

# GEOPHYSICAL SURVEY REPORT

# sumo

Survey

GEOPHYSICS FOR  
ARCHAEOLOGY &  
ENGINEERING

## High Carlingill Native Settlement Project

Client

**Lunesdale Archaeological Society**

Survey Report

**13019**

Date

**July 2018**

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## GEOPHYSICAL SURVEY REPORT

Project name:  
**High Carlingill Native Settlement  
Project**

SUMO Job reference:  
**13019**

Client:  
**Lunesdale Archaeological Society**

Survey date:  
**25 June, 7 July 2018**

Report date:  
**23 July 2018**

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## TABLE OF CONTENTS

1	SUMMARY OF RESULTS	1
2	INTRODUCTION	1
3	METHODS, PROCESSING & PRESENTATION	2-3
4	RESULTS	3-5
5	DATA APPRAISAL & CONFIDENCE ASSESSMENT	5
6	CONCLUSION	6
7	REFERENCES	6
	Appendix A	Technical Information: Magnetometer Survey Method
	Appendix B	Technical Information: Magnetic Theory
	Appendix C	Aerial Photogrammetry - Processing Report
	Appendix D	Archaeological Walkover Survey Report
	Appendix E	Text Accompanying RCHME Survey of 1993

## LIST OF FIGURES

Figure 01	1:25 000	Site Location Diagram
Figure 02	1:1250	Location of Survey Areas
Figure 03	1:1250	Magnetometer Survey - Greyscale Plots
Figure 04	1:1250	Magnetometer Survey - Interpretation
Figure 05	1:1250	Minimally Processed Data – Greyscale Plots
Figure 06	1:1250	Aerial Survey - Digital Elevation Model
Figure 07	1:1500	Walkover Survey - Recorded Sites and Features
Figure 08	1:1250	Walkover Survey Results and Geophysical Interpretation overlain on RCHME Survey Results

## 1 SUMMARY OF RESULTS

A combined magnetometer, aerial photogrammetry and archaeological walkover survey was conducted on an area of land at High Carlingill to the south of Tebay, Cumbria. A number of features associated with the 'native settlement' on the site have been identified, including hut circles, ditches, banks, terraces and hollow ways and agricultural activity in the vicinity. The features related to the settlement show potential evidence of multiple phases of activity. Other natural and modern features have been detected, including palaeochannels, tracks and a possible area of quarrying.

## 2 INTRODUCTION

### 2.1 Background synopsis

**SUMO Geophysics Ltd** were commissioned to undertake a combined geophysical, aerial photogrammetry and walkover survey of an area as part of a research project into the 'native settlement' at High Carlingill. This survey forms part of an archaeological investigation being undertaken by **Lunesdale Archaeological Society**.

The walkover survey was conducted by members of the Lunesdale Archaeological Society, supervised by Dan Elsworth of Greenlane Archaeology. The geophysical and aerial surveys were conducted by field staff from SUMO Geophysics and SUMO Aerial Surveys.

### 2.2 Site details

<b>NGR / Postcode</b>	NY 613 007 / CA10 3XX
<b>Location</b>	The site is located approximately 3.5km south of Tebay, Cumbria and is bound by Fairmile Road to the west and woodland to the north.
<b>HER/SMR</b>	Cumbria
<b>District</b>	South Lakeland
<b>Parish</b>	Tebay CP
<b>Topography</b>	Sloping down from north to south, undulating
<b>Current Land Use</b>	Rough pasture
<b>Geology</b>	Solid: Coniston Group - sandstone, siltstone and mudstone. Superficial: Till, Devensian - diamicton (BGS 2018).
<b>Soils</b>	Cegin Association (713d) - slowly permeable seasonally waterlogged fine silty and clayey soils (SSEW 1983).
<b>Archaeology</b>	The native settlement at High Carlingill has been subject to previous archaeological survey work (RCHME 1993), whereby a late prehistoric enclosed settlement comprising at least four contiguous enclosures and hut platforms were identified (See Appendix E). The Roman fort at Low Borrowbridge lies to the north of the site indicating that the site lies within an archaeologically rich landscape.
<b>Survey Methods</b>	Magnetometer survey (fluxgate gradiometer)
<b>Study Area</b>	3.6 ha - magnetometer 9.5 ha - aerial photogrammetry 7 ha - walkover

### 2.3 Aims and Objectives

To locate and characterise any anomalies associated with the 'native settlement' at High Carlingill on the east side of the Lune Valley, and to re-examine and identify remains detected in the previous archaeological survey work (RCHME 1993).



### 3 METHODS, PROCESSING & PRESENTATION

#### 3.1 Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (CIfA 2014) and the European Archaeological Council (EAC 2016).

#### 3.2 Survey methods

Detailed magnetic survey and aerial photogrammetry were chosen as efficient and effective methods of locating archaeological anomalies. To compliment this, an archaeological walkover survey was conducted to assess the features on the ground and aid the interpretation of both geophysical and photogrammetric results.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1.0m	0.25m
Photogrammetry	UAV with gimbal mounted camera	N/A	1.35cm/pix

More information regarding the magnetometer technique is included in Appendices A and B.

#### 3.3 Walkover Survey

A walk-over survey was carried out to Historic England Level-1 type standards (Historic England 2017) and according to the guidelines of the Chartered Institute for Archaeologists (CIfA 2014a). This is a relatively low-level of investigation intended to provide basic descriptive details about each site of archaeological or historical interest within the Level 1 survey area and the site as a whole. It comprised three types of recording:

***Drawn Record:***

the grid coordinates of each site or find of archaeological or historical interest were recorded using a Garmin Etrex GPS, accurate to within c5m and subsequently marked on a digital plan of the site;

***Written Record:***

a basic descriptive record of each site was made on Greenlane Archaeology standard *pro forma* record sheets. These records describe each site's form, size, and (where possible) function and date. In addition, the landscape and historic setting of the site was described, in particular its relationship with other sites identified, field boundaries, and the local topography;

***Photographic record:***

photographs in 35mm colour print film and colour digital format (both 12 meg jpeg and RAW format) were taken of each site. A written record was kept of all of the photographs that were taken detailing the direction, size of scale, date, and identity of the photographer. The digital photographs have also been used for illustrative purposes within the report.

For more information and the complete walkover survey report (GA 2018) see Appendix D.

#### 3.4 Data Processing

##### 3.4.1 Magnetometer

The following basic processing steps have been carried out on the data used in this report:

De-stripe; de-stagger; interpolate

### 3.4.2 **Aerial**

The data images are processed in photogrammetry software to generate point cloud, mesh and textured models of the ground surface.

The Digital Elevation Model (DEM) files are processed further using relief visualisation tools or geographical information systems software.

A detailed processing report with further technical information for this technique is included in Appendix C.

## 3.5 **Presentation of results and interpretation**

### 3.5.1 **Magnetometer**

The presentation of the results includes a 'minimally processed data' and a 'processed data' greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the 'Interpretation' drawings.

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: *Abbey Wall* or *Roman Road*. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: *Probable*, or *Possible Archaeology*. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification *Possible*.

### 3.5.2 **Aerial**

Output files are generated in the form of a georeferenced DEM which can be seen in Figure 06.

## 4 **RESULTS**

*The survey has been divided into three survey areas (Areas 1-3) and specific anomalies have been given numerical labels [1] [2] (magnetometer) and [A] [B] (walkover) which appear in the text below, as well as on the Interpretation Figures.*

### 4.1 **Magnetometer Survey**

#### ***Probable / Possible Archaeology***

- 4.1.1 Several weakly enhanced, small sub-circular anomalies [1-7], each approximately 7m in diameter are present in Area 1; they correspond with small earthwork 'hut circles' which have been previously recorded on the RCHME survey (1993). The responses from these features are magnetically weak, and without the archaeological context it is probable that they would be interpreted as being of natural origin, reflecting topographic effects on the instruments.

- 4.1.2 A curvilinear band of enhanced response [8] aligns with earthwork features visible in the aerial photogrammetry, noted during the walkover survey and recorded in the previous archaeological survey (*ibid*); it represents the outer enclosure bank of the native settlement.
- 4.1.3 Further weak sub-circular and irregularly shaped anomalies [9-10] represent additional possible hut circles. Their response is similar to those of anomalies [1-7] but do not correspond with earthwork features identified in the previous RCHME survey work or aerial survey.
- 4.1.4 A weak linear trend [11] running north/south in the east of the area has also been classified as having possible archaeological origins. It approximates with the location of a possible post-medieval trackway visible in both the walkover survey results and photogrammetry data.
- 4.1.5 A weak negative linear trend [12] in the west of the area could be related to a former bank or earthwork of possible archaeological origin. The response appears to correlate, in part, with a possible terrace visible in the results of the walkover survey, which is thought to be related to the settlement site itself.
- 4.1.6 Two curving linear responses [14-15] have been detected extending towards the north of the survey area. These align with ditches identified in the walkover survey and photogrammetry and may relate to former hollow ways.
- 4.1.7 A sinuous, curving linear anomaly [16] in the north-west of the site could be of archaeological or natural origin. The alignment and morphology of the response is similar to that of the possible hollow ways detected to the east; however, it has not been identified in the walkover survey. The aerial data indicates the presence of a broad, sinuous anomaly in the same location, which is suggestive of a palaeochannel.
- 4.2 **Agricultural – Modern Track**
- 4.2.1 A curving linear alignment of magnetic debris [17] in the north of the site is related to a modern track, visible on current OS mapping as well as the aerial photogrammetry data.
- 4.3 **Natural / Geological / Pedological / Topographic**
- 4.3.1 Sinuous bands of enhanced magnetic response in the north of the area are thought to have natural origins, i.e. relating to palaeochannels. The anomalies correspond to the location of a watercourse visible on the OS base-mapping.
- 4.4 **Ferrous / Magnetic Disturbance**
- 4.4.1 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.
- 4.5 **Aerial Survey**
- 4.5.1 Earthwork ditches and small raised areas are visible in the area of the 'native settlement', many of which correspond with features detected in the magnetometer survey and walkover results. It is likely that the small raised mounds / platforms relate to hut circles. These appear to be enclosed by a bounding ditch and bank at the southern and northern extents.

4.5.2 Two linear ditch-like features are visible in the northern part of the area. These correspond with two possible hollow ways which are visible in the walkover survey results (discussed below).

4.5.3 Sinuous and curvilinear cut features are visible in the north-east of the area and are probably a result of former water courses / palaeochannels.

#### 4.6 Archaeological Walkover Survey

4.6.1 A total of 10 'sites' (see Figure 07) of archaeological interest were identified within the study area, thought to cover several time periods, particularly prehistoric and post-medieval; however, many of the features are not readily dateable. These include the settlement site itself [I] and associated terraces [J]. Probable hollow ways [F-G] were visible in the walkover survey, as well as a possible post-medieval track [E] and palaeochannel [H] (GA 2018) (Appendix D).

4.6.2 The settlement site [I] comprises at least one phase, with an outer enclosure bank over 1m high and 2m wide, with numerous internal hut circles of relatively small size. The north side is less clear and seems to incorporate a number of shallow terraces on the north-east side.

4.6.3 Two hollow ways of uncertain date [F-G] have been recorded. The first [F] is visible as a large ditch running approximately north/south, typically up to 2m wide and 0.5m high, visible in both the magnetic and aerial survey results. It is joined by a number of shallower ditches, also visible in the aerial survey results. These are thought to represent a hollow way, or group of hollow ways, leading to the higher ground to the north-east. The second feature [G] comprises a short section of ditch up to 3m wide and less than 1m deep, orientated north-west/south-east. It probably represents a further hollow way and the photogrammetric survey suggests that it continues further to the south-east. This feature is not visible in the magnetic data.

4.6.4 A possible post-medieval track [E] runs approximately north-south through the east side of the settlement [I], before turning to the east. The feature overlies a potential earlier track, and was recorded during the earlier RCHME survey and aerial photogrammetry, but is only partially visible in the magnetic data.

4.6.5 A shallow rounded scoop cut into a slope [D], little more than 1m deep and 3m in diameter probably represents a small quarry of possible post-medieval date.

## 5 DATA APPRAISAL & CONFIDENCE ASSESSMENT

5.1 Historic England guidelines (EH 2008) Table 4 states that the average magnetic response on mudstone, siltstone and sandstone is poor but can be variable, as can results over superficial deposits of diamicton. The weak anomalies in this survey reflect this fact but the given the results reflect -hut circles and ditches possible hollow ways and palaeochannels, it can be determined that the technique has been effective.

5.2 The conditions for both the aerial and walkover surveys were favourable, with clear weather and few obstructions on the ground. Both techniques have been successful in identifying earthwork features associated with the native settlement and surrounding landscape.

## 6 CONCLUSION

- 6.1 The combined magnetometer, aerial photogrammetry and archaeological walkover survey at High Carlingill has identified a number of features associated with the 'native settlement' on the site. The results indicate that the settlement site lies within a wider landscape of archaeological remains. The walkover survey report (GA 2018) suggests that the majority of the features identified, namely hut circles, ditches, banks, terraces and hollow ways, relate to the period that the settlement was in use, however the remains cannot be dated without further investigative work. The features associated with the settlement show potential evidence of multiple phases of settlement, while the possible hollow ways that have been identified are most likely to be remnants of the agricultural regime that supported the site. Other natural and modern features have been detected, including palaeochannels, tracks and a possible area of quarrying.

## 7 REFERENCES

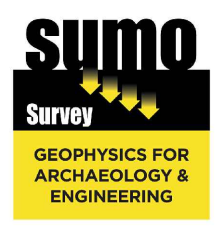
- BGS 2018 British Geological Survey, Geology of Britain viewer [Accessed 18/07/2018] *website:* (<http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps>)
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[http://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics\\_2.pdf](http://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_2.pdf)
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 Site Location

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Title:  
Site Location Diagram

Client:  
Lunesdale Archaeological Society

Project:  
13019 - High Carlingill Native Settlement Project

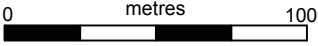
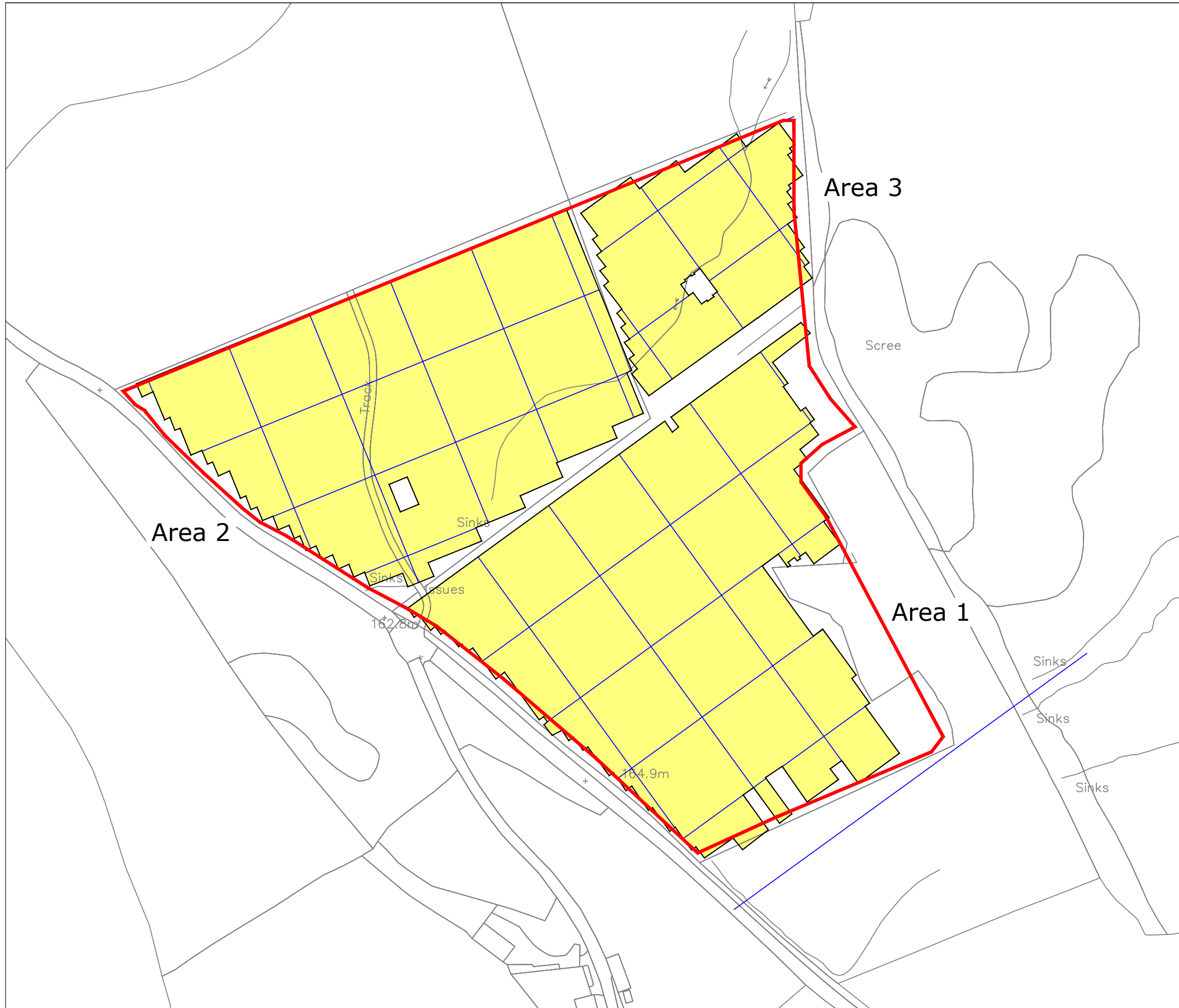

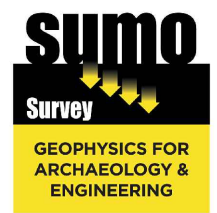
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Fig No:  
01



 Magnetometer Survey Areas - showing 30m grid



Title: Location of Survey Areas

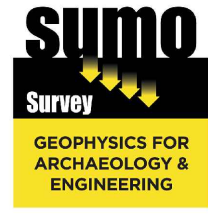
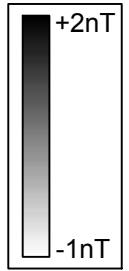
Client: Lunesdale Archaeological Society

Project: 13019 - High Carlingill Native Settlement Project

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Fig No: 02





Title:  
Magnetometer Survey - Greyscale Plots

Client:  
Lunesdale Archaeological Society

Project:  
13019 - High Carlingill Native Settlement Project

Scale:  
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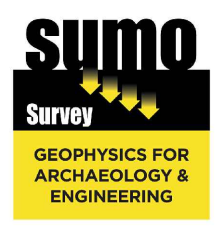
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### KEY

	Probable archaeology (discrete anomaly / trend)
	Possible archaeology (discrete anomaly / trend / area of increased response)
	Modern track
	Natural (e.g. geological / pedological)
	Ferrous



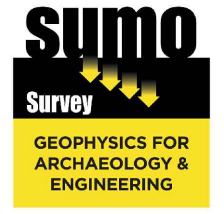
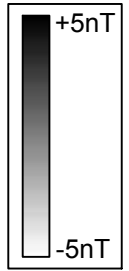
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Client: Lunesdale Archaeological Society

Project: 13019 - High Carlingill Native Settlement Project

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Fig No: 04



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Minimally Processed Data - Greyscale Plots

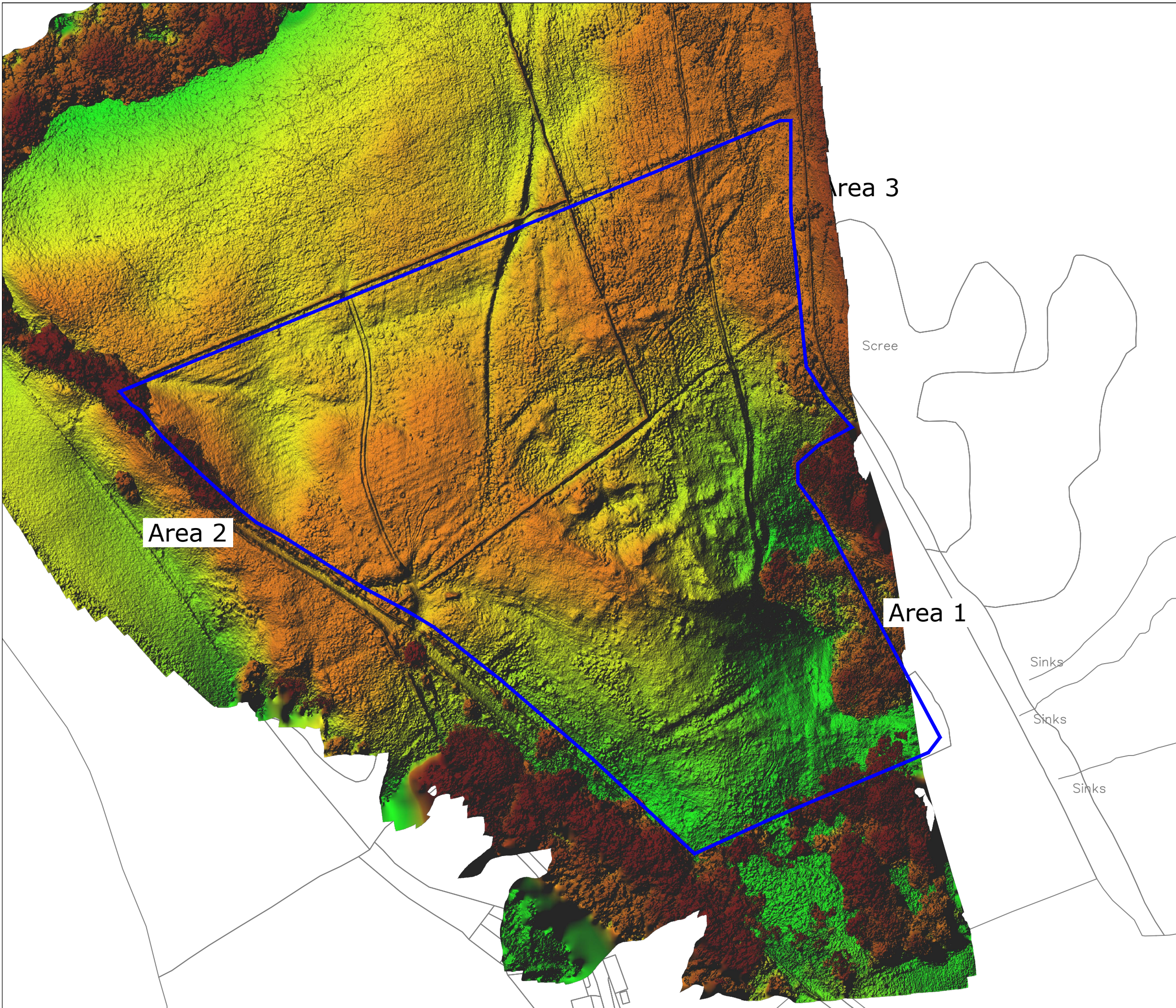
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Lunesdale Archaeological Society

Project:  
13019 - High Carlingill Native Settlement Project

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Fig No:  
05





Area 3

Scree

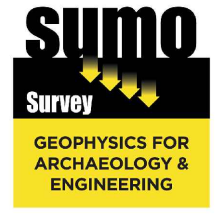
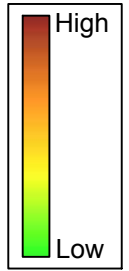
Area 2

Area 1

Sinks

Sinks

Sinks



Title:  
Aerial Survey - Digital Elevation Model

Client:  
Lunesdale Archaeological Society

Project:  
13019 - High Carlingill Native Settlement Project

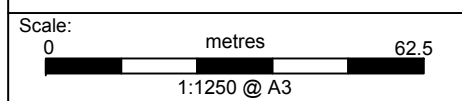



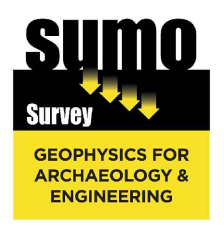
Fig No:  
06





Site	Type	Period
A	Culvert	Post-medieval?
B	Structure	Post-medieval?
C	Mound	Uncertain
D	Quarry	Uncertain
E	Track	Post-medieval?
F	Hollow way	Uncertain
G	Hollow way	Uncertain
H	Palaeochannel	Uncertain
I	Settlement	Prehistoric - Romano-British
J	Terraces / Road	Prehistoric - Romano-British

	Recorded feature
A	Feature label (see above table)



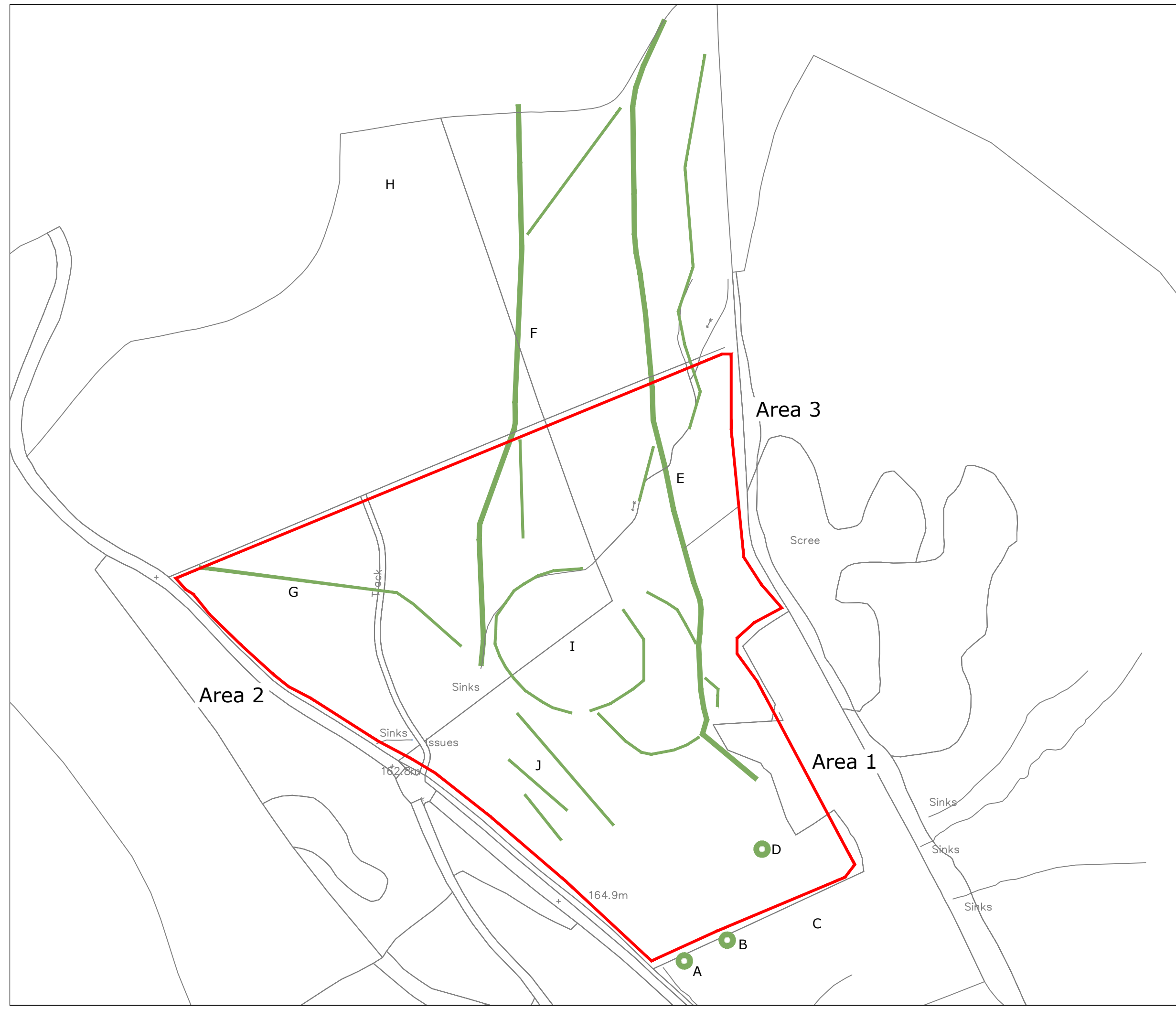
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Walkover Survey - Recorded Sites and Features

Client:  
Lunesdale Archaeological Society

Project:  
13019 - High Carlingill Native Settlement Project

Scale:  
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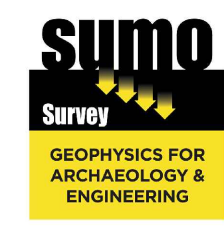
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07





**KEY**

	Probable archaeology (discrete anomaly / trend)
	Possible archaeology (discrete anomaly / trend / area of increased response)
	Modern track
	Natural (e.g. geological / pedological)
	Ferrous
	Walkover Survey feature



Title: Walkover Survey Results and Geophysical Interpretation overlain on RCHME Survey Results

Client: Lunesdale Archaeological Society

Project: 13019 - High Carlingill Native Settlement Project

Scale: 0 metres 62.5  
1:1250 @ A3

Fig No: 08

## Appendix A - Technical Information: Magnetometer Survey Method

### Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

### Instrumentation: **Bartington Grad 601-2**

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. 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 site survey, data is transferred to the office for processing and presentation.

### Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

### Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.
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## Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall, etc.*) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

<i>Archaeology / Probable Archaeology</i>	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
<i>Possible Archaeology</i>	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
<i>Industrial / Burnt-Fired</i>	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
<i>Former Field Boundary (probable &amp; possible)</i>	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
<i>Ridge &amp; Furrow</i>	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.
<i>Agriculture (ploughing)</i>	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
<i>Land Drain</i>	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
<i>Natural</i>	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
<i>Magnetic Disturbance</i>	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present. They are presumed to be modern.
<i>Service</i>	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
<i>Ferrous</i>	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
<i>Uncertain Origin</i>	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of <i>Possible Archaeology / Natural</i> or (in the case of linear responses) <i>Possible Archaeology / Agriculture</i> ; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).



## Appendix B - Technical Information: Magnetic Theory

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. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

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

Thermoremanence 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. Thermoremanent archaeological features can include hearths and kilns; 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 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 feature. The difference between the two sensors will relate to the strength of a magnetic field created by this 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 and disturbance from modern services.



## Appendix C - Photogrammetry: Processing Report

# HC-rpt

Processing Report

28 June 2018



# Survey Data

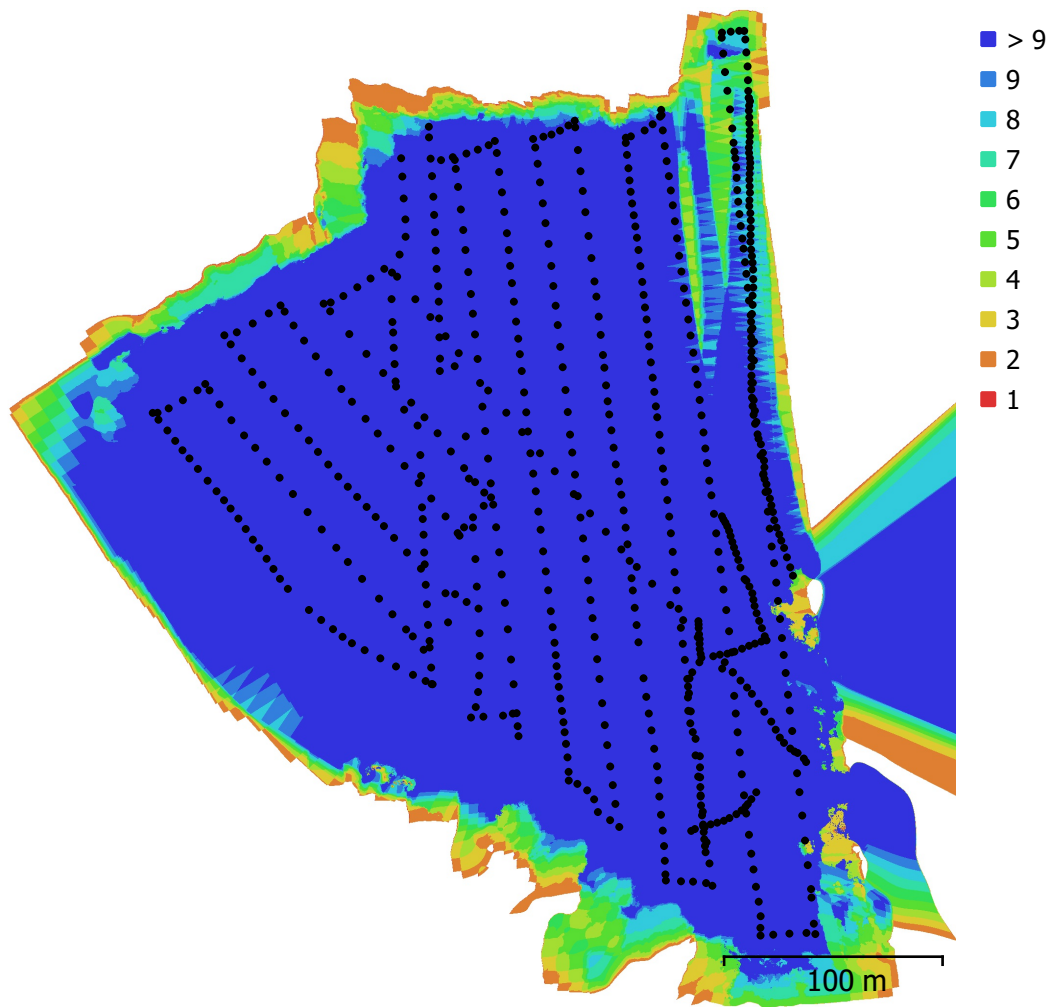


Fig. 1. Camera locations and image overlap.

Number of images:	690	Camera stations:	690
Flying altitude:	53.3 m	Tie points:	321,673
Ground resolution:	1.35 cm/pix	Projections:	1,372,932
Coverage area:	0.118 km <sup>2</sup>	Reprojection error:	2.66 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC6510 (8.8mm)	4856 x 3640	8.8 mm	2.61 x 2.61 $\mu$ m	No

Table 1. Cameras.

# Camera Calibration

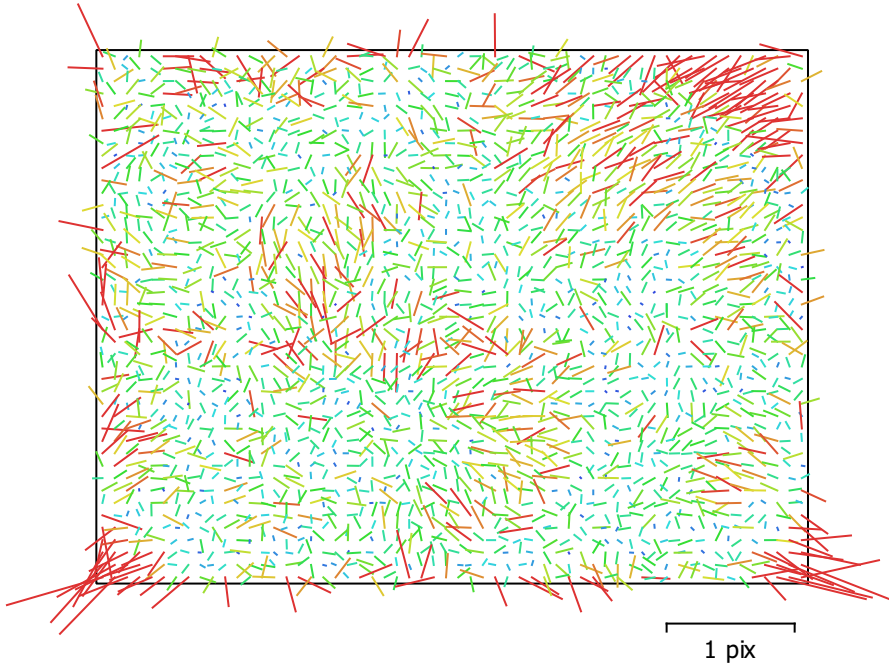


Fig. 2. Image residuals for FC6510 (8.8mm).

## FC6510 (8.8mm)

690 images

Type	Resolution	Focal Length	Pixel Size
<b>Frame</b>	<b>4856 x 3640</b>	<b>8.8 mm</b>	<b>2.61 x 2.61 <math>\mu</math>m</b>

	Value	Error	F	B1	B2	K1	K2	P1	P2
<b>F</b>	<b>3675.68</b>	0.49	1.00	-0.00	-0.48	-0.03	0.09	0.01	0.16
<b>B1</b>	<b>0.59143</b>	0.023		1.00	-0.02	-0.04	0.03	-0.33	-0.11
<b>B2</b>	<b>-0.337635</b>	0.024			1.00	-0.04	-0.03	0.07	-0.23
<b>K1</b>	<b>-0.00226962</b>	3.4e-05				1.00	-0.92	-0.03	0.01
<b>K2</b>	<b>0.00668092</b>	5.2e-05					1.00	-0.03	0.02
<b>P1</b>	<b>-0.000217198</b>	5.9e-06						1.00	-0.09
<b>P2</b>	<b>-0.00178242</b>	5.1e-06							1.00

Table 2. Calibration coefficients and correlation matrix.



# Ground Control Points

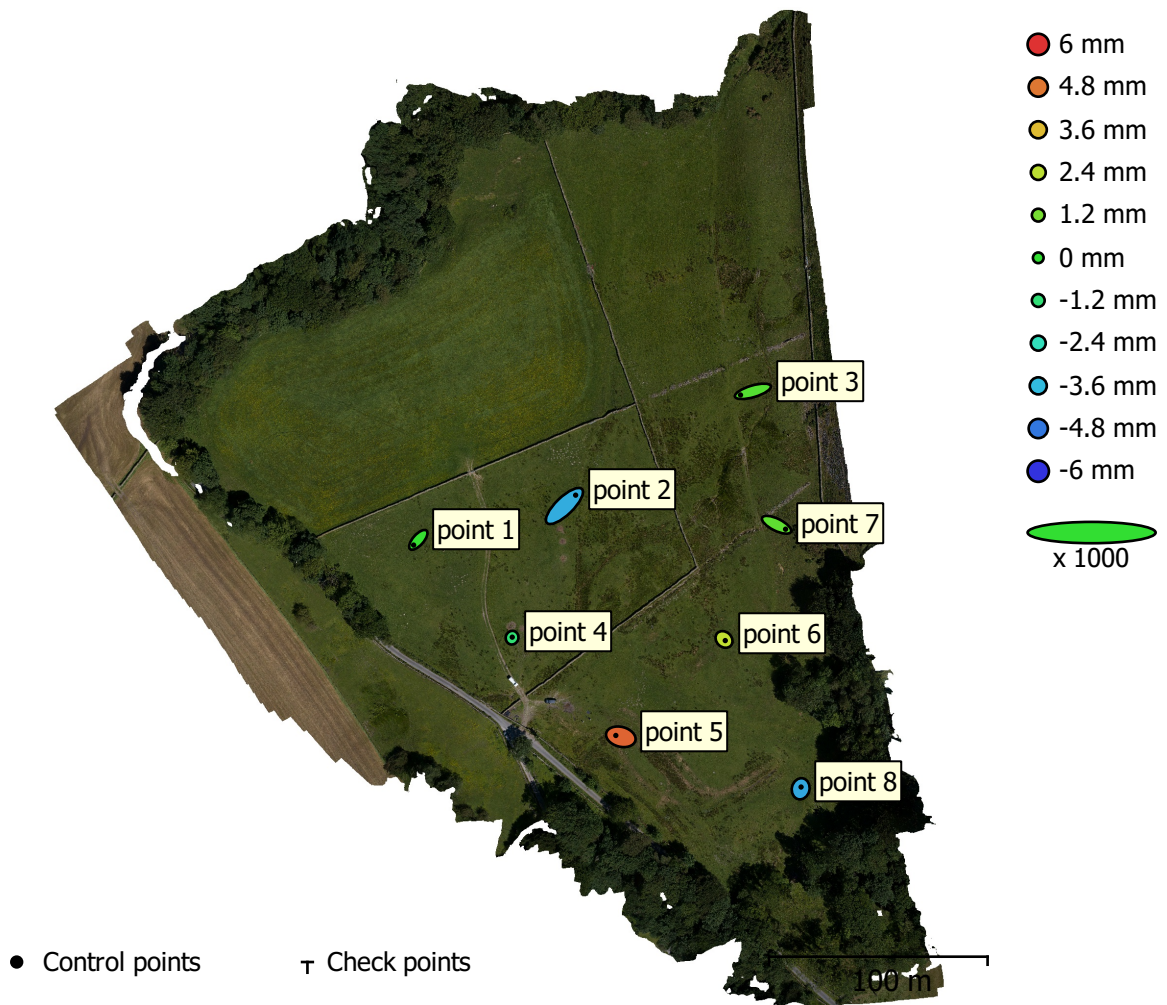


Fig. 3. GCP locations and error estimates.

Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.

Estimated GCP locations are marked with a dot or crossing.

Count	X error (mm)	Y error (mm)	Z error (mm)	XY error (mm)	Total (mm)
8	6.53996	4.39377	2.86173	7.87885	8.38247

Table 3. Control points RMSE.

X - Easting, Y - Northing, Z - Altitude.

<b>Label</b>	<b>X error (mm)</b>	<b>Y error (mm)</b>	<b>Z error (mm)</b>	<b>Total (mm)</b>	<b>Image (pix)</b>
point 1	-4.29137	-4.79971	0.0664924	6.43874	0.004 (48)
point 2	10.2568	9.9164	-3.87676	14.784	0.006 (41)
point 3	-11.3253	-3.33986	0.581666	11.8218	0.007 (12)
point 4	0.147833	0.48047	-1.15394	1.25868	0.004 (44)
point 5	-4.56979	1.21933	5.12994	6.97754	0.006 (43)
point 6	1.13353	-1.02767	2.49754	2.92894	0.006 (29)
point 7	8.24425	-4.06242	0.786198	9.22437	0.005 (28)
point 8	0.363114	1.62417	-3.9548	4.29072	0.004 (37)
<b>Total</b>	<b>6.53996</b>	<b>4.39377</b>	<b>2.86173</b>	<b>8.38247</b>	<b>0.005</b>

Table 4. Control points.  
X - Easting, Y - Northing, Z - Altitude.

# Digital Elevation Model

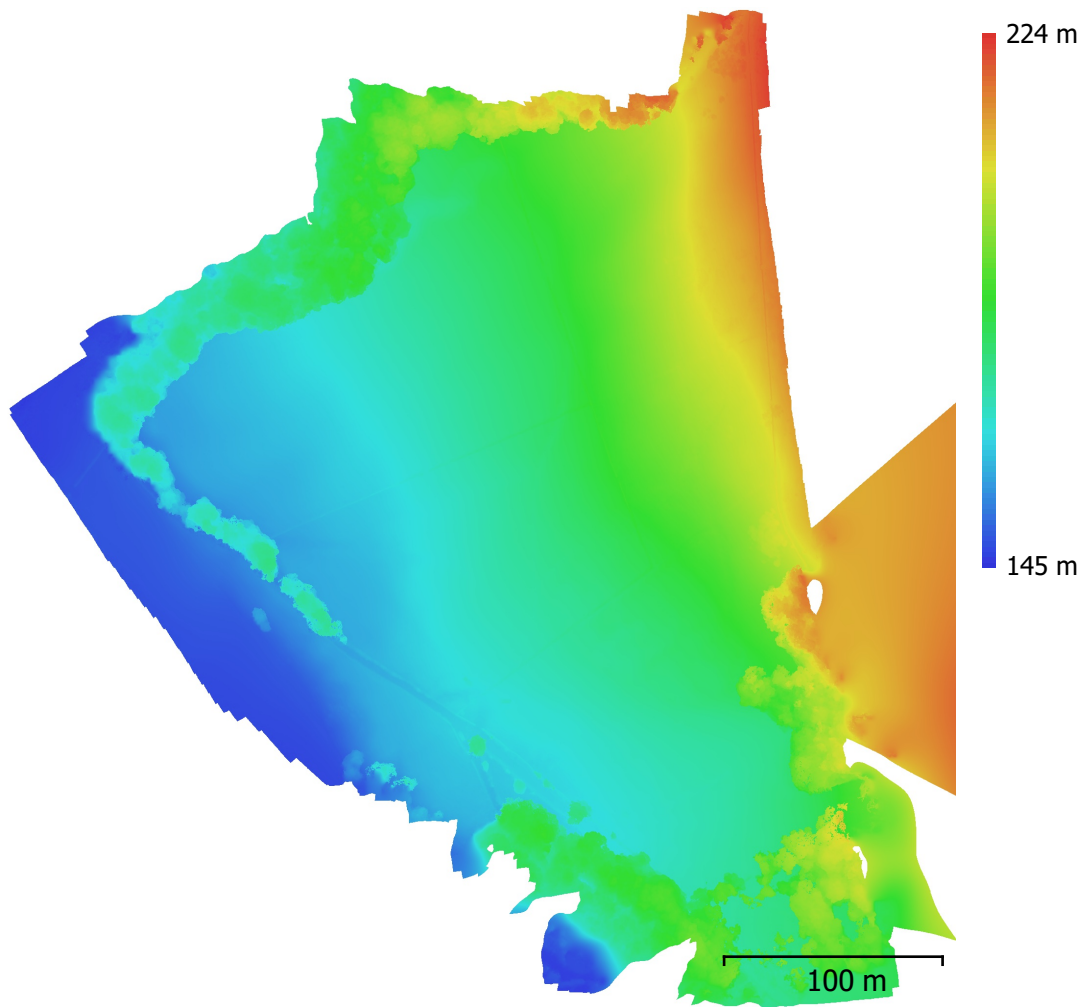


Fig. 4. Reconstructed digital elevation model.

Resolution: 5.42 cm/pix  
Point density: 341 points/m<sup>2</sup>

# Processing Parameters

## General

Cameras	690
Aligned cameras	690
Markers	8
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Rotation angles	Yaw, Pitch, Roll

## Point Cloud

Points	321,673 of 357,126
RMS reprojection error	0.165248 (2.66415 pix)
Max reprojection error	0.560255 (54.0449 pix)
Mean key point size	14.7464 pix
Point colors	3 bands, uint8
Key points	No
Average tie point multiplicity	5.07937

## Alignment parameters

Accuracy	Low
Generic preselection	Yes
Reference preselection	Yes
Key point limit	40,000
Tie point limit	4,000
Adaptive camera model fitting	Yes
Matching time	1 minutes 41 seconds
Alignment time	4 minutes 14 seconds

## Optimization parameters

Parameters	f, b1, b2, k1, k2, p1, p2
Adaptive camera model fitting	No
Optimization time	11 seconds

## Depth Maps

Count	690
-------	-----

## Reconstruction parameters

Quality	Medium
Filtering mode	Aggressive
Processing time	27 minutes 34 seconds

## Dense Point Cloud

Points	48,799,113
Point colors	3 bands, uint8

## Reconstruction parameters

Quality	Medium
Depth filtering	Aggressive
Depth maps generation time	27 minutes 34 seconds
Dense cloud generation time	51 minutes 38 seconds

## Model

Faces	4,927,973
Vertices	2,472,314
Vertex colors	3 bands, uint8
Texture	8,192 x 8,192, 4 bands, uint8

## Reconstruction parameters

Surface type	Arbitrary
Source data	Dense
Interpolation	Enabled
Quality	Medium
Depth filtering	Aggressive
Face count	5,000,000
Processing time	33 minutes 6 seconds

## Texturing parameters

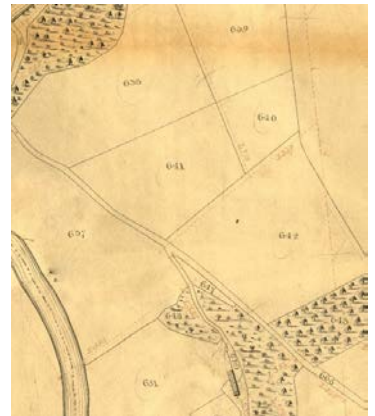


Mapping mode	Generic
Blending mode	Mosaic
Texture size	8,192 x 8,192
Enable hole filling	Yes
Enable ghosting filter	Yes
UV mapping time	1 minutes 58 seconds
Blending time	30 minutes 17 seconds
<b>DEM</b>	
Size	10,276 x 11,059
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
<b>Reconstruction parameters</b>	
Source data	Dense cloud
Interpolation	Enabled
Processing time	1 minutes 42 seconds
<b>Orthomosaic</b>	
Size	30,104 x 33,895
Coordinate system	OSGB 1936 / British National Grid (EPSG::27700)
Colors	3 bands, uint8
<b>Reconstruction parameters</b>	
Blending mode	Mosaic
Surface	Mesh
Enable hole filling	Yes
Processing time	12 minutes 30 seconds
<b>Software</b>	
Version	1.4.2 build 6205
Platform	Windows 64

## Appendix D - Archaeological Walkover Survey Report

# HIGH CARLINGILL, TEBAY, CUMBRIA

## Archaeological Walkover Survey



Client: Lunesdale  
Archaeological Society

NGR: NY 6141 0069 (centre)

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July 2018



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## Contents

Illustrations.....	2
List of Figures.....	2
List of Tables.....	2
List of Plates.....	2
Non-Technical Summary.....	3
Acknowledgements.....	3
1. Introduction.....	4
1.1 Circumstances of the Project.....	4
1.2 Location, Geology, and Topography.....	4
2. Methodology.....	5
2.1 Introduction.....	5
2.2 Desk-Based Assessment.....	5
2.3 Level 1 Survey.....	5
2.4 Archive.....	5
3. Site Background.....	6
3.1 Map Regression.....	6
4. Results.....	7
4.1 Summary.....	7
4.2 Previous Archaeological Investigation.....	7
4. Discussion.....	9
4.1 The Walkover Survey.....	9
4.2 Recommendations.....	9
4.3 Conclusion.....	9
5. Bibliography.....	10
5.1 Primary and Cartographic Sources.....	10
5.2 Secondary Sources.....	10
Appendix 1: Site Gazetteer.....	11
Appendix 2: Text Accompanying the RCHME Survey of 1993.....	21

## Illustrations

### List of Figures

Figure 1: Sites recorded during the walkover survey overlaid on a view of the digital elevation model data .....	8
--	---

### List of Tables

Table 1: Summary of sites of archaeological interest recorded during the walkover survey .....	7
--	---

### List of Plates

Plate 1 (left): Extract for the tithe map of 1841 (NA IR30/27/75 (2) 1841) .....	6
Plate 2 (right): Extract from the Ordnance Survey map of 1862 .....	6
Plate 3 (left): Extract from the Ordnance Survey map of 1898.....	6
Plate 4 (right): Extract from the Ordnance Survey map of 1914 .....	6
Plate 5 (left): The culvert (Site 01), viewed from the north-west .....	11
Plate 6 (right): The culvert (Site 01) and associated ditch viewed from the south-east .....	11
Plate 7: Site of possible structure (Site 02), viewed from the north-west.....	12
Plate 8: Revetted wall forming edge of mound (Site 03), viewed from the north-west.....	13
Plate 9: Site of possible quarry (Site 04), viewed from the north-west.....	14
Plate 10 (left): View along the track (Site 05), from the north.....	15
Plate 11 (right): Remains of a gatepost at the point where the track (Site 05) meets the former field boundary, viewed from the west.....	15
Plate 12 (left): View along the hollow way (Site 06), from the south-west .....	16
Plate 13 (right): Stones bridging across the hollow way (Site 06), viewed from the west .....	16
Plate 14: Hollow way (Site 07), viewed from the south-east .....	17
Plate 15: Palaeochannel (Site 08), viewed from the south-east.....	18
Plate 16: General view of the settlement (Site 09), from the south .....	19
Plate 17: General view of the settlement (Site 09) from the south-east.....	19
Plate 18: Area of terracing and possible road (Site 10), viewed from the north.....	20
Plate 19: RCHME survey of 1993.....	23

## Non-Technical Summary

As part of a research project organised by the Lunesdale Archaeological Society to investigate a 'native settlement' on the east side of the Lune Valley south of the Roman fort at Low Borrowbridge near Tebay, Cumbria a programme of geophysical and aerial photogrammetry survey was carried out by Sumo Survey. To complement this Greenlane Archaeology was appointed to carry out an archaeological walkover survey in order to assess the features on the ground and aid the interpretation of the results of the geophysical and photogrammetric survey.

Historic map regression showed that the field boundaries within the survey area had been in place by the time of the tithe map in 1841, and had stayed essentially unchanged ever since, with the exception of the plantation of new woodland along the eastern side of the southernmost field in the mid-19<sup>th</sup> century.

The RCHME had surveyed the 'native settlement' site in 1993, including associated elements. The walkover survey re-examined the remains, and identified an additional four sites within the area – a culvert, a possible structure, a mound, and a quarry, all in the southern end of the survey area.

The proposed archaeological excavation of parts of the settlement site would provide a rare opportunity to examine a site of this type, made potentially more interesting by the possibility of it having multiple phases of development. This report recommends areas to target within the complex.

The walkover survey revealed that the original RCHME survey had not covered the north-west side of the site in sufficient detail, in part because it was considerably wetter, but it had also been disturbed by attempts at drainage at that time. Earthworks thought to perhaps represent the outer enclosure of the settlement in this area were observed during the walkover survey; further, more detailed, survey would definitely be beneficial in this area.

## Acknowledgements

The walkover survey was carried out by members of the Lunesdale Archaeological Society supervised by Dan Elsworth. Dan Elsworth compiled this report and managed the project on behalf of Greenlane Archaeology. The report was edited by Jo Dawson.

# 1. Introduction

## 1.1 Circumstances of the Project

1.1.1 As part of a research project organised by the Lunesdale Archaeological Society (LAS) to investigate a 'native settlement' on the east side of the Lune Valley south of the Roman fort at Low Borrowbridge near Tebay, Cumbria (NGR NY 6141 0069 (centre)) a programme of geophysical and aerial photogrammetry survey was carried out by Sumo Survey. To complement this Greenlane Archaeology was appointed to carry out an archaeological walkover survey in order to assess the features on the ground and aid the interpretation of the results of the geophysical and photogrammetric survey. The onsite work was carried out on the 7<sup>th</sup> July 2018.

1.1.2 The 'native settlement' site had been surveyed by the Royal Commission in 1993 (see *Appendix 2*).

## 1.2 Location, Geology, and Topography

1.2.1 **Location and Topography:** the walkover survey area lies around 3.5km south of Tebay, which is a small village in Cumbria on the east side of the M6 motorway near junction 38 (Ordnance Survey 2015). It lies at the north-eastern corner of South Cumbria Low Fells (Countryside Commission 1998, 65), and covers c7 hectares of land around the 'native settlement' site. It comprises rough grazing land, is bounded by Fairmile Road to the west, by woodland to the north, by a field boundary running south from there along the east, and the remainder is bounded by the edge of broadleaf woodland to the south.

1.2.2 **Geology:** the underlying solid geology is Bannisdale Slates and Coniston Grits (Moseley 1978, plate 1). The solid geology is commonly overlain by glacially derived boulder clay (till) across the area (Countryside Commission 1998, 66).



## 2. Methodology

### 2.1 Introduction

2.1.1 The walkover survey comprised a Level-1 walk-over survey of the area around the settlement. The methodology used for the survey is detailed below. All of the work was carried out in accordance with the brief provided by the LAS (LAS 2018) and ClfA guidelines.

### 2.2 Desk-Based Assessment

2.2.1 No specific desk-based research was carried out prior to the walkover survey but information already compiled by the LAS was consulted as appropriate. In addition, the tithe map and available historic Ordnance Survey mapping were consulted.

### 2.3 Level 1 Survey

2.3.1 A walk-over survey was carried out to Historic England Level-1 type standards (Historic England 2017) and according to the guidelines of the Chartered Institute for Archaeologists (ClfA 2014a). This is a relatively low-level of investigation intended to provide basic descriptive details about each site of archaeological or historical interest within the Level 1 survey area and the site as a whole. It comprised three types of recording:

- **Drawn Record:** the grid coordinates of each site or find of archaeological or historical interest were recorded using a Garmin Etrex GPS, accurate to within c5m and subsequently marked on a digital plan of the site;
- **Written Record:** a basic descriptive record of each site was made on Greenlane Archaeology standard *pro forma* record sheets. These records describe each site's form, size, and (where possible) function and date. In addition, the landscape and historic setting of the site was described, in particular its relationship with other sites identified, field boundaries, and the local topography;
- **Photographic record:** photographs in 35mm colour print film and colour digital format (both 12 meg jpeg and RAW format) were taken of each site. A written record was kept of all of the photographs that were taken detailing the direction, size of scale, date, and identity of the photographer. The digital photographs have also been used for illustrative purposes within the report.

### 2.4 Archive

2.4.1 A comprehensive archive of the project has been produced in accordance with the project design and current ClfA guidelines (ClfA 2014b). The paper and digital archive and a copy of this report will be deposited in the Cumbria Archive Centre in Kendal (CAC(K)) on completion of the project. A digital and paper copy of the report for the project will be provided for the client, and one will also be deposited with the Historic Environment Record held by the Lake District National Park Authority, and a copy will be retained by Greenlane Archaeology. In addition, a record of the project will be made on the OASIS scheme.

## 3. Site Background

### 3.1 Map Regression

3.1.1 **Tithe map, 1841:** the land that comprises the survey area (field numbers 638 to 642) is part of the farmland belonging to High Carlingill farm, owned by Michael Branthwaite and occupied by Richard Jackson. The field names are as follows: 638 – Brackenthwaite; 639 – Far fell Mires; 640 – Near fell Mires; 641 – Near Brackenthwaite; 642 – Woodcock hill (NA IR 29/37/75 1841, 5). All five fields are apparently empty of notable features.

3.1.2 **Ordnance Survey map, 1862:** this map, surveyed in 1858, 17 years after the tithe map, shows no change in the four fields to the north, other than a single tree in the north-western field, and a watercourse along the western edge of the field to the south. The southernmost field now has woodland along its eastern edge, a single tree on the west, and a sheepfold is also marked.

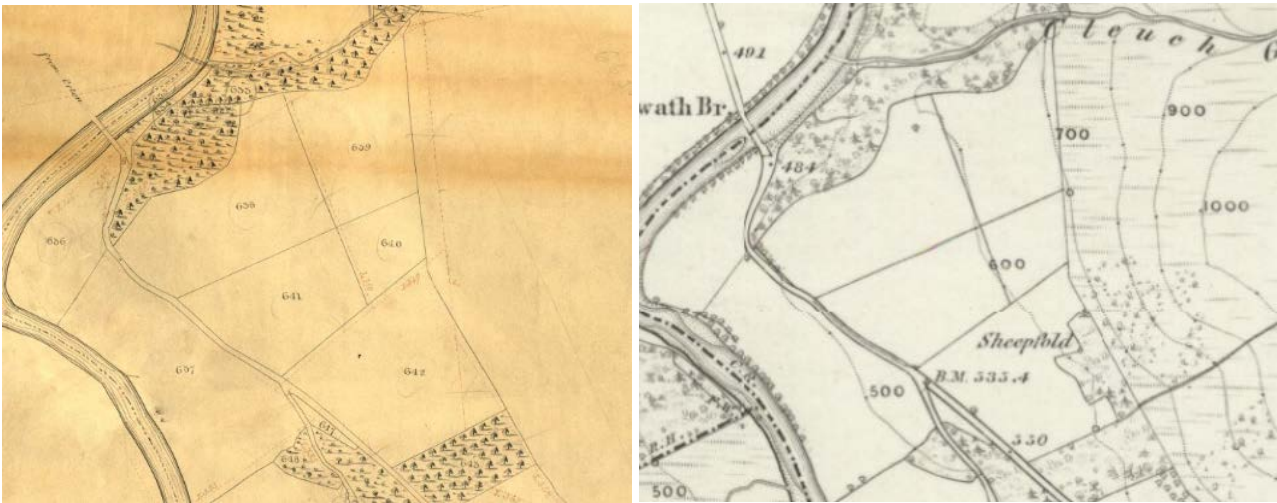


Plate 1 (left): Extract for the tithe map of 1841 (NA IR30/27/75 (2) 1841)

Plate 2 (right): Extract from the Ordnance Survey map of 1862

3.1.3 **Ordnance Survey 1898:** there is now also a watercourse shown in the north-eastern field, which stops at the boundary between the two northern fields.

3.1.4 **Ordnance Survey 1914:** there is no change since the previous map.

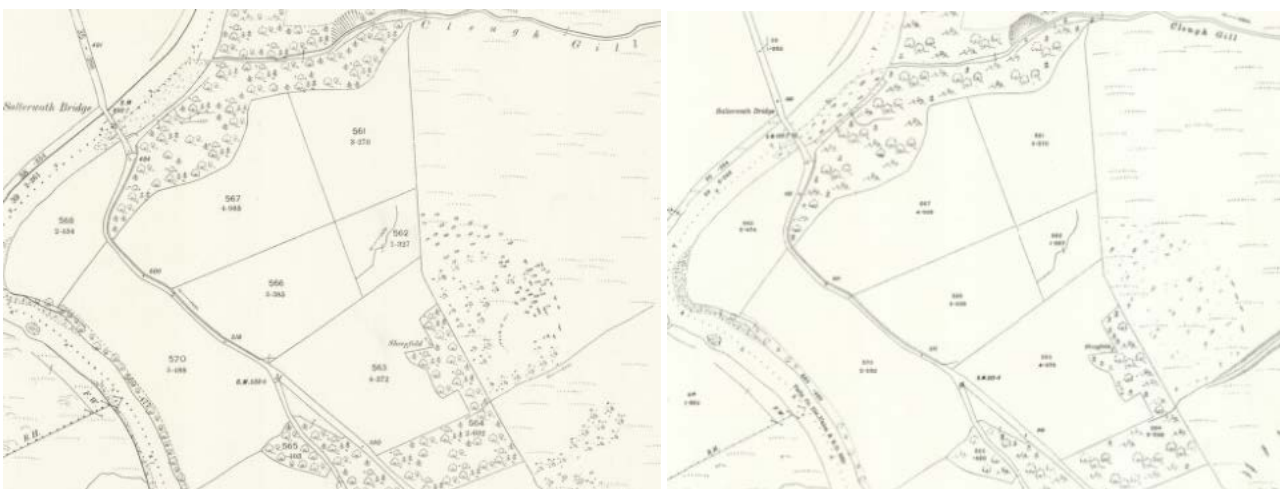


Plate 3 (left): Extract from the Ordnance Survey map of 1898

Plate 4 (right): Extract from the Ordnance Survey map of 1914

## 4. Results

### 4.1 Summary

4.1.1 A total of 10 sites of archaeological interest were identified within the study area during walkover survey (see Figure 1 and *Appendix 1*; summarised in Table 1 below), covering several periods, particularly the prehistoric and post-medieval, although many are not readily dateable. These include the settlement site itself (**Site 09**) and associated terraces (**Site 10**), which was assessed as part of the walkover survey but already known, as were the probable hollow ways (**Sites 06** and **07**), the track (**Site 05**), and the palaeochannel (**Site 08**), all of which were revealed particularly well through the geophysical and photogrammetric survey. The remaining sites were previously unrecorded (**Sites 01-04**).

Site	Type	Period
<b>01</b>	Culvert	Post-medieval?
<b>02</b>	Structure	Post-medieval?
<b>03</b>	Mound	Uncertain
<b>04</b>	Quarry	Uncertain
<b>05</b>	Track	Post-medieval?
<b>06</b>	Hollow way	Uncertain
<b>07</b>	Hollow way	Uncertain
<b>08</b>	Palaeochannel	Uncertain
<b>09</b>	Settlement	Prehistoric – Romano-British
<b>10</b>	Terraces and road	Prehistoric – Romano-British

**Table 1: Summary of sites of archaeological interest recorded during the walkover survey**

### 4.2 Previous Archaeological Investigation

4.2.1 The settlement (**Site 09**) had already been subject to a detailed topographic survey (RCHME 1993; see *Appendix 2*). This also included a number of associated elements (**Sites 05-07** and **10**).

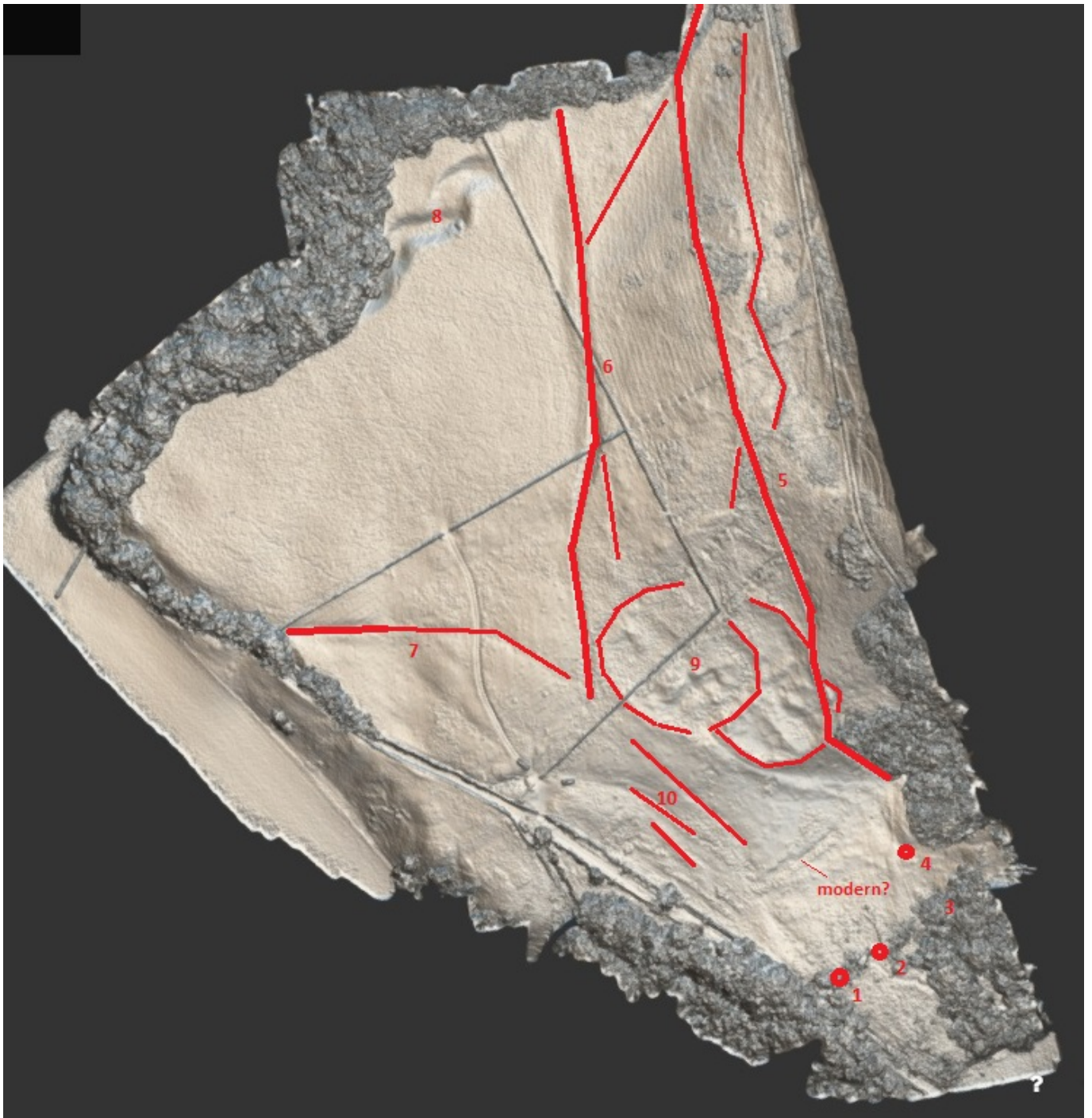


Figure 1: Sites recorded during the walkover survey overlaid on a view of the digital elevation model data

## 4. Discussion

### 4.1 The Walkover Survey

4.1.1 It is apparent from the results of the walkover survey, especially when considered alongside the results of the geophysical and photogrammetric survey, that the settlement (**Site 09**), which forms the focus of the whole research project, is part of a wider landscape of archaeological remains. Moreover, these remains evidently represent several periods and show how the site as a whole has changed through time, although many of the features identified cannot be dated without further work. Nevertheless, it is likely that the majority of the features relate directly to the period in which the settlement was occupied or otherwise in use. This includes the probable hollow ways (**Sites 06 and 07**) and the terraces and possible road (**Site 10**), all of which are most likely remnants of the agricultural regimes that supported a site of this type: the hollow ways for moving animals to and from the higher ground to the east, the terraces for cultivating crops. Examples of the latter are known in association with settlements of broadly the same type (see Oswald *et al* 2006, for example). With the exception of the possible palaeochannel, which is potentially very ancient indeed, the remaining sites probably relate to activity that post-dates the use of the settlement, with the trackway (**Site 05**) very obviously post-dating the settlement. What is not clear is how old it is; it seems very well-built and was clearly in use at the same time the boundary walls which it crosses were, which would suggest it is post-medieval. However, it is not shown on any available maps of the area (see *Section 3.1* above); this may simply be an omission, but it seems odd that such a well-constructed feature would not be depicted. It was suggested in the previous survey that it, and the underlying and less evident track, were constructed to serve the peat-cuttings higher up the fell (RCHME 1993). The possible structure (**Site 02**) is also not shown on any maps (see *Section 3.1*, above), although it is not clear how genuine this even is.

4.1.2 The settlement itself is of particular interest because of the potential evidence it shows for multiple phases of development. There is a clear discrepancy between the manner in which the outer enclosure has been laid out when comparing the south-east side to the north-west. While the original survey (RCHME 1993) suggested there were four main sections defined by the outer boundary, and as many as 11 hut circles, it is possible that the settlement represents two phases; an initial enclosure to the south-east, which was then partially overlain by the moving of the settlement to the north-west.

### 4.2 Recommendations

4.2.1 The proposed archaeological excavation of parts of the settlement site would provide a rare opportunity to examine a site of this type, made potentially more interesting by the possibility of it having multiple phases of development. There are numerous areas of interest to target during the excavation but it is suggested that cutting across hut circles I and II in Enclosure C (as numbered in the RCHME survey) and the trackway to the east (**Site 05**, labelled T2 in the RCHME survey) would be particularly useful in establishing the relationships between these different elements. In addition, targeting hut circles III and V in Enclosure A would allow the large enclosure bank to the east to also be investigated, which would aid in understanding the phasing of the whole complex. Excavation across the line of one or other of the possible hollow ways (**Sites 06 and 07**) and the terraces to the south-west of the settlement (**Sites 10**) might also provide dating evidence for these elements and therefore confirm whether they were contemporary, although this would be difficult as suitable dating material is unlikely to be found in such areas.

### 4.3 Conclusion

4.3.1 The walkover survey revealed that the original RCHME survey had not covered the north-west side of the site in sufficient detail, in part because it was considerably wetter, but it had also been disturbed by attempts at drainage at that time. Earthworks thought to perhaps represent the outer enclosure of the settlement in this area were observed during the walkover survey; further, more detailed, survey would definitely be beneficial in this area.



## 5. Bibliography

### 5.1 Primary and Cartographic Sources

NA IR 29/37/75, 1841 *Apportionment of the Rent-Charge in Lieu of Tithes in the Township of Tebay in the Parish of Orton in the County of Westmorland*

NA IR30/27/75 (2), 1841 *Plan of the Eastern Part of the Township of Tebay in the Parish of Orton in the County of Westmorland, by John Watson, Land Surveyor, Kendal, A.D. 1841. Map of Tebay in two parts, Part 2*

Ordnance Survey, 1862 *Westmorland Sheet XXXIV*, surveyed 1858, 1:10,560

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## Appendix 1: Site Gazetteer

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**Site Number: 01**

**NGR:** NY 61496 00586

**Sources:** walkover survey

**Type:** culvert

**Description:** a stone built culvert running beneath the boundary wall, which incorporates a lintel at this location. It is connected to a drain comprising a ditch to the south.

**Period:** post-medieval?



**Plate 5 (left):** The culvert (Site 01), viewed from the north-west

**Plate 6 (right):** The culvert (Site 01) and associated ditch viewed from the south-east

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**Site Number: 02**

**NGR:** NY 61503 00607

**Sources:** walkover survey

**Type:** structure

**Description:** possible structure revealed as a line of boulders running out from the boundary wall before turning and returning to it, forming a small structure approximately 2m wide by 5m long orientated approximately east/west.

**Period:** post-medieval





**Plate 7: Site of possible structure (Site 02), viewed from the north-west**

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**Site Number: 03**

**NGR:** NY 61512 00604

**Sources:** walkover survey

**Type:** mound

**Description:** a large mound of material running downslope approximately east/west and covering a large area. It is revetted by the boundary wall on the north side and may represent a natural accumulation of material, perhaps via a landslide.

**Period:** uncertain



**Plate 8: Revetted wall forming edge of mound (Site 03), viewed from the north-west**

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**Site Number: 04**

**NGR:** NY 61476 00615

**Sources:** walkover survey

**Type:** quarry

**Description:** a shallow rounded scoop cut into the slope, little more than 1m deep and perhaps 3m in diameter, probably representing a small quarry.

**Period:** post-medieval?





**Plate 9: Site of possible quarry (Site 04), viewed from the north-west**

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**Site Number: 05**

**NGR:** NY 61452 00655 – NY 61420 00927

**Sources:** RCHME 1993; geophysical and photogrammetric survey; walkover survey

**Type:** track

**Description:** a well-built track running approximately north/south, 2-3m wide and cutting through the east side of the settlement (**Site 09**), where it turns to the east before disappearing. In the centre it crosses two ruined sections of field boundary and there are the remains of stone gate posts, which demonstrate that line of the track was respected when the walls were constructed. At its north end it turns where it meets the ghyll into a narrow ravine before coming to a gate with a stone-built step at its base. This track overlies a presumably earlier track that runs north-east/south-west and then along the slope at a higher altitude; it was recorded during the earlier RCHME survey and is visible in the photogrammetric survey but was not particularly evident during the walkover survey, although an L-shaped bank in the approximate area may have been part of it. It is probably a precursor to the more obvious and better built track.

**Period:** post-medieval?



Plate 10 (left): View along the track (Site 05), from the north

Plate 11 (right): Remains of a gatepost at the point where the track (Site 05) meets the former field boundary, viewed from the west

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**Site Number: 06**

**NGR:** NY 61354 00695 – NY 61375 00905

**Sources:** geophysical and photogrammetric survey; walkover survey

**Type:** hollow way

**Description:** a large ditch running approximately north/south typically up to 2m wide and 0.5m tall. It is joined by a number of shallower ditches, only really visible on the photogrammetric survey, all of which converge at the same point as the end of the track (**Site 05**). This probably represents a hollow way or group of hollow ways leading to the higher ground to the north-east. A drain has been cut through part of the settlement (**Site 09**) on the north-west side and led into the ditch, making it very wet in places, and boulders have been placed across part of it to form an *ad hoc* bridge.

**Period:** uncertain





**Plate 12 (left): View along the hollow way (Site 06), from the south-west**

**Plate 13 (right): Stones bridging across the hollow way (Site 06), viewed from the west**

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**Site Number: 07**

**NGR:** NY 61240 00730 – NY 61276 00728

**Sources:** geophysical and photogrammetric survey; walkover survey

**Type:** hollow way

**Description:** a short section of ditch up to 3m wide and less than 1m deep orientated north-west/south-east running towards the road. It probably represents a hollow way and the photogrammetric survey suggests it continues further to the south-east.

**Period:** uncertain



**Plate 14: Hollow way (Site 07), viewed from the south-east**

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**Site Number: 08**

**NGR:** NY 61313 00884 (centre)

**Sources:** geophysical and photogrammetric survey; walkover survey

**Type:** palaeochannel

**Description:** curvilinear ditch running approximately east/west down slope from the edge of the gyll to the north of the survey area. At least 3m wide and 1m deep.

**Period:** uncertain





**Plate 15: Palaeochannel (Site 08), viewed from the south-east**

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**Site Number: 09**

**NGR:** NY 6141 0069 (centre)

**Sources:** RCHME 1993; geophysical and photogrammetric survey; walkover survey

**Type:** settlement

**Description:** Romano-British or 'native' settlement site comprising at least one phase, with an outer enclosure bank over 1m tall and 2m wide and numerous internal hut circles of relatively small size. The north side is less clear where the ground is more overgrown and seems to incorporate a number of shallow terraces on the north-east side where the enclosure is less obvious and cut by natural water courses running down the hill. It seems likely that there are two phases to the settlement, with the earliest perhaps represented by the south-easternmost part, which was then partially overlain by the north-west end. But this could only be demonstrated through excavation. The east side has certainly been partially cut through and overlain by the track (**Site 05**), which must therefore be later.

**Period:** prehistoric – Romano-British





**Plate 16: General view of the settlement (Site 09), from the south**



**Plate 17: General view of the settlement (Site 09) from the south-east**

**Site Number: 10****NGR:** NY 61388 00640 (centre)**Sources:** RCHME 1993; geophysical and photogrammetric survey; walkover survey**Type:** terraces and road?**Description:** an area of shallow terraces situated to the south-west of the settlement (**Site 09**) each a few meters wide and less than 0.5m tall orientated north-west/south-east, with a possible road or trackway through the centre, perhaps connecting with the hollow way to the north-west (**Site 07**).**Period:** prehistoric – Romano-British

**Plate 18: Area of terracing and possible road (Site 10), viewed from the north**

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## Appendix 2: Text Accompanying the RCHME Survey of 1993

### NY 615 006 High Carlingill: settlement

At NY 6141 0069, in rough pasture, there are the turf-covered remains of a late prehistoric enclosed settlement, comprising at least four contiguous enclosures (marked A-D on RCHME 1:1000 plan, 1993), in which a number of hut platforms can be identified. The site lies at 175m OD on sloping ground on the W flank of the Lune Valley just below the point where the valley steepens sharply and becomes scree-covered; the height difference between the highest and lowest points on the settlement is about 7.5 m.

A modern dry-stone wall cuts through enclosure (or enclosures) A from ENE to WSW. That part of the site N of the wall is ill-drained and has become silted, and though attempts have been made to drain this area, most recently in September 1993, it remains difficult to interpret. The major part of the settlement, which lies S of the field wall, is much better preserved, but it too is affected by the incursion of marsh, and also by robbing, surface quarrying, and the presence of an old terraced trackway (T2 on RCHME plan) which cuts across the E side of the site. The effect of these mutilations is to render identification of individual elements of the site, particularly the ephemeral hut platforms, extremely awkward; there are undoubtedly more huts than those listed below.

Enclosure A is probably the nucleus of the settlement but, more than any of the others, it is obscured by later mutilations, notably the modern wall (and parallel trampling by stock), to the extent that it is no longer clear whether this is just one or more than one feature. Assuming it to be a single feature, it appears to be sub-oval, measuring internally approximately 53 m NW-SE by about 45 m transversely. In common with the other enclosures it is scarped into the hill-slope, with a back scarp, up to 0.9 m high to the NE, and the remains of low, turf-covered banks around the other three sides; the front apron, where it has survived, is about 4.0 m wide and 0.7 m maximum height. There appears to have been an entrance at the S corner, now much disturbed, which is approached by a terraceway (T1) (see below).

The interior is a mass of scarps and depressions confused by quarrying, but the customary configuration of a courtyard in the lower part of the enclosure with up to six hut platforms (I- VI) ranged around the upper periphery, in this case the E and NE, is still discernible.

- Hut I is a slight depression, 4.5 m in diameter and 0.2 m deep, with an entrance in the SW arc, 1.0 m wide. Recently a site for the feeding of stock, it is filled with wet silage.
- Hut II remains as a platform, about 4.0 m in diameter, with a gap on the SW side; the front apron is 0.4 m high, but the rest is indistinct.
- Hut III, about 5.0 m across, is terraced into the slope, with a front apron and a back scarp each 0.3 m-0.4 m high, though the latter is spread.
- Hut IV is only a possibility; it survives as a vague depression on a raised terrace.
- Hut V is about 4.0 m in diameter with a spread back scarp, 0.2 m high, with little of the apron visible.
- VI is a possible hut, about 4.5 m in diameter, with a vague back scarp, 0.1 m high; it is masked by bog and the perimeter is very indistinct. AX (on RCHME plan), a somewhat angular scoop into the natural slope, 0.8 m deep and 6.8 m across, though superficially resembling a hut, is a later quarry with a hollowed approach from the SW.

No hut platforms nor any other internal details can be seen in enclosure A to the N of the modern wall. The recent (Sep 93) drain, still open during field survey, has cut through the perimeter of A, unearthing a concentration of heavy stones, but no structural details survive in situ. This must indicate a dry-stone construction for this part of the settlement, and almost certainly for the rest, though there is little evidence of this on the ground surface.

Enclosure B is D-shaped, measuring internally 21.5 m NW-SE by 12.0 m transversely. Like the rest it is scooped into the SW-facing hill-slope, with a back scarp 0.8 m high; the front apron is about 4.0 m wide and 0.7 m high externally, with a discontinuous counterscarp, up to 0.14 m high. It displays the classic pattern of a courtyard on the lower SW side with up to five hut platforms (I-V) around the upper N and NE periphery, each with a front apron 0.4 m maximum height but more generally 0.2 m high. A barely visible lowering of the bank on the S side may be an entrance, but there are a number of stones visible in the gap. All that can be seen of hut I in the SE corner of the enclosure is a flat area, 4.5 m across, but it has no discernible shape. A possibility only. Hut II is a platform, 3.5 m in diameter, scooped into the back scarp of the enclosure. Hut III is doubtful. There are slight traces of what may be an apron, but the ground is disturbed and the feature is now quite shapeless. IV, in the N corner of enclosure B, is only a possible hut; like I and III, it is vague and its validity as a hut is based more on its position than for any other reason. V is a good example set into the inner side of the enclosure bank, measuring 4.0 m in diameter.

Enclosure C, measuring 30.0 m NW-SE by 25.5 m transversely, adopts the usual pattern of two levels; in this example the upper terracing is 1.0-2.0 m above the lower yard. Two huts (I and II) can be identified with certainty on the upper level, though there are probably others. The much later grass track (T2) slices through the E side of the enclosure leaving the E corner stranded. No entrance is visible. Hut I, the best example in the whole settlement, measures 5.0 m in diameter, with a front apron 1.2 m high and a back scarp 0.5 m high. The NE side of hut II is destroyed by the later track and only the SW side of the platform, 4.0 m across, survives.

Enclosure D is D-shaped, measuring 27.7 m NW-SE by 13.2 m transversely; the back scarp in the NE is 1.7 m high and the apron on the opposite side is 0.9 m high. The enclosure is unusual compared to the others in that there are no huts to be seen around the upper side, and the interior is free of all evidence of structures save, possibly, in the extreme S corner where there is a curving scarp, 0.2 m high, forming a hook-shape, 3.8 m across with the S side open. This resembles minor quarrying rather than a hut platform. The terrace T1, on average 2.0 m wide approaches the entrance to enclosure A from the SE gradually ascending the natural slope diagonally by the easiest route available, skirting the SW side of enclosure B. This access seems to be contemporary with the settlement, but caution is necessary here as there is clear evidence of tractor tracks on the terraceway, and the interior of A has been used both as a quarry and, quite recently, as an animal feeding point. It meets with the grass track (T2) in an old stream valley where it is poorly-defined, but here, as far as it can be seen, it appears to be overlaid by T2. This latter grass track extends from a gap in the dry-stone field wall to the SE of the settlement, diagonally up the hill-slope to a gate in the extreme N corner of the same field containing the settlement, from which it then runs alongside the modern boundary wall defining the enclosed land in the valley. As such it is not later than the present field pattern, which is probably contemporary with the farmhouses in this area, assessed by DOE as 17th century, though clearly it post-dates the settlement itself.

There are further tracks within the survey area. One, T3, runs from a point just N of enclosure D, beneath T2, continues through a field gate, and climbs steeply up the hill to the vicinity of the peat cuttings on Blease Fell (see NY 60 SW 24). This is one of a number of peat roads extending from the farms in the Lune Valley up to the cuttings on the fell summits. Presumably the tracks shown on plan to the SW and S of the settlement served a similar function. No trace can be seen of cultivation associated with the settlement.

Surveyed at 1:1000 scale by RCHME.



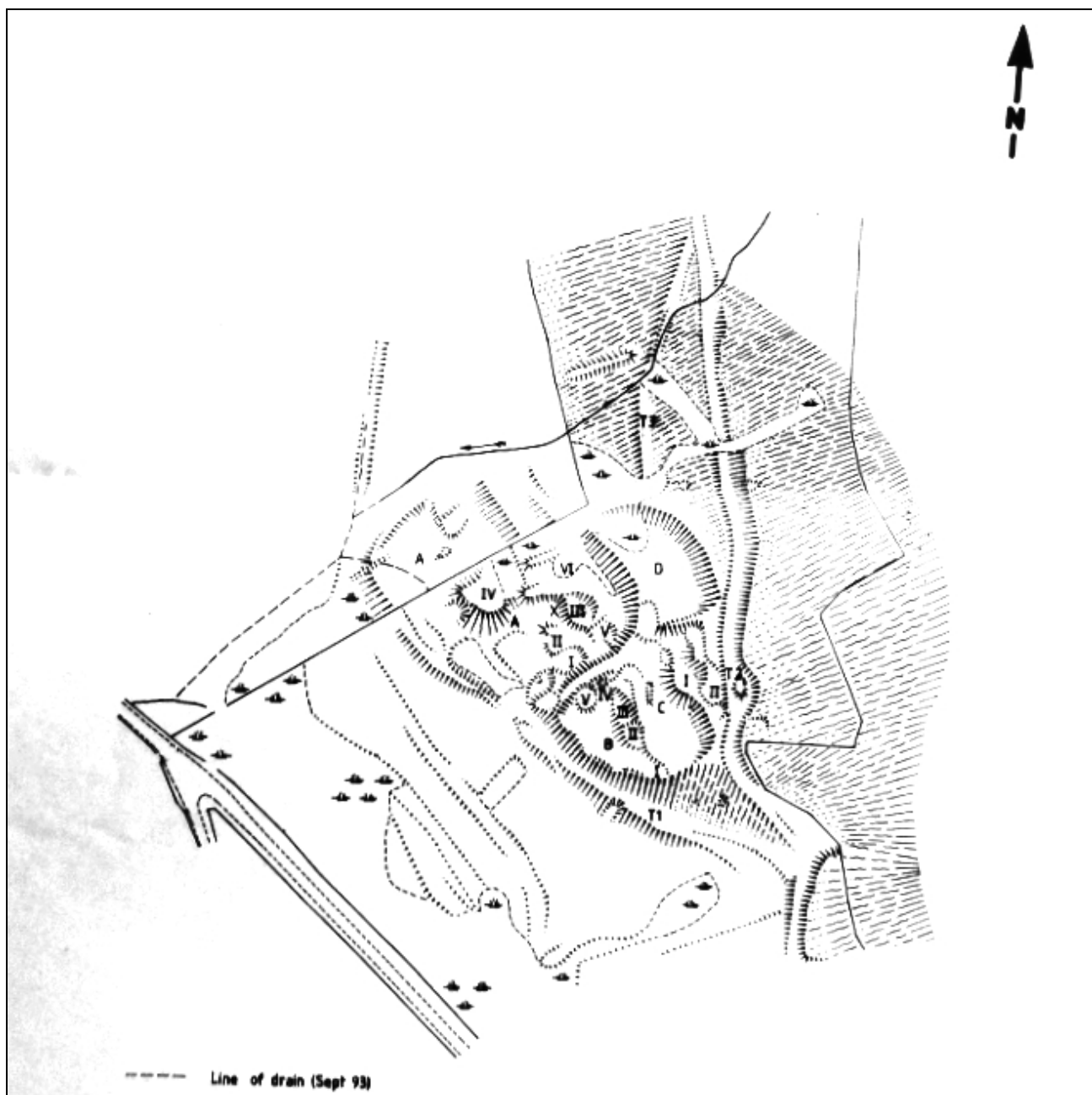


Plate 19: RCHME survey of 1993

Appendix E - Text Accompanying RCHME Survey of 1993

**NY 615 006 High Carlingill: settlement. (Not visible on RAF air photographs 1954). (1)**

At NY 6141 0069, in rough pasture, there are the turf-covered remains of a late prehistoric enclosed settlement, comprising at least four contiguous enclosures (marked A-D on RCHME 1:1000 plan, 1993), in which a number of hut platforms can be identified. The site lies at 175m OD on sloping ground on the W flank of the Lune Valley just below the point where the valley steepens sharply and becomes scree-covered; the height difference between the highest and lowest points on the settlement is about 7.5 m.

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wide and 0.7 m high externally, with a discontinuous counterscarp, up to 0.14 m high. It displays the classic pattern of a courtyard on the lower SW side with up to five hut platforms (I-V) around the upper N and NE periphery, each with a front apron 0.4 m maximum height but more generally 0.2 m high. A barely visible lowering of the bank on the S side may be an entrance, but there are a number of stones visible in the gap. All that can be seen of hut I in the SE corner of the enclosure is a flat area, 4.5 m across, but it has no discernible shape. A possibility only. Hut II is a platform, 3.5 m in diameter, scooped into the back scarp of the enclosure. Hut III is doubtful. There are slight traces of what may be an apron, but the ground is disturbed and the feature is now quite shapeless. IV, in the N corner of enclosure B, is only a possible hut; like I and III, it is vague and its validity as a hut is based more on its position than for any other reason. V is a good example set into the inner side of the enclosure bank, measuring 4.0 m in diameter.

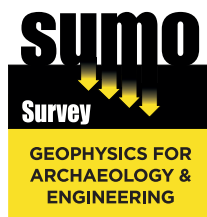
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Surveyed at 1:1000 scale by RCHME. [2]





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