STRATASCAN

Geophysical Survey Report

Oasby, Heydour Grantham

for

Archaeological Project Services

August 2006

J2199

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Document Title:	**Geophysical Survey Report** **Oasby, Grantham** Heydour
Client:	**Archaeological Project Services**
Stratascan Job No:	**J2199**
Techniques:	**Detailed magnetic survey (gradiometry)**
National Grid Ref:	**TF ~~002 385~~ 0032 3875**

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Project Manager:	**Simon Stowe BSc. (Hons)**
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LIST OF FIGURES

1 SUMMARY OF RESULTS

A geophysical survey undertaken over land due to be developed as a treatment works in Oasby, near Grantham, has located a number of anomalies of possible archaeological origin. Positive linear and area anomalies highlight possible cut features whilst possible former banks or earthworks have been identified by the presence of negative linear anomalies. A number of discrete positive anomalies have been located which may indicate pits of an archaeological origin.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Archaeological Project Services to undertake a geophysical survey of an area outlined for development as a sewage treatment plant.

2.2 Site location

The site is located within Oasby, near Grantham at OS ref. TF 002 385.

2.3 Description of site

The survey area consists of approximately 1ha of agricultural land currently used for pasture. Hedges and wire fences caused some obstruction during the survey.

2.4 Geology and soils

The underlying geology is Inferior Oolite (British Geological Survey South Sheet, Fourth Edition Solid, 2001). The overlying soils are known as Elmton 3 soils which are derived from the Jurassic limestone and clay. These consist of shallow well drained brashy calcareous fine loamy soils (Soil Survey of England and Wales, Sheet 4 Eastern England).

2.5 Site history and archaeological potential

Crop marks indicate the presence of a ring-ditch immediately to the west of the survey area and there is a possibility of the presence of a shrunken medieval settlement at the northern end of the site. These factors may contribute to the archaeological potential of the site.

2.6 Survey objectives

The objective of the survey was to locate any features of possible archaeological significance in order that they may be assessed prior to development.

2.7 Survey methods

Detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over 1 day on the 7th August 2006. Weather conditions during the survey were clear and sunny.

3.2 Grid locations

The location of the survey grid has been plotted in Figure 2 together with the referencing information. Grids were set out using a Leica 705auto Total Station and referenced to suitable topographic features around the perimeter of the site.

3.3 Survey equipment

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each sensor has a 1m separation between the sensing elements increasing the sensitivity to small changes in the Earths magnetic field.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

3.4.2 Depth of scan and resolution

The Grad601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution.

3.4.3 Data capture

The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Processing is performed using specialist software known as *Geoplot 3*. This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all processed gradiometer data used in this report:

1. *Despike* (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)

   Geoplot parameters:
   X radius = 1, y radius = 1, threshold = 3 std. dev.
   Spike replacement = mean

2. *Zero mean grid* (sets the background mean of each grid to zero and is useful for removing grid edge discontinuities)

   Geoplot parameters:
   Threshold = 0.25 std. dev.

3. *Zero mean traverse* (sets the background mean of each traverse within a grid to zero and is useful for removing striping effects)

Geoplot parameters:
Least mean square fit = off

3.5.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the raw data both as greyscale (Figure 3) and trace plots (Figures 4 and 5), together with a greyscale plot of the processed data (Figure 6). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 7).

4 RESULTS

The geophysical survey undertaken at Oasby has located a number of anomalies of possible archaeological origin.

A number of parallel positive linear anomalies can be noted in the northern limits of the survey area. These features represent agricultural activity on site such as ridge and furrow. Other positive linear anomalies, more irregular in character, are evident in the central and southern areas of the site. These anomalies indicate the presence of cut features, such as ditches, and may be of an archaeological origin.

Positive area anomalies are evident across the survey area. These areas may be of archaeological origin and represent cut features such as pits. These anomalies are concentrated in the southern limits of the site; however similar anomalies can be noted in the central and northern areas of the site.

Negative linear anomalies can be noted in the southern and central areas of the site representing possible former earthworks or banks of an archaeological nature. The majority of these anomalies have a northwest to southeast orientation and are often in close proximity to positive linear anomalies representing cut features of possible archaeological origin.

Discrete positive anomalies are evident within the survey area with a particular concentration in the southern limits. These anomalies have been interpreted as possible pits of archaeological origin.

Two large areas of magnetic variation can be noted in the northern limits and central section of the survey area. This variation seems to suggest that some form of ground disturbance has taken place.

Bipolar anomalies are evident in the southern limits of the survey area. These anomalies represent buried ferrous objects.

5 CONCLUSION

The gradiometer survey undertaken in Oasby, near Grantham, has been successful in locating a number of anomalies of possible archaeological potential. Positive linear and area anomalies indicate the presence of cut features such as ditches. Negative anomalies provide evidence for former banks or earthworks. The majority of these anomalies seem to occur to the south of the field boundary and therefore may suggest a centre of activity. However, this is not certain due to the small survey area. A cluster of discrete positive anomalies, indicating the presence of possible pits, are located in the southern limits of the survey area.

Two large areas of ground disturbance can be noted in the northern limits and centre of the site. The origin of this disturbance remains unknown.

Bipolar anomalies, representing buried ferrous objects can be seen clustered in the southern limits of the survey area.

APPENDIX A – Basic principles of magnetic survey

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremnant* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

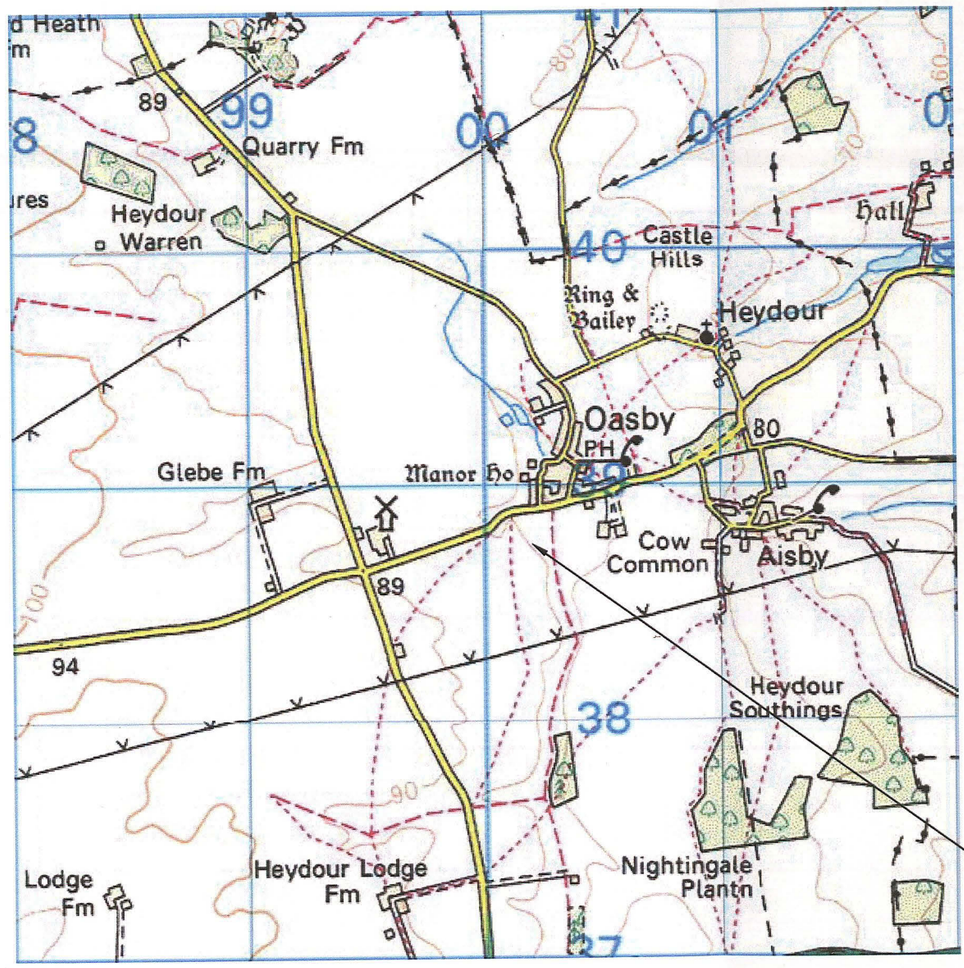
Thermoremnance is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremnant archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically either 0.5 or 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

OS 100km square = TF



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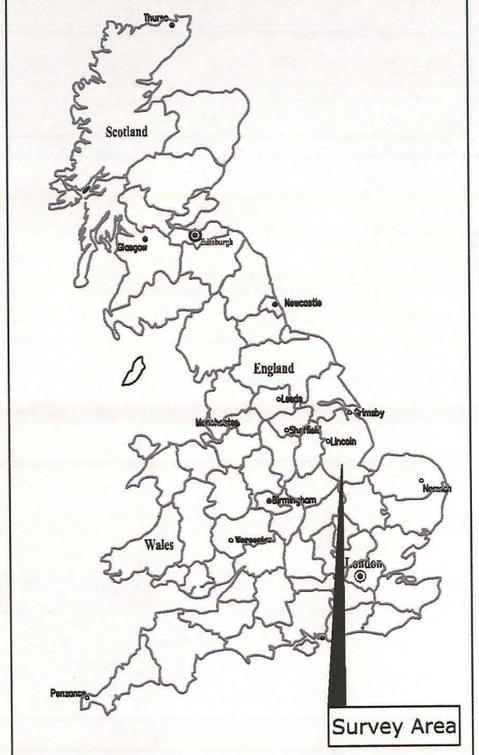

Site centred on NGR TF 002 385

Client
ARCHAEOLOGICAL PROJECT SERVICES

Project Title Job No. 2199
GEOPHYSICAL SURVEY - OASBY TREATMENT WORKS

Subject
LOCATION PLAN OF SURVEY AREA

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REGISTERED ORGANISATION IFA

Scale 1:25 000 — 0m 500 1000m

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Survey date	Drawn by	Figure No.
AUG 06	RAJS	01

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		-

REFERENCING INFORMATION

A-B	60m	A-C	164.32m	A-D	167.91m
A-E	224.18m	B-F	184.63m	B-G	41.99m
B-H	9.45m	G-H	50m		

A-B	Base line
C, D, E	Referencing points
2	Grid number
	Area surveyed within grid

Client
ARCHAEOLOGICAL PROJECT SERVICES

Project Title — Job No. 2199
GEOPHYSICAL SURVEY -OASBY TREATMENT WORKS

Subject
SITE PLAN SHOWING LOCATION OF SURVEY GRIDS AND REFERENCING

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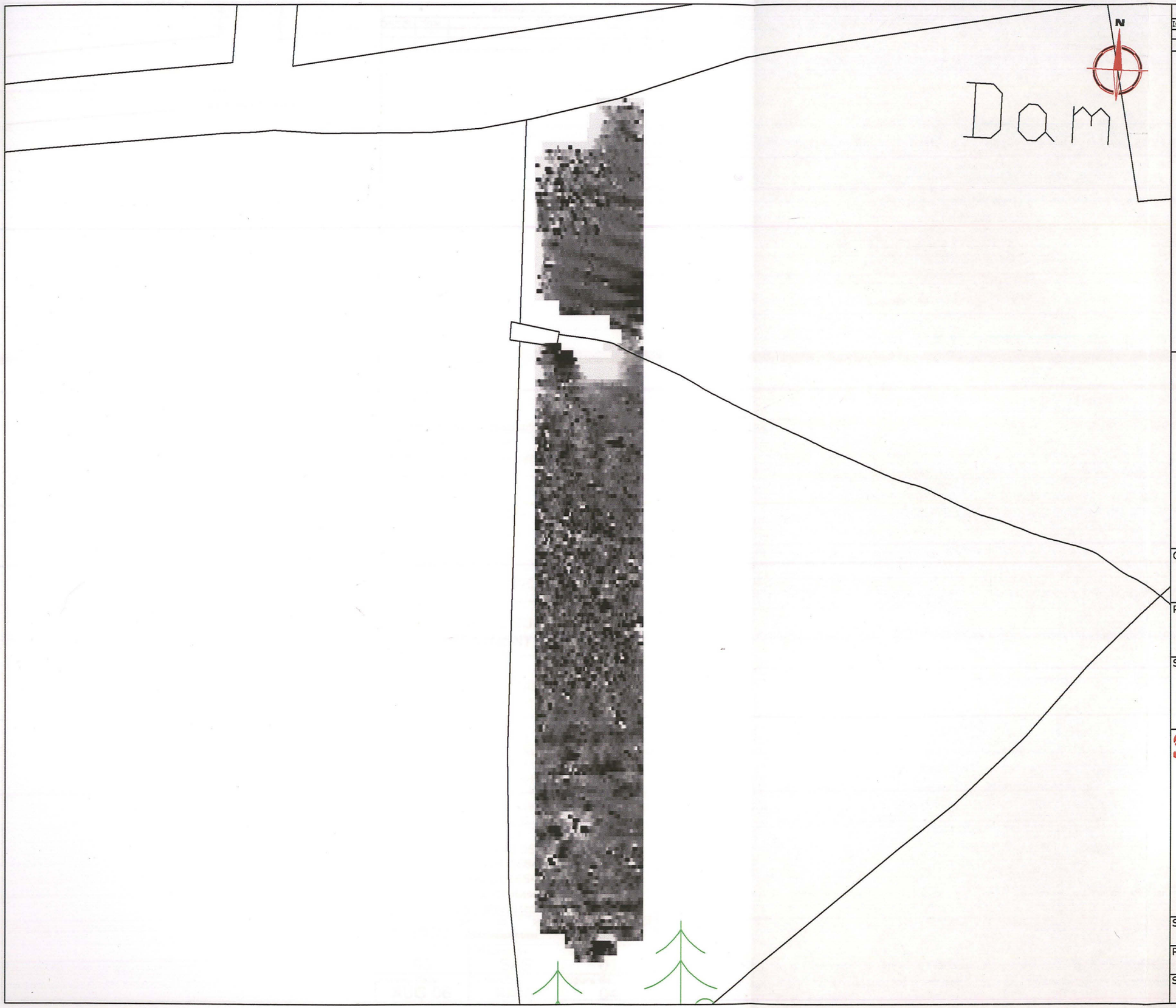

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Minimum -5nT (white)

-3SD +3SD

+5nT

-5nT

Client
ARCHAEOLOGICAL PROJECT SERVICES

Project Title Job No. 2199
GEOPHYSICAL SURVEY -OASBY TREATMENT WORKS

Subject
PLOT OF RAW GRADIOMETER DATA

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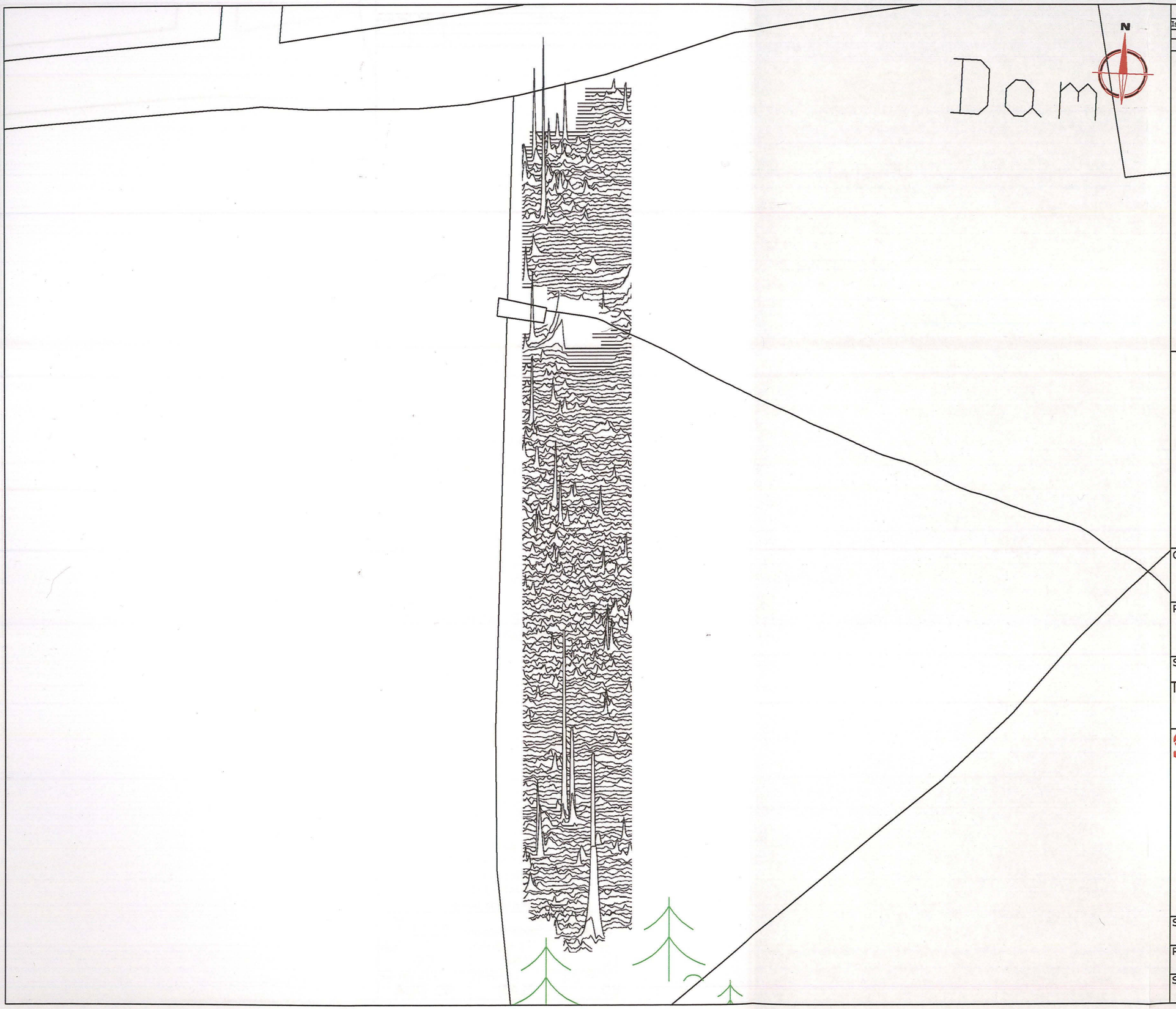

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80nT
40nT
0nT

Client
ARCHAEOLOGICAL PROJECT SERVICES

Project Title — Job No. 2199
GEOPHYSICAL SURVEY -OASBY TREATMENT WORKS

Subject
TRACE PLOT OF GRADIOMETER DATA SHOWING POSITIVE VALUES

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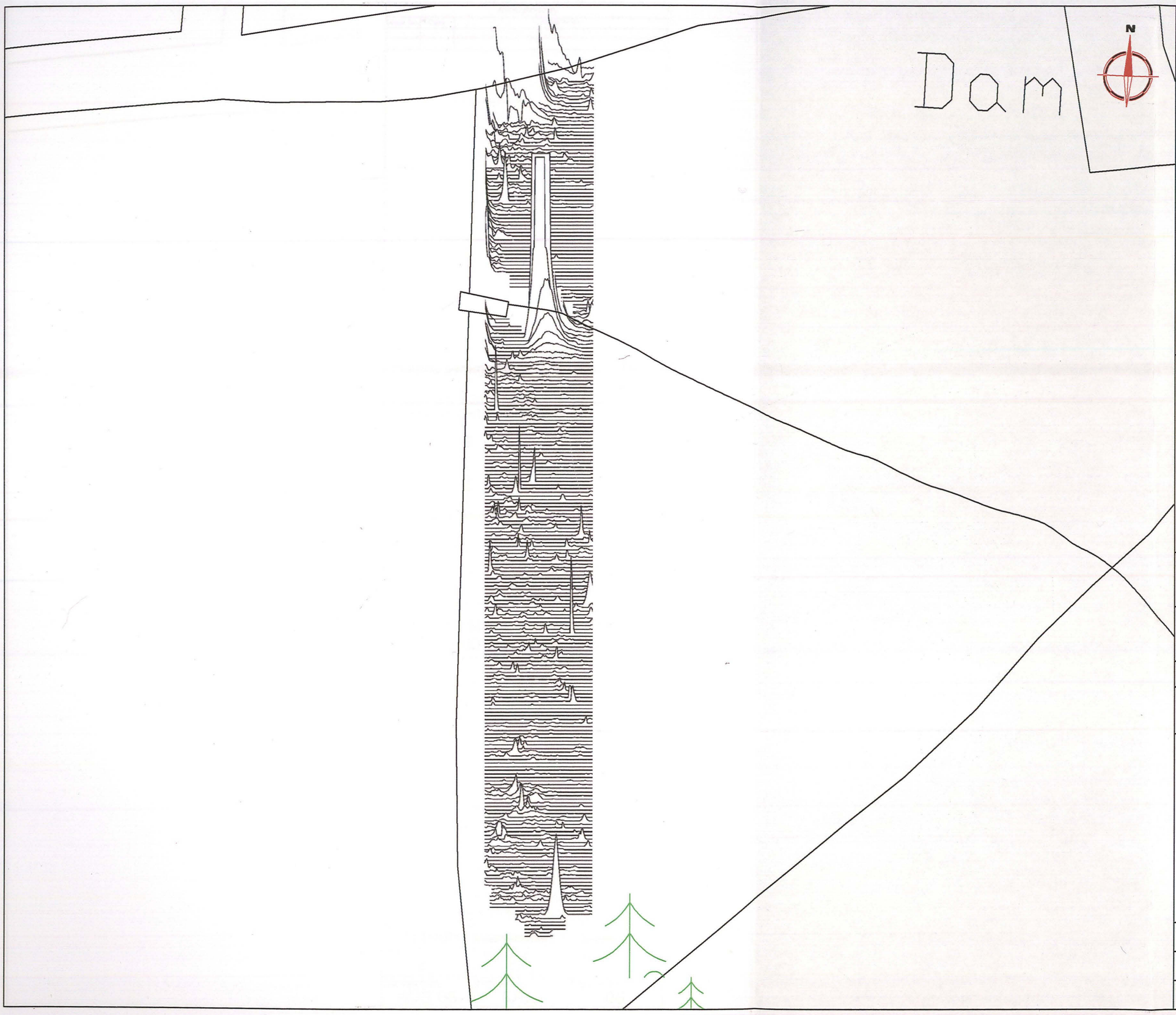

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Plotting parameters

-40nT

(*Negative values displace above the trace line. Hidden values have not been plotted*)

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-160nT
-120nT
-80nT
-40nT
0nT

Client
ARCHAEOLOGICAL PROJECT SERVICES

Project Title — Job No. 2199
GEOPHYSICAL SURVEY -OASBY TREATMENT WORKS

Subject
TRACE PLOT OF GRADIOMETER DATA SHOWING NEGATIVE VALUES

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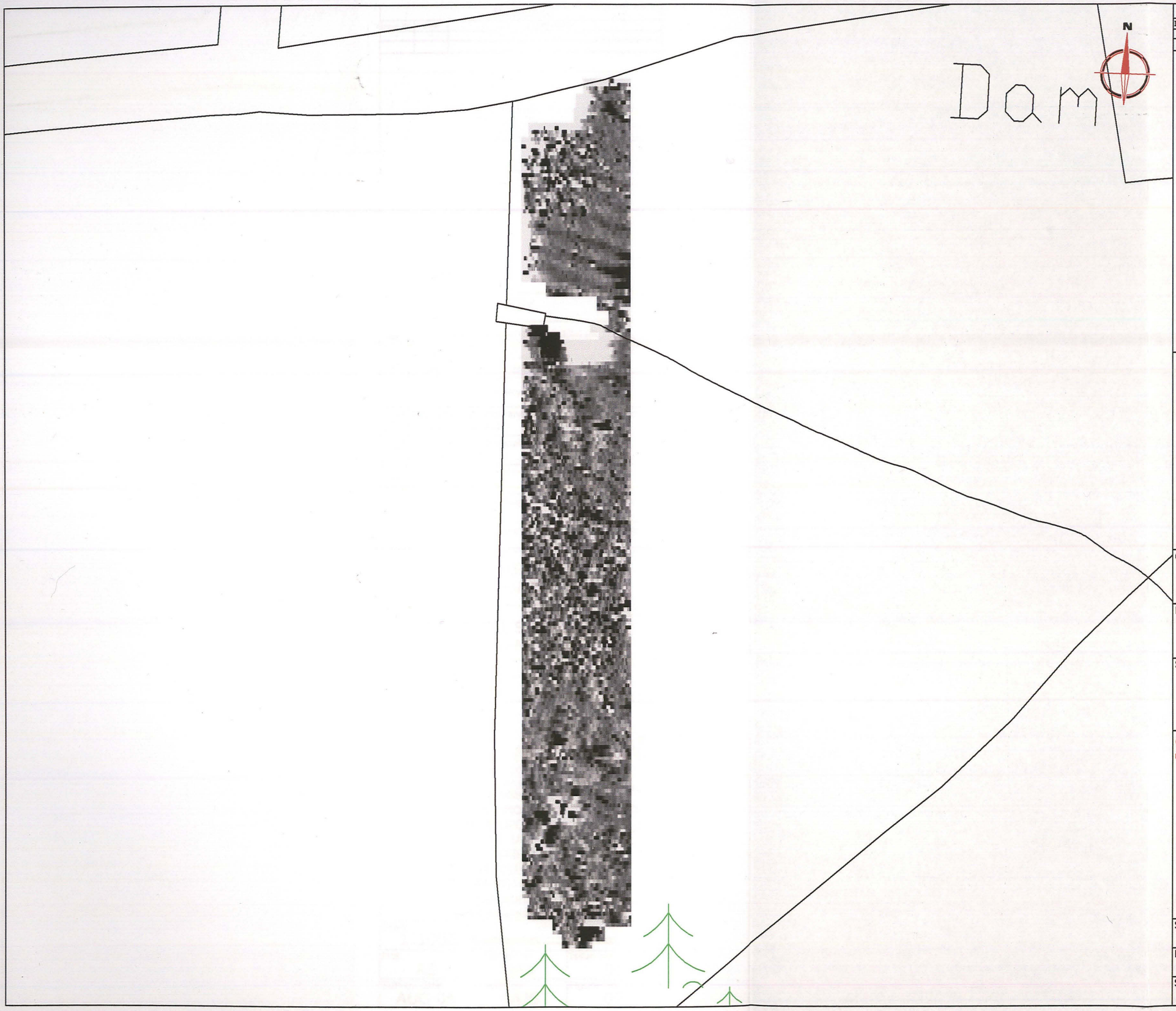

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Minimum -3nT (white)

-3SD +3SD

+3nT

-3nT

Client
ARCHAEOLOGICAL PROJECT SERVICES

Project Title Job No. 2199
GEOPHYSICAL SURVEY -OASBY TREATMENT WORKS

Subject
PLOT OF PROCESSED GRADIOMETER DATA

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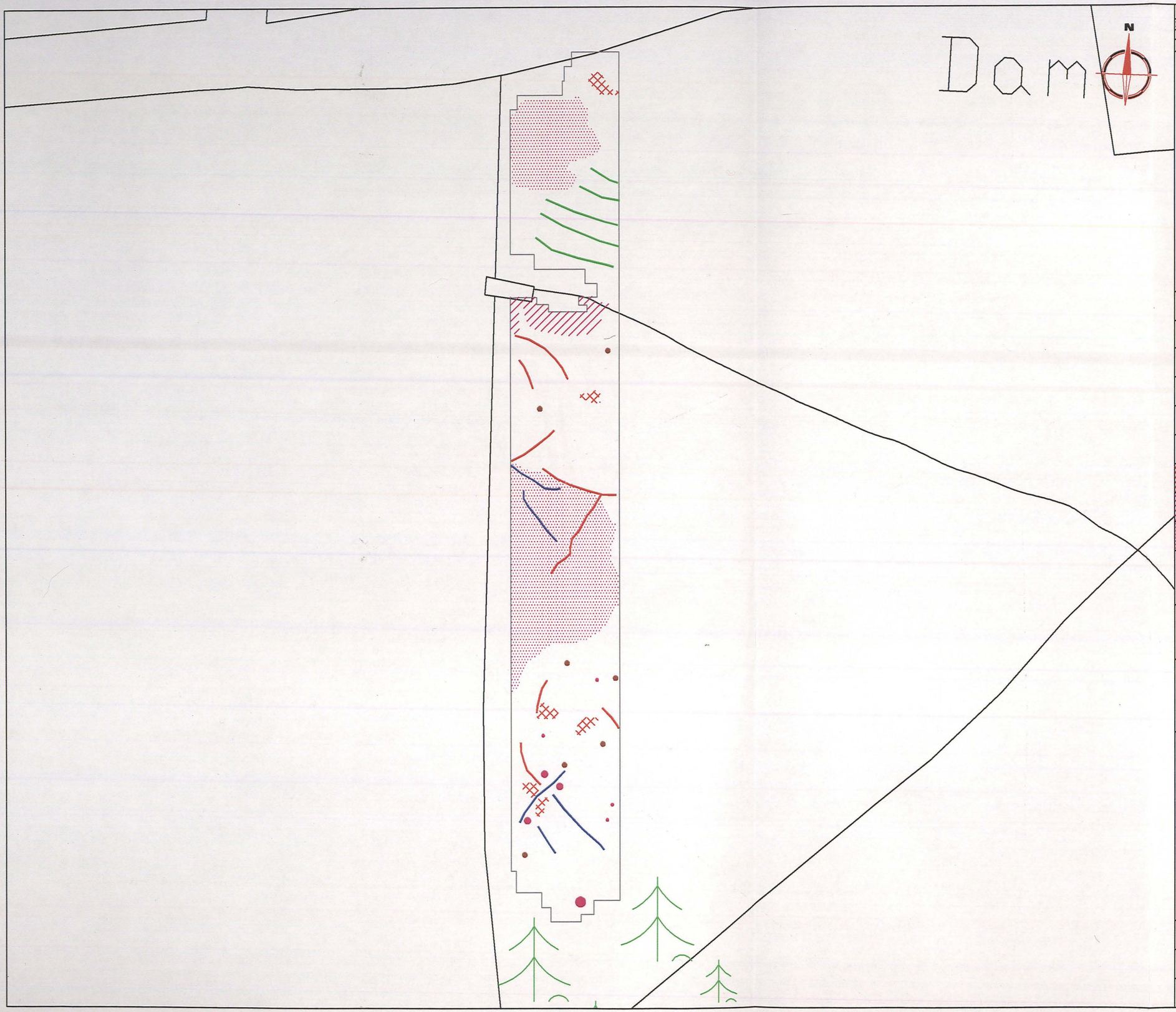

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KEY

- Discrete positive anomaly - possible pit
- Positive anomaly with associated negative response - ferrous object
- Positive linear anomaly - agricultural mark
- Positive linear anomaly - cut feature of possible archaeological origin
- Negative linear anomaly- possible former earthwork/bank
- Positive area anomaly- cut feature of possible archaeological origin
- Area of magnetic disturbance- related to metal fences etc
- Area of magnetic variation - evidence of ground disturbance

Client
ARCHAEOLOGICAL PROJECT SERVICES

Project Title — Job No. 2199
GEOPHYSICAL SURVEY -OASBY TREATMENT WORKS

Subject
ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES

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Survey date	Drawn by	Figure No.
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