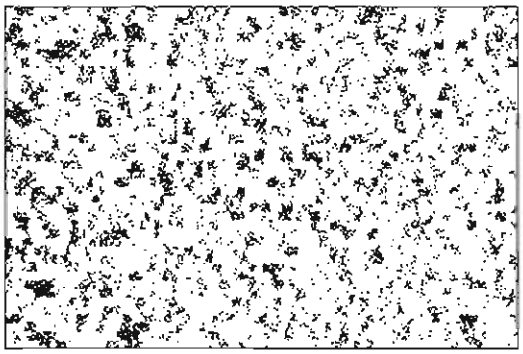

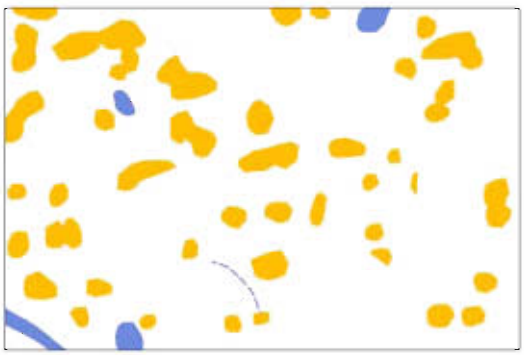

? Archaeology Trend Ferrous

0 metres 25

ISO 9001:2000 EQA CERT NO. 2915

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METRO NORTH
G83: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION
RAILWAY PROCUREMENT AGENCY

DH 01/07/2009

A1.85
1:625 @ A3

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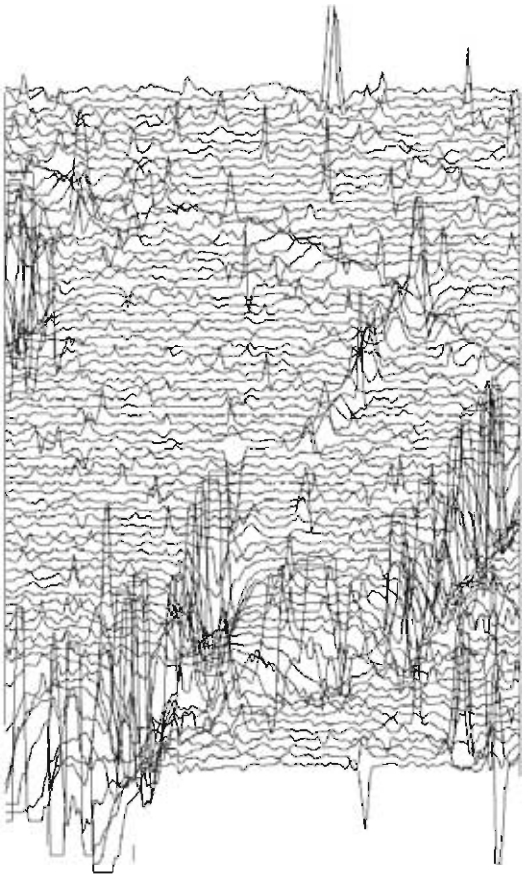
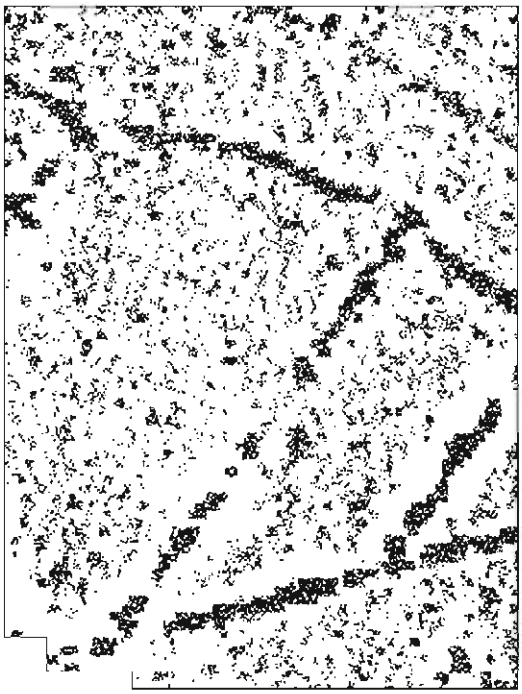
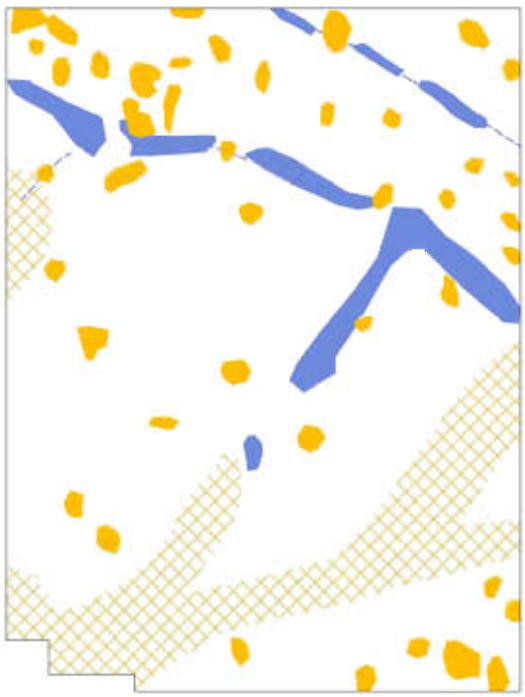
G84: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION







? Archaeology Trend Ferrous Area of Magnetic Disturbance

0 metres 25

METRO NORTH

G84: XY-TRACE, DOT DENSITY PLOT & INTERPRETATION

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Appendix 2

A2.1 G50: Ground Penetrating Radar Survey. Lissenhall & Balheary Bridges

APPENDIX 2

murphy
GLOBAL CONSULTING SURVEYORS

Metro North Ground Penetrating Radar Survey

Lissenhall Bridge & Balheary Bridge

Swords, Co Dublin

for

Margaret Gowen & Co Ltd

Contents

1.0 Overview

This document is the geophysical report for a Ground Penetrating Radar (GPR) survey carried out over an area between Lissenhall and Balheary bridges, just outside Swords, Co Dublin.

Murphy Surveys Limited (MSL) has been appointed by Margaret Gowen & Co Ltd to carry out this survey. The survey is a component of an archaeological geophysical survey undertaken on behalf of the Railway Procurement Agency (RPA) for the proposed Metro North scheme. The GPR survey took place on Thursday 2nd April 2009 with Brice Le Comte (Geophysicist) and Toma Achetrateri (Surveyor) on site.

All site work for the GPR survey was completed that day.

2.0 Objectives

The survey area is located between Lissenhall Bridge (RMP DU011-081; RPS341) and Balheary Bridge (RPS 340) to the North and South respectively and is mainly composed of grass with small trees as part of a newly developed embankment for the new R321. The old road linking the two bridges is still visible on the Lissenhall bridge but is narrowed by the embankment material on the East side and only a tarmac pathway remains turning Westward before the Balheary bridge to access the adjacent sports grounds.

A GPR survey was carried out on the date in order to assess the presence of buried arches and evidence that the existing Lissenhall and Balheary bridges belong to the same structure.

3.0 Survey Methodology

The GPR data were collected using a multi-channel and multi-frequencies RIS-MF system mounted on a cart. An odometer is mounted on the cart for distance calibration. The grid spacing is 3 metres in both directions and the trace spacing is set up to 2.5 cm for each profile. The GPR data collected is composed of 8 channels and 2 frequencies of 200 and 600 MHz for shallower and deeper investigations. The time window is set up to 120 nanoseconds with a wave velocity of 10 cm/ns giving a maximal depth of investigation of 6m. However, the signal attenuation was strong even for the lower frequencies and only an average depth of penetration of 2.5 meter below ground level was achieved at the site with possibly even less on the more clayey embankment material.

The survey area is approximately 78 by 12 square meters and has been surveyed in to the Irish National Grid using a Trimble RTK GPS system. The presence of vegetation and street furniture (bench) at the site limited the GPR data coverage in some locations within the survey area. These areas are marked on dwg ref 09460_C1 as not surveyed by GPR.

Photograph One: Site at Lissenhall Bridge

4.0 Results

A number of underground services are present at the site and have been plotted on the interpretation map.

Only one arch, which is partially visible on the west side of LIssenhall Bridge, has been clearly identified on the GPR data even though the presence of underground utility right above it affected the structure response. However, on the southeast side of Lissenhall bridge a linear anomaly is clearly visible and extend towards Balheary bridge over a distance of approximately 30m and it disappears as the embankment material rises over the old road level .This is interpreted as the response of the old road wall or its foundations and that could suggest a continuous bridge structure within the survey area.

Photograph Two: Visible arch on West side of Lissenhall Bridge

5.0 Conclusion

The results from the GPR survey are of good quality but the depth penetrated was limited by ground conditions. Whilst data was collected to depths of over 5.0m below surface level, the responses from depths beyond 3.0m were very weak due to attenuation.

There are two main indications within the data that suggest a continuous structure exists between the Lissenhall and Balheary bridges. The first is the arch which extends 9m in from the western wall. This distance would correspond to the road width to the Northern end of the survey.

The second is the strong target interpreted as the edge of the old road level. This too presents evidence of an existing structure some 9m wide and approximately 30m in length.

As in any method of indirect measurement these results depend upon the interpretation of the information received, in this instance from the Ground Penetrating Radar data.

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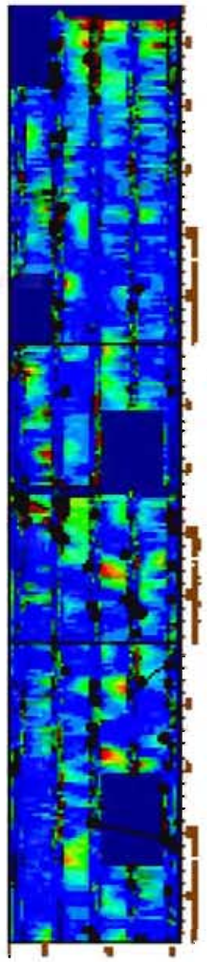
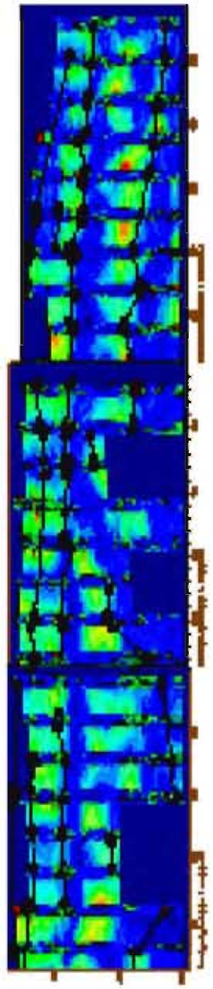
Neil Welsh – Head Geophysicist

Tomographic Map of Longitudinal Files



Tomographic Map of Transversal Files



No further evidence of this target in GPR data beyond here.

Strong Linear GPR anomaly interpreted to be edge of buried bridge structure.

No further evidence of this target in GPR data beyond here.

No further evidence of this target in GPR data beyond here.

Arch Structure.
Solid hatch and depths relate to apex of arch. Hatched area is interpreted structure to a depth of 2.5m.

Arch Structure.
Extents of Arch correspond to width of Lissen Hall bridge.

No further evidence of this target in GPR data beyond here.

No further evidence of this target in GPR data beyond here.

No further evidence of this target in GPR data beyond here.

Survey Area

6.6

4.9

LS

Mh

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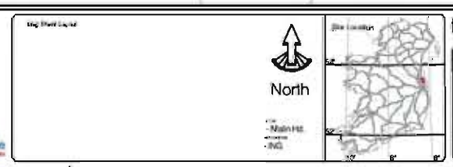
No. 318

Supply-Line



North

murphy
GLOBAL CONSULTING SURVEYORS
Kildare Cork Belfast London

Client : Margaret Gowen & Co Ltd
Project : Lissenhall Bridge - Balheary Bridge Survey
Date : 15-04-2009
Scale : 1:250 @ A3
Description : GPR Survey
Drawing Number : 09460_C1

Appendix 3

A3.1 Ground Conditions

Appendix 3 - Ground Conditions

Survey Area	Description of Ground Conditions	Size (ha)	Area scanned (ha)	Area surveyed in detail (ha)	Notes
AS1 (G1- G36)	5 fields containing stubble from recent cereal crop. 1 field recently harrowed.	39.61	39.61	15.86 (40%)	• 2 probable enclosures with associated annexes. • Numerous pit-type responses • Field boundaries and drains
AS2 (G36-G40)	2 fields containing pasture. 1 field recently harrowed.	2.31	2.31	1.13 (49%)	• 2 isolated pit-type responses • Minimal background fluctuation
AS3 (G41-G43)	1 field containing pasture. 1 field recently harrowed. 1 field unsuitable for survey due to potato crop	2.02	1.6	0.8 (50%)	• 6 isolated pit-type responses • Minimal background fluctuation
AS4	2 fields unsuitable for survey due to potato crop	2.77	0	0	
AS5 (G44)	1 field containing pasture 1 field unsuitable for survey due to potato crop	1.74	0.43	0.06 (14%)	• No responses of archaeological potential
AS6 (G44-G48)	3 fields containing pasture	2.18	2.18	0.87 (39.9%)	• Occasional pit-type responses throughout
AS7 (G49)	1 field containing broad-leafed crop Broad area unsuitable due to modern disturbance	0.46	0.18	0.03 (16.6%)	• Broad areas of magnetic interference from modern service pipe • No responses of archaeological potential
AS8	Whole area unsuitable due to modern disturbance	0.15	0	0	
AS9	1 field containing broad-leafed crop	0.04	0.04	0	• Broad areas of magnetic interference from modern service pipe
AS10	Whole area unsuitable due to modern disturbance	0.19	0	0	• GPR Survey (see appendix 2)
AS11	1 field containing short grass	0.15	0.15	0	• Broad areas of magnetic interference from modern service pipe
AS12	1 field containing short grass	0.95	0.95	0	• Broad areas of magnetic interference
AS13	1 field containing short grass	0.61	0.61	0	• Broad areas of magnetic interference
AS14	Land not in use, overgrown, modern dumping	0.89	0.75	0	• Broad areas of strong magnetic interference from modern dumping
AS16 (G51)	2 fields containing pasture	2.23	2.23	0.56 (25%)	• Linear trend - ? Ditch • Plough trends

Survey Area	Description of Ground Conditions	Size (ha)	Area scanned (ha)	Area surveyed in detail (ha)	Notes
					• Magnetic interference from adjacent structures • Minimal archaeological potential
AS17	2 gardens unsuitable for survey	1.65	0	0	
AS18	Whole area unsuitable due to landscaping	1.4	0	0	
AS19 (G52)	1 field containing short cereal crop	2.36	2.29	1.3 (56.76%) 0.8ha Res	• Probable archaeological complex • Numerous pit-type responses • Former field boundary • Broad background response due to frequent ferrous material within topsoil
AS20 (G53-G54)	1 field containing short cereal crop	1.75	1.75	0.91 (52%) 0.56ha Res	• Probable archaeological complex • Numerous pit-type responses • Former field boundary • Broad background response due to frequent ferrous material within topsoil
AS21 (G55)	1 field containing rough overgrown vegetation	0.76	0.76	0.34 (44.7%)	• Area of increased response, pit-type responses • Series of plough trends
AS22 (G56)	1 field containing rough overgrown pasture	0.68	0.68	0.37 (54%)	• Possible ditch • 2 pit-type responses • Area of increased background response – probably modern
AS23	1 field containing rough overgrown pasture	2.2	2.2	0	• Broad areas of modern magnetic interference adjacent to road • Steep gradient unsuitable for detailed survey
AS34 (G57-G71)	1 field recently harrowed	15.67	15.67	6.57 (41.9%)	• Occasional pit-type responses • Former field boundaries • Broad background response
AS35 (G72)	1 field containing stubble Broad area unsuitable for survey due to disused water treatment plant	1.13	0.97	0.41 (42.26%)	• 1 curvilinear trend – possible small ditch • Magnetic interference from adjacent structures

Survey Area	Description of Ground Conditions	Size (ha)	Area scanned (ha)	Area surveyed in detail (ha)	Notes
AS36 (G74-G75)	1 field containing stubble	1.2	1.2	0.48 (40%)	• 1 pit-type response • 1 fragmented linear response – possible ditch • Magnetic interference from manhole covers
AS37 (G76)	1 field containing stubble Broad area unsuitable for survey due to farm buildings and dumping	1.15	1.15	0.4 (34.8%)	• Former field boundary • Series of plough trends • Broad area of magnetic interference from adjacent buildings
AS38	1 field containing stubble	0.27	0.27	0	• Low level of background response during gradiometer scanning
AS39	1 field containing rough overgrown pasture	0.5	0.5	0	• Strong magnetic interference throughout
AS41 (G77-G78)	1 field containing stubble	2.47	2.46	0.96 (39%)	• Linear responses – prob agricultural • Linear ferrous response represents former boundary • Broad level of background response
AS43	3 small fields containing pasture	0.12	0.12	0	• Broad level of background response
AS44	2 small fields containing pasture	0.11	0.11	0	• Broad level of background response
AS45	2 areas containing short pasture	1.1	1.1	0	• Broad level of background response
AS46	1 area containing short pasture	0.49	0.49	0	• Broad level of background response
AS47	Area unsuitable for survey due to modern landscaping	0.07	0	0	
AS48	Area unsuitable for survey due to modern landscaping	0.1	0	0	
AS49 (G79-G80)	1 area containing sports field	1.73	1.73	0.59 (34.1%)	• Linear response – prob ditch • 1 pit-type response • Series of plough trends • Broad area of magnetic interference from goal posts
AS50 (G81-G82)	1 area containing sports field	2.99	2.99	1.2 (40.1%)	• Linear responses – prob ditch • Series of plough trends
AS52 (G83-G84)	1 field containing short cereal crop	1.61	1.61	0.72 (44.7%)	• Curvilinear response thought to represent townland boundary • 3 pit-type responses

Survey Area	Description of Ground Conditions	Size (ha)	Area scanned (ha)	Area surveyed in detail (ha)	Notes
					• Broad areas of magnetic disturbance – modern services?
AS53	St Stephens Green unsuitable for survey due to modern landscaping	1.61	0	0	
AS54	Area unsuitable for detailed survey due to modern landscaping	0.11	0.11	0	• Broad level of background response
AS55	1 area containing short grass	0.59	0.59	0	• Broad areas of magnetic interference from adjacent buildings
AS56	1 area unsuitable for survey due to modern landscaping	0.13	0	0	
AS57	1 area unsuitable for survey due to modern landscaping	0.17	0	0	
AS58	1 area adjacent to Swords bypass	0.2	0.2	0	• Broad areas of magnetic interference from modern ground disturbance
AS59	1 area adjacent to Swords bypass	0.17	0.17	0	• Broad areas of magnetic interference from modern ground disturbance
AS60	Area unsuitable for survey due to modern landscaping	0.28	0.28	0	• Broad areas of magnetic interference from modern ground disturbance
AS61	Area unsuitable for survey due to modern landscaping	0.28	0.28	0	• Broad areas of magnetic interference from modern ground disturbance
AS62	Area unsuitable for survey due to modern landscaping	0.19	0	0	
AS63 (G72-G73)	2 fields containing stubble	1.6	1.6	0.45 (28%)	• One pit-type response • Probable field boundary • Broad area of magnetic interference from modern dump
AS64	Area unsuitable for survey due to modern landscaping	0.44	0		