

**ARCHAEOLOGICAL ASSESSMENT  
& GEOPHYSICAL SURVEY  
OF PROPOSED  
ALSTON TO HILLHEAD WATER MAIN,  
KINGSWEAR AND TORBAY**

**By**

**P. Manning and C. Smart**

Exeter Archaeology

Report No. 09.46

Project No. 6660

April 2009

## CONTENTS

1. Introduction	1
2. Statutory and other designations	1
3. Historical and archaeological background	1
4. Sites of historical and archaeological interest	2
5. Conclusions	5
6. Results of geophysical survey	7
Acknowledgements	11
Sources consulted	11

### **List of Illustrations**

- Fig. 1. Location of pipeline route
- Fig. 2 Location of pipeline route and sites of archaeological interest
- Fig. 3 Extract from the OS surveyors' two-inch drawing, 1803-4
- Fig. 4 Extract from the Brixham Tithe Map, 1838, and Churston Ferrers Tithe Map, 1839
- Fig. 5 Extract from the 1869 OS 1:10560 map
- Fig. 6 Extract from the 1907 OS 1:10560 map
- Fig. 7 Evaluative gradiometer survey at northern end of pipeline route
- Fig. 8 Evaluative gradiometer survey at southern end of pipeline route
- Fig. 9 Plotting parameters of evaluative gradiometer survey along pipeline route

## 1. INTRODUCTION

This assessment was undertaken in October 2008 to determine the archaeological impact of a water trunk main from Alston Reservoir to Hillhead Reservoir, in Torbay and Kingswear (centre SX 8936 5446, Fig. 1). The work was commissioned by May Gurney on behalf of South West Water.

### 1.1 Methodology

The assessment conforms to a brief provided by the Devon County Council Historic Environment Service (HES).<sup>1</sup> The work comprised a desk-based assessment of the pipeline route and vicinity and a geophysical survey of the pipeline route.

The assessment has included consultation of the following sources:

- Historic maps and documentary sources at the Devon Record Office and Westcountry Studies Library
- Existing archaeological information and aerial photographs held by the Devon County Council Historic Environment Record.
- English Heritage Listed Buildings online website
- Exeter Archaeology archives

The results of the geophysical survey are presented in section 6 of this report.

### 1.2 Geology

The geology of the area dates from the Devonian period. The southern part of the route consists of sandstone with interbeds of siltstone and slaty mudstone. The central part of the route consists of mudstone with slaty laminae and thin beds of limestone and fossil coquinas, and the northern part consists of slaty mudstone with thin beds of siltstone and limestone to the base.<sup>2</sup>

## 2. STATUTORY AND OTHER DESIGNATIONS

Noss Hillfort, a Scheduled Monument,<sup>3</sup> lies some 0.7 km to the south-west of the pipeline route. The pipeline route runs close to the boundary of Lupton Park (Site 5) which is registered as Grade II\* in the Register of Parks and Gardens of Special Historic Interest in England.<sup>4</sup> All the major buildings on the site are listed including the kennels, lodge and associated gatepiers (Site 6 & 7, Listed Grade II).

## 3. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

The pipeline route lies within the historic parishes of Brixham and Churston Ferrers, the latter, formerly a chapelry of Brixham, appears to have been a parish in its own right by at least 1590.<sup>5</sup> The route passes to the west of Lupton Park, a small part of which is situated to the south-west of the road. The settlement of Lupton was referred to in Domesday and has been suggested as the possible site of a prehistoric settlement

---

<sup>1</sup> Brief dated 12.9.08.

<sup>2</sup> BGS 2004.

<sup>3</sup> DCC HER SX85SE/21; SM No. 281:33792.

<sup>4</sup> No. PG1687.

<sup>5</sup> Peskett 1979, 120.

associated with Noss Hillfort. The surrounding farms of Hillhead, Raddicombe and Greenway are all documented in the medieval period and Alston in the 18th century.<sup>6</sup>

The regular boundaries of some of the fields depicted on the historic maps (Figs 4-6) on the pipeline route suggests that they may represent post-medieval enclosure. In the early 19th century (Tithe Map) two fields to the north of Hillhead Farm were called Great and Little New Park, indicating the creation of new fields, and other fields with a 'Down' element, suggest former open ground.<sup>7</sup> Other, less regular boundaries, may be of medieval or earlier origin. The Tithe Apportionments (1839/1840) describe all of the fields as being under arable cultivation at that time. The route of the A379 road is of probable of early origin, becoming a turnpike road in the early 19th century, and the lane from the road to Higher Greenway, formerly Greenway Barton, may be of medieval date.

The historic maps (Figs 4-6) suggest that there has been little significant change along the pipeline route since the early 19th century, the main alterations being the removal of a number of field boundaries. The surviving boundaries all consist of hedgerows. Between 1804 and 1839 (Figs 3 & 4) a new section of lane was created at the north end of the route, where the pipeline crosses to the east of the road.

#### 4. SITES OF ARCHAEOLOGICAL AND HISTORICAL INTEREST

##### 1. **Hillhead Farm** SX 9000 5385

Hillhead was probably the home of William del Hille, referred to in 1276.<sup>8</sup> On the surveyors drawing of 1803-4 (Fig. 3) the farm buildings are depicted arranged around a courtyard, with a further range and yard to the west. One of the courtyard ranges appears to have been demolished by 1838 (Tithe Map, Fig. 4) and the same arrangement is shown on the OS map of 1869 (Fig. 5). Further parts of the buildings had gone by 1907 (Fig. 6) and the modern map suggests that it has since been completely rebuilt.

On the Tithe Map/Appportionment the buildings are recorded as 'buildings, kennel and yard' (plot 392); the kennels were still marked on the OS map of 1869 (Fig. ). The property belonged to John Buller Yarde Buller Baronet and was occupied by Edward Dingle.

On the Tithe Map/Appportionment the fields immediately to the south and north of the farm buildings are called Great House Field and Little House Field, respectively (plots 395 & 391). It seems likely that the names describe the relative sizes of the fields and their position in regard to the farmhouse, rather than indicating the sites of earlier buildings.

##### 2. **Toll house** SX 90288 53806 (Torrey HER SX95SW/26 – MTO6001)

A toll house at Brixham Cross is shown on the Tithe Map (Fig. 4) and recorded in the Tithe Apportionment as 'Toll House and Garden', owned by the Trustees of Torrey Roads.<sup>9</sup> The toll house was shown on OS maps of 1862-1933 and was also the site of

<sup>6</sup> Gover *et al* 1932, 508-11.

<sup>7</sup> Brixham Tithe Map/Appportionment plot nos. 389-390; plot nos 386-388, 289-91.

<sup>8</sup> Gover *et al* 1932, 508.

<sup>9</sup> Brixham Tithe Map/Appportionment no. 546.

a bench mark. The building no longer exists; the site lies beneath the widened pavement at the northern apex of the road junction (HER).

3. **Quarry** SX 8999 5407 (Torbay HER SX85SE/281 – MTO4552)

A quarry, marked ‘Old Quarry’ is shown on OS maps surveyed in 1861 and 1904, but is not shown on the OS map of 1963. The quarry may have been used as a source of stone for Lupton House (HER). It is shown as a feature on the Tithe Map (Fig. 4).

4. **Quarry** SX 8970 5376

A quarry is depicted on the Tithe Map (Fig. 4) extending south-eastward from the western boundary of a field. The field is recorded as ‘Quarry Waste’ in the Tithe Apportionment (plot 394). The OS maps of 1869 and 1907 show the area as wooded (Figs 5 & 6).

5. **Lupton Park Listed Grade II\*** SX 9027 5550 (Torbay HER SX95NW/36/1 – MTO324)

Lupton Park is designated as Grade II\* in the Register of Parks and Gardens of Special Historic Interest in England.<sup>10</sup> The Park consists of parkland, woodland and formal gardens associated with Lupton House (Site 9). It lies to the north-east of the road, apart from a small area of ornamental plantation, called Kennel Wood, to the south-west of the road (area shown on Fig. 2). It is not certain if a spur from the pipeline will pass through the south-eastern end of the wood.

6. **Kennels to Lupton House Listed Grade II** SX 8970 5419 (DCC HER PRN 45523)

Buildings arranged around four sides of a central yard are shown and marked ‘Kennels’ on the OS map of 1869 (Fig. 5). Buildings around part of the same circuit are shown on the Tithe Map (1838; Fig. 4). The buildings still exist and are described as a mid 19th-century kennel block in Tudor-Gothic style designed by Wightwick (HER). They are located within a small section of Lupton Park (Site 5).

7. **Lodge to Lupton House (including gatepiers) Listed Grade II** SX 8970 5420

This lodge was present by 1838 (Tithe Map; Fig. 4) and was probably the work of George Wightwick as part of his improvements at Lupton House. The listing description gives the date of the building as *c.* 1840. It lies within Lupton Park (Site 5).

8. **Settlement** SX 902 551 (Torbay HER SX95NW/32 – MTO1585)

Within Lupton is the site of a small medieval settlement recorded in Domesday as *Lochetona*. The name, however, is believed to derive from *Luh(h)a*'s farm, a form which suggests an origin several centuries earlier.<sup>11</sup> It is possible that the former Higher Lupton farm<sup>12</sup> (shown on Fig. 3) and, or, Lupton House, may be relicts of this settlement. The site has also been considered to be sufficiently well situated to have been the settlement associated with Noss Hillfort.

9. **Lupton House Listed Grade II\*** SX 9027 5500 (Torbay HER SX95NW/36 – MTO1585)

---

<sup>10</sup> No. PG1687.

<sup>11</sup> EA draft report 2007, 2.

<sup>12</sup> Torbay HER SX95SW/3 – MTO44127.

Lupton House was built, or remodelled, by Charles Hayne about 1772, the original structure having faced north. It is possible that it is on the site of an earlier mansion, which was of sufficient status to have included an early 15th-century chapel.<sup>13</sup>

**10. Parish boundary** SX 89400 54338

The pipeline route will cross the historic parish boundary between Brixham and Churston Ferrers. Churston Ferrers was formerly a chapelry of Brixham; records of christenings, marriages and burials dating from 1590 onwards indicate that it was a parish in its own right by this time.<sup>14</sup> The boundary is shown on recent maps but appears to have been removed. Close to the road the boundary was formerly marked with a boundary stone, but this was apparently removed before 2000.<sup>15</sup>

**11. Quarry** SX 89262 54322

A quarry is shown on the Churston Ferrers Tithe Map (Fig. 4) on the edge of the southern parish boundary. It is not shown on the OS 1:10560 map of 1869 (Fig. 5).

**12. Milestone** SX 8936 5442 (DCC HER PRN 45500)

The HER record a milestone marked on OS maps of 1904 and 1963. It is still shown on the OS 1:2500 map of 2006.

**13. Deadmans Close** SX 8930 5440

A field at this location (north and west boundaries since removed) was called Deadmans Close on the Churston Ferrers Tithe Map/Apportionment (1839/1840). The name can refer to a place where someone died, or a body was found and there is one instance of it occurring on a Civil War burial ground.<sup>16</sup> As this particular field lies on the parish boundary, at the junction of a road and trackway, it is possible that it was the site of a gallows.

**14. WWII Anti-Aircraft Battery** SX 893 545 (DCC HER PRN 71726)

The site of a heavy anti-aircraft battery is recorded at Lupton. It does not appear to have been armed or equipped with radar (HER). The precise location of the site is presumably unknown.

**15. Building** SX 8928 5457

An apparent building is depicted on the 1803-4 surveyors' drawing on the north side of an east-west boundary that has since gone. It is not depicted on the Churston Ferrers Tithe Map (1839). Rubble was noted at this location during the field visit.

**16. Quarry** SX 8919 5453

Two quarries are depicted in this area on the Churston Ferrers Tithe Map at which time the area was divided into several small fields (Fig. 4). The quarries are not shown on the OS 1:10560 map of 1869.

**17. Quarry** SX 8911 5477

An elongated quarry, aligned north/south, is depicted on the Churston Ferrers Tithe Map (Fig. 4) at this location, with a further quarry in the field to the west (dividing

---

<sup>13</sup> EA draft report 2007.

<sup>14</sup> Peskett 1979, 120.

<sup>15</sup> pers. comm. Hal Bishop Torbay HER.

<sup>16</sup> Field 1972, 61.

boundary since removed). The OS 1869 and 1996 1:2500 map show the area of the eastern quarry as wooded. During the site visit several quarry pits were seen in this area, together with a number of smaller hollows and associated spoil dumps.

**18. Quarry** SX 89175496

A quarry is depicted on the Churston Ferrers Tithe Map. It is not depicted on the OS 1:10560 map of 1869.

**19. Quarries** SX 8908 5511

The Churston Ferrers Tithe Map (Fig. 4) depicts three quarried areas in this field, the northern boundary of which has since been removed. They are not shown on the OS 1:10560 map of 1869.

**20. Yamberry fieldname** SX 8905 5520

This field was divided into two fields on the Churston Ferrers Tithe Map, called Great Yamberry and Lower Yamberry.<sup>17</sup> The ‘berry’ element of a name can refer to the existence of former earthworks, of prehistoric or later origin.

**21. Enclosures/Field system** SX 8942 5492 & SX 897 552 (Torbay HER  
SX85SE/330 – MTO5501 & SX85NE/63 – MTO62208

A complex of rectilinear enclosures extending over several fields were recorded from the air in 1984. The features lie on a north-facing slope and extend over an area of *c.* 500m east-west by 250m north-south. They are not visible on the ground. The Tithe Map shows a complex of small fields in this area.

**22. Quarry** SX 8922 5519

A linear quarry, following the north side of a field boundary (since removed), is depicted on the Churston Ferrers Tithe Map (Fig. 4). No evidence of quarrying was detected in this area during the geophysical survey.

## 5. CONCLUSIONS

The pipeline route lies within a landscape of essentially medieval and post-medieval fields associated with the surrounding farms, including Hillhead (Site 1). It is possible that a settlement at Lupton (Site 8) existed earlier than this, however, and prehistoric activity in the vicinity is attested by the presence of Noss Hillfort. At the north end of the route the adjacent fields with the name ‘Yamberry’ (Site 20) may indicate former earthworks of prehistoric or medieval date, and cropmarks representing enclosures and a field system are recorded (Site 21). The fieldname ‘Deadmans Close’ (Site 13) is intriguing and may relate to post-medieval activity, possibly the site of a gallows.

Features of Post-Medieval or later date include Kennel Wood, a small part of Lupton Park (Grade II\* Historic Park, Site 5), which lies just to the north-east of the main route; it is not certain if a spur from the pipeline will pass through the wood. The kennels within the wood are also statutorily protected as a Grade II Listed Building (Site 6).

---

<sup>17</sup> Churston Ferrers Tithe Apportionment plot nos 221 & 330.

There are a number of quarry sites along the route, of at least early 19th-century origin, some of which are still evident as features (ie. Site 17). Evidence of a building present in 1803-4 was also found (Site 15). The most recent site is the WWII aircraft battery (Site 14), however, the precise location of this has not been established, and it may have lain some distance from the pipeline route.



## 6. RESULTS OF GEOPHYSICAL SURVEY (Figs 7-9)

prepared by C. Smart

### 1. AIMS

The aim of the geophysical survey was to assess the archaeological potential of the pipeline route using suitable geophysical techniques. The results are intended to inform decisions regarding further archaeological investigation at the site.

### 2. METHOD

Five fields along the route of the pipeline were subject to selective evaluation by magnetometer (gradiometer) survey. Magnetometer survey was selected as a proven method of accurately and rapidly detecting archaeological features (Appendix A).

#### 2.1 Survey Design

Field assessment indicated suitable locations for the selective geophysical evaluation, the extent of which was determined by topography and land-use. The pipeline route follows a north-south ridge and the survey targeted the most elevated positions with potential for past human activity. These had extensive views across Torbay and the River Dart. Elsewhere, the survey was distributed to give a fair coverage of the pipeline route. Five fields were subject to geophysical evaluation, with a total of 28 survey grids, each measuring 20m by 20m.

The magnetic survey was undertaken using a Bartington Instruments Ltd. Grad601-2 dual sensor gradiometer sampling eight readings per metre at 1m traverse intervals in the 1nT range.

### 3. RESULTS

#### **Field 1 (immediately south of Alston reservoir centred SX892552)**

A total of seven grids, providing coverage of 20m by 140m, were positioned according to the pipeline route across the brow of the hill. When surveyed, the field was covered with long stubble, attesting use for arable. The dominant features are a series of parallel plough scars oriented SSE-NNW, which show as positive linear anomalies. The magnitude of the plough scars indicates that the underlying geology is at a shallow depth. **Feature A** consists of a pair of positive linear anomalies oriented approximately E-W with a negative linear anomaly between. The characteristics of this feature suggest that this was a former hedgebank flanked by ditches. This is confirmed by Ordnance Survey first edition mapping dated 1869, which shows a boundary bisecting the modern field in this position. **Feature B** consists of a linear grouping of dipolar point anomalies that probably represents thermoremnant material scattered by ploughing. It can be seen that these anomalies are distributed evenly along the plough scars. **Feature C** consists of parallel linear positive and negative anomalies oriented NW-SE. The character of this feature is suggestive of a ditch with the remnants of a bank on its northern edge. The southeast terminus of this feature is apparent. The anomaly corresponds with a field boundary recorded on Ordnance Survey surveyors drawing no. 22E, dated 1803-04, as well as the Churston Ferrers Tithe map dated 1839. **Feature D** is a strong positive curvilinear anomaly that most

likely represents a ditch. Again, no boundaries are shown on historic mapping on this orientation so an earlier date may be supposed.

### **Field 2 (centred SX891547)**

A total of four grids, providing coverage of 20m by 80m, were positioned in the southeast corner of the field parallel with the eastern hedgeline. When surveyed, the field was under pasture. There are, however, very faint traces of SE-NW oriented plough scars showing that the field has previously been ploughed. The northern end of the survey showed an area of magnetic disturbance. **Feature E**, an alternating positive/negative bipolar linear anomaly running across this area is likely to represent the line of a modern service. To the north of Feature E are a number of positive point anomalies. Positive point responses may indicate natural hollows, tree throws, or pits of archaeological derivation for example, but the anomalies seen here cannot be ascribed to a single feature class with any certainty. **Feature F** is a wide positive linear anomaly oriented SE-NW. Whilst it is possible that this anomaly represent a manmade feature, its irregular character and position at the head of a combe suggests that it may be of natural origin. It is known that quarrying took place nearby but this feature appears to be unrelated to that activity. Between Features E and F are six positive point anomalies of uncertain origin. Again, to the south of Feature F are at least three positive point anomalies. There are also a several dipolar magnetic responses indicative of near-surface ferrous or thermoremnant material of probable modern origin.

### **Field 3 (centred SX893544)**

Three areas of magnetic survey were distributed along the pipeline route within this field. The field, which had recently been ploughed, is shown as consisting of five smaller fields on Ordnance Survey first edition mapping dated 1869. The survey areas, each consisting of three grids with coverage of 20m by 60m, were placed in the north, roughly central, and in the south of the field.

The northernmost survey showed distinctive N-S oriented plough scars. **Feature G** is a positive curvilinear anomaly oriented NE-SW. This feature does not correspond with the eradicated field boundaries and probably represents a substantial ditch of earlier origin. **Feature H** is a narrower positive linear anomaly oriented N-S. The feature was also recorded further south, showing that it runs the length of Field 3. The line of this feature follows that of the pipeline route and it is possible that it represents an earlier service that is not shown on plans supplied to Exeter Archaeology. However, there is no indication that this feature contains a metal pipe. **Feature I** has been identified so as to exclude it from discussion. It derives from heavy magnetic disturbance immediately inside of the field's gateway.

The central survey again showed distinctive north-south oriented plough scars. A positive linear anomaly on the western side of the survey is probably a continuation of **Feature H**. **Feature J** is a positive linear anomaly of lower magnitude on roughly the same orientation as Feature H. It is of greater magnitude than the plough scars and possibly represents a ditch of uncertain age or function. It is reasonable to suggest that Feature K continues into the southern survey area. **Feature K** has the same character as Feature A in Field 1, and represents a removed field boundary shown on Ordnance Survey first edition mapping. **Feature L**, at the eastern end of Feature K, represents a spread of magnetic debris probably derived from the demolition of a building shown

on an Ordnance Survey surveyor's drawing of 1803-04. A scatter of building debris was noted in this location. There is a general spread of dipolar responses of lower magnitude that may indicate thermoremnant material such as brick, fired clay and other heat-affected debris. Amongst the general scatter of dipolar magnetic responses there appear to be several positive point responses, although it is possible that these may be low magnitude dipolar anomalies that are difficult to discern within the plotting parameters.

The southernmost survey again showed distinctive plough scars following the orientation of the field. A strong positive linear anomaly on the western side of the survey is a continuation of **Feature H**, also seen further north. A continuation of positive linear anomaly **Feature J** is also evident, though it is not dead-straight. As previously discussed, the purpose or date of this cut feature is not known. There are a small number of positive point anomalies that may represent pits or hollows, but these may be a result of ploughing on the shallow soils.

#### **Field 4 (centred SX895541)**

A total of four grids, providing coverage of 20m by 80m, were positioned according to the pipeline route. When surveyed, the field was covered with arable stubble. Two series of plough scars are evident, the first oriented NW-SE and the second E-W. The magnitude of the scars suggests that ploughing has caused disturbance across this area and contributed to the movement of magnetised material. **Feature Group M** is a series of positive linear anomalies. At the southern end of the group is a positive curvilinear anomaly with two parallel positive linear anomalies running northwards from it. It is possible that there are further E-W positive linear anomalies, although as these are oriented with the ploughs scars it is possible that these represent the movement of magnetised material in the direction of ploughing. **Features N** and **O** are distinct dipolar anomalies that may represent in situ heating or highly magnetised objects. Areas of magnetic disturbance surround them. The magnitude of these anomalies excludes the possibility that these are modern ferrous objects. These anomalies are positioned adjacent to the aforementioned positive linear anomalies of Feature Group M. **Feature P** is a short positive linear anomaly on the same axis as Feature Group N, and appears unrelated to the orientation of plough scars.

#### **Field 5 (centred SX897540)**

A total of four grids, providing coverage of 20m by 80m, were positioned according to the pipeline route. The field was under pasture when the survey was carried out but it revealed two series of roughly E-W oriented and N-S oriented plough scars, attesting past use for arable. **Feature Q** is a positive linear anomaly oriented NNE-SSW. Its intermittent appearance may be a result of truncation through ploughing. There are at four positive point anomalies, representing pits or hollows of uncertain origin, to the west of this feature. It is possible that Feature Q is the line of a former boundary but it does not have the character of an eradicated hedgebank (Features A and K, for example). **Feature Group R** is a series of high magnitude positive anomalies aligned with plough scarring. It is possible that these are natural hollows although they may be of archaeological interest. At the southwest end of the survey area are at least five areas of dipolar magnetic responses that may indicate spreads of thermoremnant material. It was noted that piles of manuring material, including clinker, had been dumped at points across the field to be spread across it.

## Conclusion

The geophysical assessment sought to investigate the potential for archaeological remains prior to the commencement of ground works along the line of the Alston to Hillhead trunk main. Magnetic survey was chosen as a suitable method. Areas of survey were distributed along the course of the pipeline, specifically targeting positions of archaeological potential. These were largely determined on topographic grounds.

The survey revealed three eradicated hedge banks shown on historic mapping. It is apparent that Field 1 has undergone at least two phases of boundary changes. Field 3 was once subdivided into five smaller fields. Feature L corresponds to a structure shown on an Ordnance Survey drawing of 1803-04 and building debris was noted in this location. Features D in Field 1 and G in Field 3 are of the greatest archaeological potential as they represent curvilinear ditches that are unrelated to the historic field pattern. They are potentially of medieval, Roman or prehistoric origin. Heavy ploughing has obscured the character of Feature Group M in Field 4, but it also has archaeological potential. The heavy plough scarring seen along the length of the pipeline route demonstrates the shallow depth of soils and the potential for damage to in situ archaeological deposits.

## APPENDIX A: BASIC PRINCIPLES OF MAGNETIC SURVEY

High-resolution magnetic survey can be used to detect localised anomalies in the Earth's magnetic field (Clark 1990, 64-97; Gaffney and Gater 2003, 36-42). Iron is present in soils, clays and geology as weakly magnetised chemical compounds. The past activities of man impact upon the natural state and distribution of these magnetised compounds, which can be detected as a contrast or variation with the Earth's magnetic field. Such changes in *magnetic susceptibility* and *thermoremanence* are produced by different actions.

A material's *magnetic susceptibility* relates to the magnetism that is induced in it when placed in a magnetic field. The Earth's magnetic field is permanent and therefore the induced magnetism of a material is also permanent. The greater the induced magnetism, the higher the susceptibility. There is natural variation in the magnetic susceptibility of rock, subsoils and topsoils, but it can also be affected by heating and biological or fermentation processes. Accurate measurement of localised variations in magnetic susceptibility enables a picture of human activity to be constructed. As topsoil usually has a greater magnetism than subsoil and bedrock, archaeological features cut into these and backfilled or silted-up with topsoil will have a greater magnetic susceptibility and show as a positive anomaly. Examples include ditches and pits, but may also include natural hollows and channels. On shallow soils, ploughmarks can often show as positive linear anomalies. Conversely, if less magnetic material, such as building stone, is introduced into the topsoil (higher magnetism), it will have a lower magnetic susceptibility and show as a negative anomaly. Examples include buried wall foundations, floor surfaces and earthen banks, but natural outcrops of geology may also give a similar negative response.

*Thermoremanence* is the magnetism of a material that has been heated to the Curie point (675°C for haematite and 565°C for magnetite), at which time they become demagnetised, then re-magnetised by the Earth's magnetic field. The acquired magnetism is in the direction of the Earth's field at the time of cooling. Archaeological features that will show such effects are hearths, furnaces and kilns. Materials, such as brick and tile, and even ash, will also acquire thermoremanence detectable by detailed magnetic survey.

For detailed magnetic survey, Exeter Archaeology employs a Bartington Instruments Ltd. Grad601-2 fluxgate gradiometer (commonly known as a *magnetometer*). A fluxgate gradiometer is a passive device consisting of two vertically-mounted sensors spaced 0.5m apart. The upper sensor measures the Earth's magnetic field. The lower sensor, which is carried approximately 0.3m from the ground, also measures the Earth's field but is directly affected by alterations to it caused by human activity (outlined above). The magnitude of the buried anomaly is calculated by subtracting the upper sensor reading from the lower sensor reading. The greater the contrast between the magnetic susceptibility of the surrounding area and an archaeological feature, the more distinctive the results are likely to be. A high level of background magnetic susceptibility may hinder the recognition of archaeological features.

## ACKNOWLEDGEMENTS

The project was administered by B. Whayman for May Gurney and P.J. Weddell for Exeter Archaeology. The desk-based element of the assessment was compiled by P. Manning and the illustrations prepared by N. Goodwin. The geophysical survey was undertaken by C. Smart and H. Rance and the figures produced C. Smart and T. Ives.

## SOURCES CONSULTED

### Unpublished sources

*Devon County Council Historic Environment Record*

Records for sites in the vicinity of the pipeline route

Aerial photographs: CPE/UK/1890 10 Dec '46 F20//Multi (4) 58 SQDN

*Torbay Historic Environment Record*

Records for sites in the vicinity of the pipeline route

*Devon Record Office (DRO)*

Brixham Tithe Map/Appportionment 1838/1840

Churston Ferrers Tithe Map/Appportionment 1839/1840

### Printed sources

(BGS) British Geological Survey 2004 1:50,000 Torquay. England and Wales Sheet 350, Solid and Drift Geology.

Clark, A. 1990. *Seeing Beneath the Soil: prospecting methods in archaeology*

Tate, G. (HES) 12.9.08 Brief for Archaeological Desk Based Assessment, Alston Reservoir to Kingshead Reservoir.

EA draft report 2007 *Archaeological Assessment of Lupton House, Brixham*

Field, J. 1972 *English Field Names: A Dictionary*

Gaffney, C. and Gater, J. 2003. *Revealing the Buried Past. Geophysics for Archaeologists*

Gover, J.E.B., Mawer, A., & Stenton, F.M. 1932 *The Place-Names of Devon: Part II*  
Ordnance Survey (OS)

surveyors' two-inch drawing No. 22E, surveyed 1803-4

1:10560 map sheet 128NW: 1869, 1907, Provisional Edition (Revision of 1904 with additions in 1938)

1:2500 Explorer Sheet OL 20, 2006

Peskett, H. 1979 *Guide to the Parish and Non-Parochial Registers of Devon and Cornwall 1538-1837*



Fig. 1 Location of pipeline route.

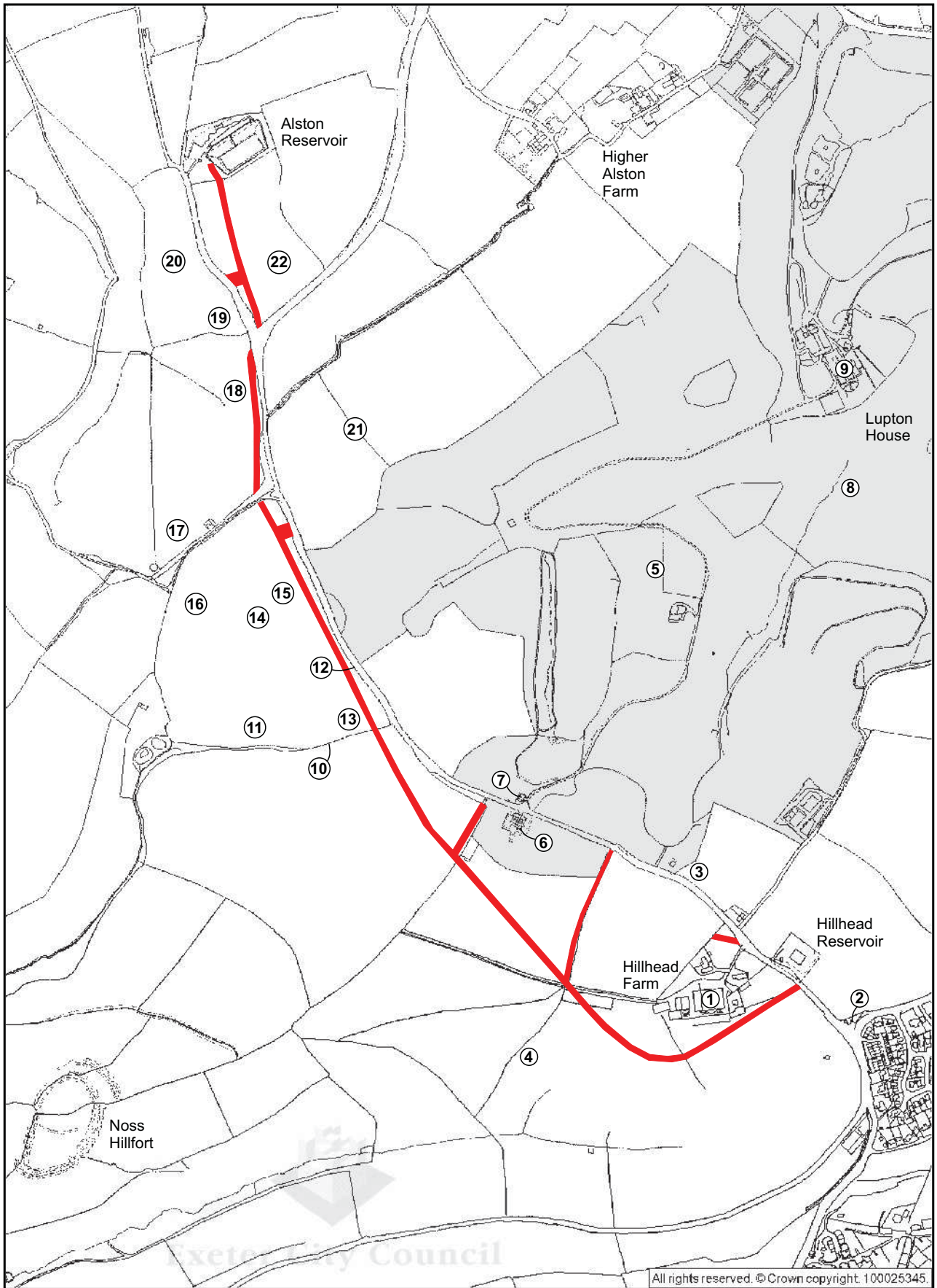


Fig. 2 Location of pipeline route and sites of archaeological interest (numbered 1-22). The historic park (site 5) is represented by the shaded area. Scale 1:10000.

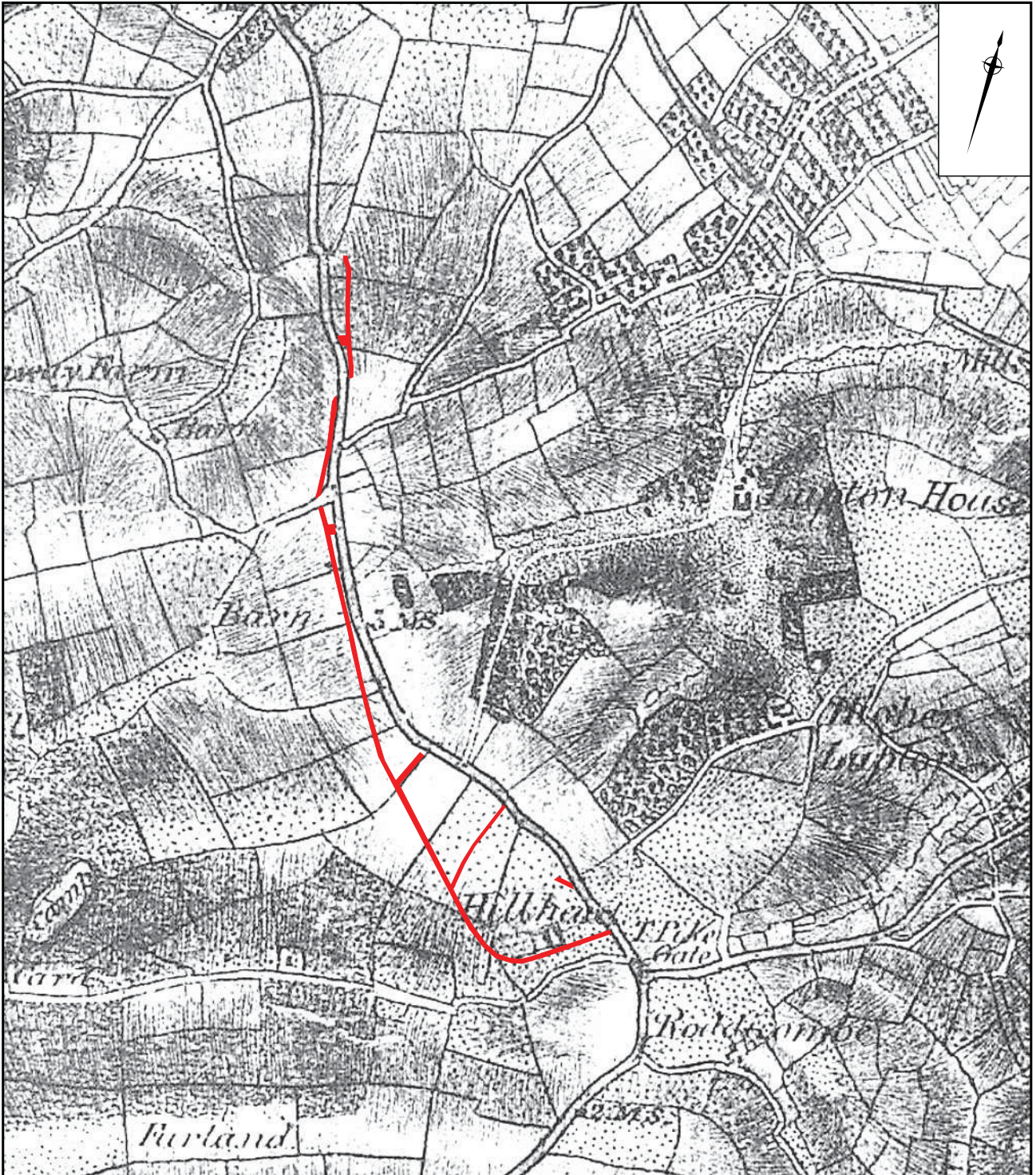


Fig. 3 Extract from the OS surveyors' two-inch drawing, 1803-4.



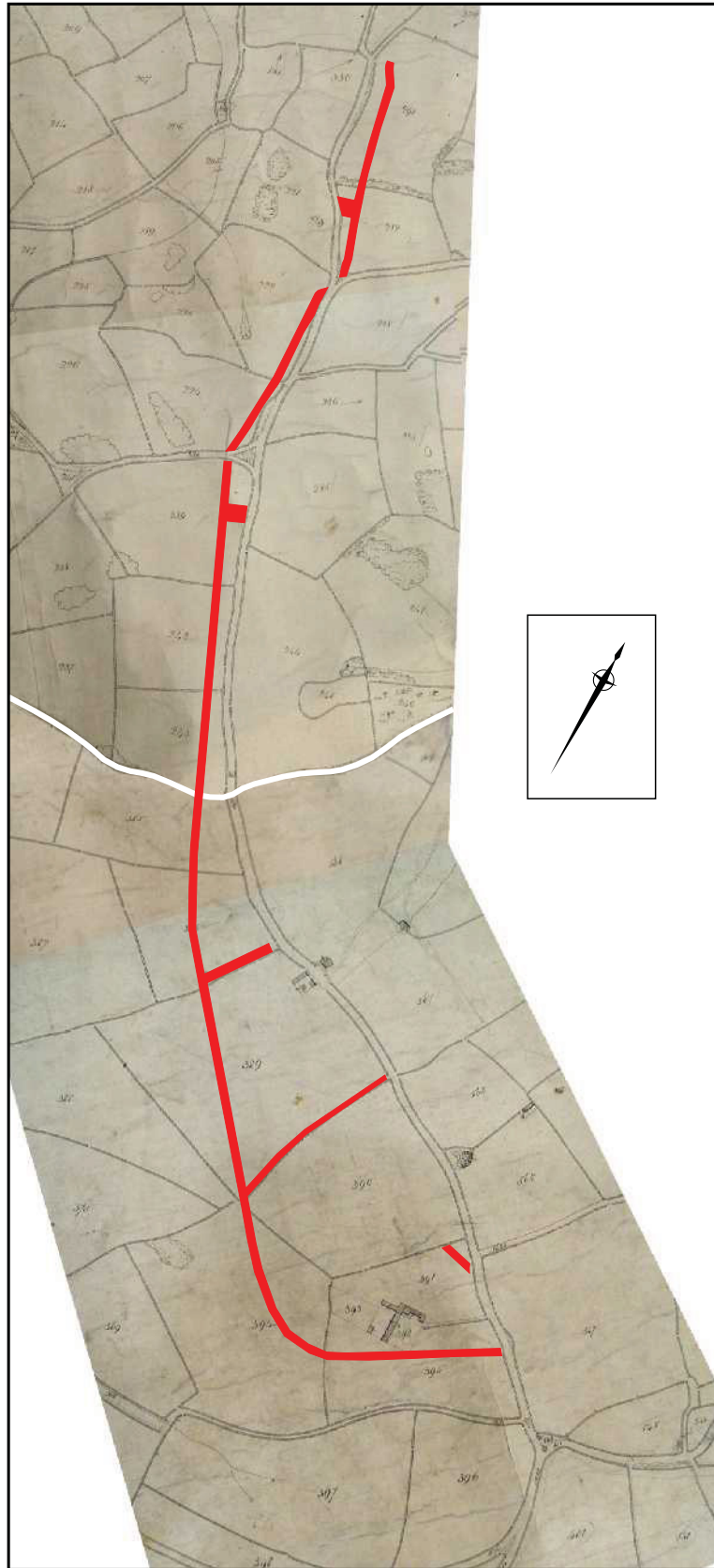


Fig. 4 Extract from Brixham Tithe Map, 1838 (south) and Churston Ferrers Tithe Map, 1839 (north).

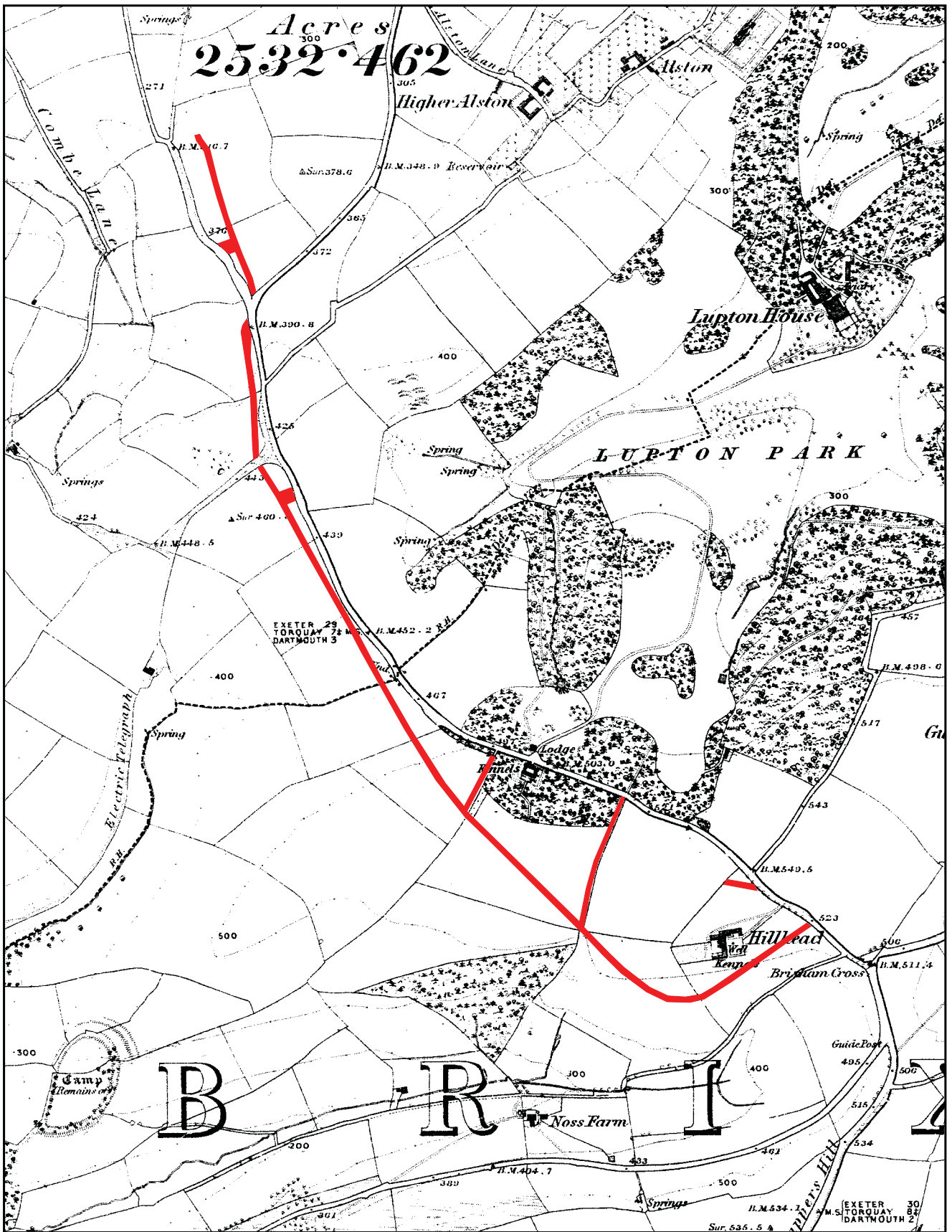


Fig. 5 Extract from the 1869 OS 1:10560 map.

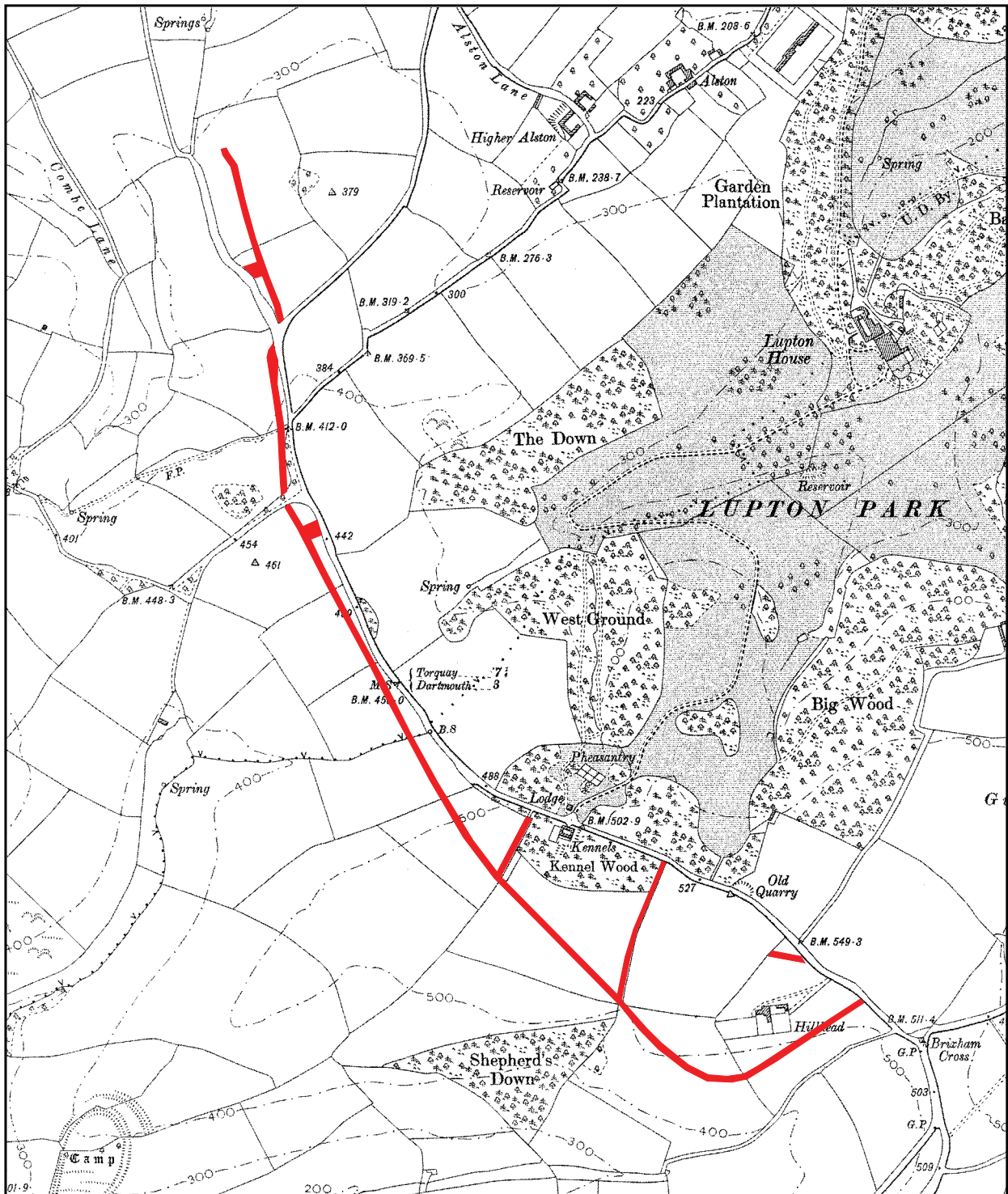


Fig. 6 Extract from the 1907 OS 1:10560 map.



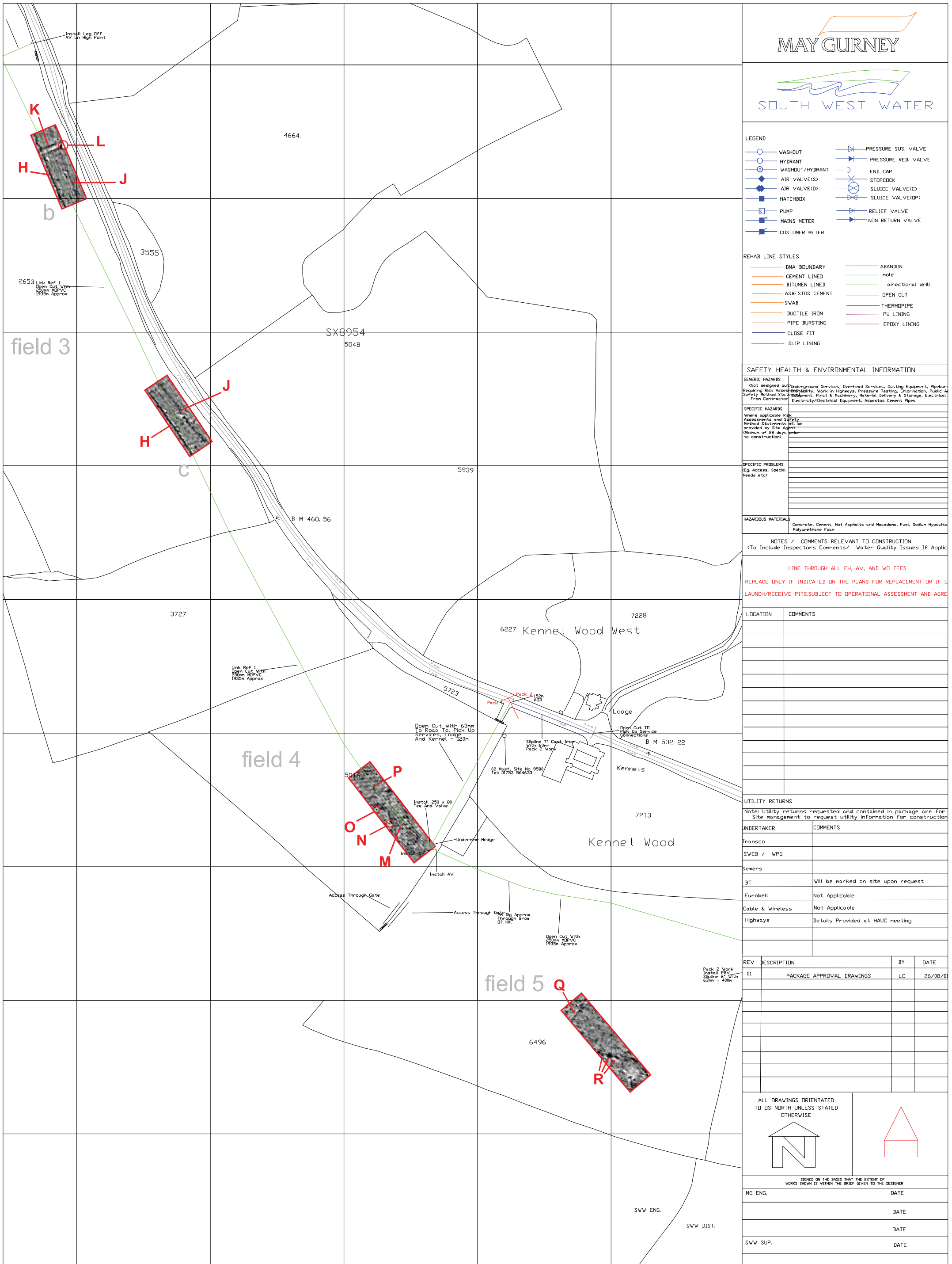


Fig. 8 Evaluative gradiometer survey at southern end of pipeline route.

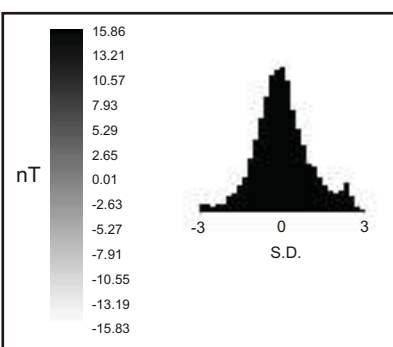
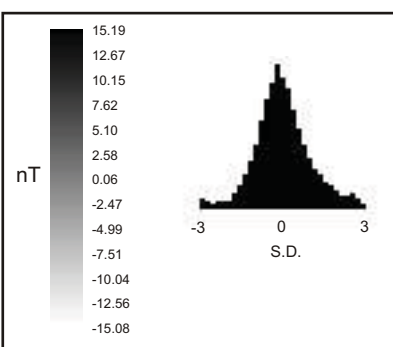
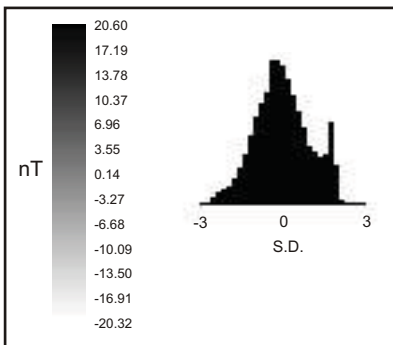
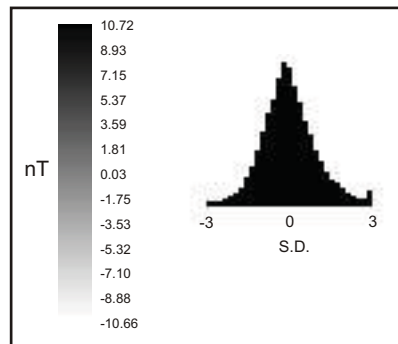
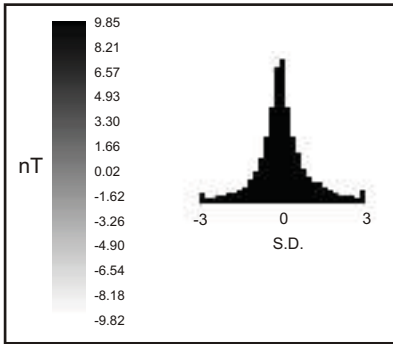
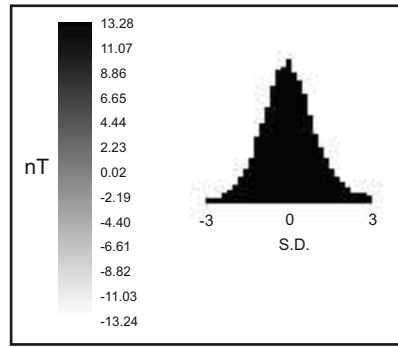
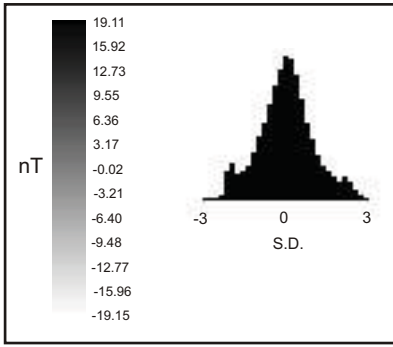


Fig. 9 Plotting parameters of evaluative gradiometer survey along the pipeline route.