Llandinam-Llanwrin Water Mains, Stage 1- Llandinam-Talerddig: ARCHAEOLOGICAL EVALUATION

CPAT Report No 238

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Llandinam-Llanwrin Water Mains Stage 1- Llandinam-Talerddig: ARCHAEOLOGICAL EVALUATION

A. M. Gibson August 1997

Report for Binnie, Black & Veatch

The Clwyd-Powys Archaeological Trust

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CPAT Report No 238, 27/08/97

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1 INTRODUCTION

- 1.1 On 13th March 1997, the Contracts Section of the Clwyd-Powys Archaeological Trust (hereafter CPAT Contracts) was invited by Binnie, Black & Veatch, acting for Severn Trent Water, to tender for the archaeological evaluation of three areas on Stage 1 of the Llandinam-Llanwrin water mains pipeline construction (Fig 1).
- 1.2 A brief had already been prepared by the Curatorial Section of the Clwyd-Powys Archaeological Trust (hereafter CPAT Curatorial) (Brief No. EVB 191, dated 14th October 1997) which outlined the scheme of works to be undertaken at each of three areas identified as being archaeologically sensitive. This brief also stated that an archaeological contracted watching brief would be necessary over the rest of the pipeline during the topsoil stripping of the wayleave and during the pipe-laying operations.
- 1.3 Accordingly a costing and specification for both the evaluation and watching brief elements were submitted by CPAT Contracts (appendix 1) and on 2nd June 1997, at a site meeting with Mr S Nash of Binnie Black & Veatch, CPAT Contracts were asked to undertake the archaeological evaluation.
- 1.4 By the 2nd of June, part of the wayleave corridor had already been fenced and topsoil stripping had begun. In view of the advanced stage of the pipeline works, it was agreed with Binnie Black & Veatch, CPAT Curatorial and CPAT Contracts that a watching brief should be immediately maintained on the whole of the topsoil stripping of the pipeline corridor but that the evaluation should proceed as originally planned.
- 1.5 This report presents the results of the archaeological evaluation. The results of the watching brief will be reported separately.

2 ARCHAEOLOGICAL REQUIREMENTS

- 2.1 Three archaeologically sensitive areas were identified in the Curatorial Brief (Fig 2).
- 2.2 Area 1 formed a dog-leg from Wig Lane (SO014922) in the N, SE along the northern side of the present Carno-Trefeglwys road for a distance of 400m (Area 1A) then S for 400m to SO019917 (Area 1B). Geophysical survey, aerial photographic rectification and trial trenching were recommended in this area to test for the presence of, or features related to, Caersws Roman Road, Park Cottage Ring Ditches 1-3 (Primary Record No (hereafter PRN) 2507, 2508, 50190), Park Cottage Enclosure (PRN 2509), and Tyddyn Canol Ring Ditches 1-2 (PRN 7029, 7133).
- 2.3 Area 2 lay to the E of and ran parallel with the present Caersws-Carno road and measured some 220m from SO016932 to SO017921. Geophysical survey, aerial photographic rectification and trial trenching were recommended in this area to test for the presence of or features related to Black Hall Cottage Ring Ditches 1-2 (PRN 2510, 4649) and the cropmarks of a possible field system at Black Hall Cottage (PRN 4488).
- 2.4 Area 3, at Carnedd Farm (SO022911), is reported in the Sites and Monuments Record (hereafter SMR) to be the findspot of an urn filled with cremated bone (PRN 1572). Such a burial custom is most likely to be Bronze Age or Roman in date and therefore three evaluation trenches were recommended in this area.

3.1 Geophysical survey

- 3.1.1 The full results of the geophysical survey form appendix 3 of this report and a summary only is presented here. M (magnetometer) and R (resistivity) numbers use the same numbering as in appendix 3.
- 3.1.2 Both magnetometry and resistivity survey were undertaken over this area within the fenced wayleave. The southernmost 220m of Area 1B had already been stripped of topsoil and the geophysical survey consequently narrowed here to avoid the spoilheaps of removed topsoil.
- 3.1.3 A possible curving ditch was recognised in Area 1A in the magnetometer survey (Fig 3, M3) and two linear anomalies were recognised in the resistivity survey (Fig 3 R3 and R2).
- 3.1.4 The ditches of the later prehistoric Park Cottage enclosure (PRN 2509) were located by both geophysical techniques in Area 1B (Fig 3, R5 and R7 and M 7-8). A large circular anomaly was located between the ditches (Fig 3, R6) which may represent a pit or well. There was also an area of anomaly located close to the Roman Road but this may also result from the removed hedgerows in this area.
- 3.1.5 The anomaly running parallel with the way leave identified in appendix 2 (M5-6 and R1) is interpreted here as interference from the existing pipeline.

3.2 Aerial photograph rectification

- 3.2.1 Poor resolution was obtained on the aerial photographic rectification due to the obliqueness of many of the photographs. The results are displayed on Fig 4.
- 3.2.2 All cropmarks recorded on the aerial photographs were shown to lie outside the wayleave corridor with the exception of PRN 2509 which the pipeline was seen to cross.

3.3 Excavation

- 3.3.1 After due discussion with the archaeological curators, three excavation trenches were recommended to investigate the anomalies noted in area IA. These excavations took place on the 7th-9th of July 1997 under the supervision of Mr G Owen of CPAT and their locations are shown on Fig 5. It was also decided that excavation was unnecessary in Area 1B since evaluation trenches would be unlikely to provide more information than was already known from the geophysical survey and the aerial photography. Accordingly it was recommended that the wayleave corridor be moved to avoid the enclosure (PRN 2509). Binnie, Black & Veatch agreed to move the corridor 40m to the E.
- 3.3.2 **Trench 1** measured 30m by 2m and was located centrally within the wayleave and parallel to its sides (Fig 5). This trench was designed to investigate the geophysical anomaly R3. The turf and topsoil were removed mechanically to a depth averaging 0.4m. The gravel surface was then cleaned by hand. No archaeological features were located in this trench and it therefore appears that the anomalies noted were due to variations in the gravel surface.
- 3.3.3 **Trench 2** measured 20m by 2m and was also located centrally within the wayleave and parallel to its sides (Fig 5). This trench was designed to investigate the geophysical anomaly R2. The turf and topsoil were removed mechanically to a depth averaging 0.4m. The gravel surface was then cleaned by hand. No archaeological features were located in this trench and it therefore appears that the anomalies noted were due to variations in the gravel surface.
- 3.3.4 **Trench 3** measured 16m by 2m and was also located centrally within the wayleave and parallel to its sides (Fig 5). This trench was designed to investigate the geophysical anomaly M3. The turf and topsoil were removed mechanically to a depth

averaging 0.4m. The gravel surface was then cleaned by hand. Four features of possible archaeological significance were located as follows (Fig 5):

F1 comprised the butt end of a possible ditch running below the SW section of the trench. It measured 0.6m across and had a shallow scooped profile reaching a maximum depth of 0.2m. It was filled with an orange-brown compact silt. There were no finds or dating material and the function of the feature is unknown.

F2 was a broad but shallow depression which also ran into the SW section. This measured 1.25m across and reached a depth of 0.1m. The fill was also a compact orange-brown silt. There were no finds or dating material and the function of the feature is unknown.

F3 was a large oval depression measuring 1.3m E-W by 0.8m N-S. Where sectioned, the pit measured 0.35m deep. The fill was also an orange-brown compact silt. The edges of this pit were difficult to define suggesting that it may be a natural alluvial feature. There were no finds or dating material and the function of the feature is unknown.

F4 was a trench running diagonally across the excavated area and may well be the anomaly recorded in the geophysical survey. The ditch measures 0.6m across and up to 0.12m deep. It was relatively steep sided with a rounded base. The fill comprised a fairly soft orange-brown silt. There were no finds or dating material and the function of the feature is unknown.

3.3.4 The evaluation excavation of the Roman Road was also deemed unnecessary and instead an intensive watching brief would be maintained on this area during the cutting of the pipetrench and time would be allowed for the archaeologist on site to record any archaeological features noted in section. This was also agreed by Binnie, Black & Veatch.

4 AREA 2

4.1 Geophysical survey (Fig 6)

- 4.1.1 The full results of the geophysical survey form appendix 3 of this report and a summary only is presented here. M (magnetometer) and R (resistivity) numbers use the same numbering as in appendix 3.
- 4.1.2 Both magnetometry and resistivity survey were undertaken over this area within the fenced wayleave.
- 4.1.3 A large linear anomaly crossing the trench diagonally was located on the magnetometer survey about midway along the area (Fig 6: M12) and a linear anomaly was noted on the magnetometer and resistivity surveys immediately to the SE of anomaly M12 (Fig 6: R10, M13). These anomalies were subsequently tested by excavation.

4.2 Aerial photograph rectification (Fig 7)

4.2.1 Poor results were obtained from the rectification of the aerial photographs due to the obliqueness of many photographs and to the paucity of control points on others. The aerial photographs of the area however, showed cropmarks which could well be equated with the geophysical anomalies R10 and M13 (Site 1 on Fig 7). In addition, site 1 could be seen on aerial photographs to curve round over a distance of 200m from beneath the present road at NGR SO01629320 into the field to the E and then back under the road at NGR SO01759303. The ditch does not show on aerial photographs in the fields to the W of the road or railway. There is no aerial photographic evidence for features within the area enclosed by the ditch. The

wayleave passes through this proposed enclosure, however, and will therefore directly affect any associated internal features which may be as yet undetected.

- 4.2.2 Ring ditches PRN 2510 and the subrectangular site PRN 4649 are also visible on the aerial photographs. The former is believed to be the ploughed-out remains of a neolithic or bronze age burial mound. While lying close to the wayleave, it is not affected by the present works.
- 4.2.3 An oval-rectangular ditched area centering on NGR SO01729320 was also noted on AP No. 81/007/021 (PRN 4649). This appears to comprise an oval ditch enclosing a broadly rectangular feature. Such cropmarks find parallel amongst the long barrows of the neolithic period, but it may equally likely represent a hay-stack stance or some similar agricultural feature.
- 4.2.4 PRN 4649 lies within a roughly rectilinear ditched area possibly representing part of a later prehistoric field system (PRN 4488). If this interpretation is correct, then it is notable that PRN 4488 seems to cut across site 1 and clearly indicates that site 1 is earlier than the field system.
- 4.2.5 Two other ring ditches, not located during the initial Assessment, were also noted on the aerial photographs (Fig 7: Sites 2 and 3). Both of these monuments lie outside the wayleave corridor and will not be affected by the pipeline construction.

4.3 Excavation

- 4.3.1 Two trenches were excavated in this area (Fig 8A) under the supervision of Mr D Thomas of CPAT.
- 4.3.2 Trench 1 measured 25m by 4m and was designed to test anomalies M13 and R10. The topsoil and turf, totalling between 0.4 and 0.5m in depth, were removed mechanically to the underlying gravel surface which was then cleaned by hand. All features were hand excavated. The geophysical anomalies were not located archaeologically and are therefore considered to be the result of geological variation.

However, two features diagonally crossed the southern end of trench 1(Fig 8B: F1 & 2). They were 4.5m apart and proved to be two parallel shallow trenches each filled with orange-brown loamy soil with few stones. Each feature averaged 0.3m across. A 1m wide section was cut across F2 which proved to have of a uniform fill, its profile was U-sectioned with slightly splayed sides and it measured 0.3m deep (Fig 8D: a-b). A single potsherd was recovered from this section. The sections of F3 were not recorded.

A small shallow circular feature F3 filled with orange-brown loam was located to the N of F2 (Fig 8B: F3). There were no finds from this feature and its date or function are unknown.

4.3.3 Trench 2 measured 20m by 3.5m and was designed to test Site 1 which was believed to lie in the centre part of the trench. No archaeological features were noted here, however, but a ditch was located in the S end of the trench (Fig 8C: F4). This may possibly represent site 1 but if so, it is noteworthy that does not exactly coincide with the geophysical anomaly. The turf and topsoil, totalling a depth of 0.4-0.5m, was removed mechanically and the gravel surface was then cleaned by hand. All features were manually excavated.

F4 measured 4m across in total and appeared to have two phases (Fig 8C & D). Phase 1 originally comprised a 4m wide shallow ditch whose remaining fill consisted of orange-brown clayey loam with some stones (Fig 8D: c-d, context 11). This had been recut in phase 2 as a 2m wide, shallow, flat-bottomed ditch 0.25m deep. The upper fill consisted of an orange-brown clayey loam with few stones and occasional charcoal and measured up to 0.35m deep (Fig 8D: c-d, context 12). Below this was a basal fill of large rounded stones and gravel which also contained occasional charcoal

flecks. There were no finds from F4 and the sparseness of the charcoal rendered it unsuitable for radiocarbon dating. However, the ditch does appear to be cut by and is thus earlier than PRN 4488 which is presumed to be of iron age date.

4.4 Finds

4.4.1 The only find from the excavation consists of a single rim sherd of pottery from the fill of F2. The fabric of this sherd is soft and porous, black in colour and with pitted surfaces. It averages 5mm thick. The rim is rounded and everted. The profile of the vessel combined with its fabric suggests that it is from a shouldered bowl of the earlier neolithic Grimston-Lyles Hill tradition conventionally dated to the early Neolithic, between 4000 and 3500 BC.

5 AREA 3

5.1 Excavation

- 5.1.1 Three trenches were opened within the area of the wayleave and to the W of Carnedd farm (Fig 9) to test for the presence of a possible cremation cemetery. Each trench measured 20m x 2m. The trenches were excavated mechanically to the top of any archaeological deposits if present, or to the natural subsoil which in this area was a sticky yellow to grey clay.
- 5.1.2 Trench 1 was excavated diagonally across the wayleave corridor just S of the river and to the NW of Carnedd Farm. It was excavated mechanically to a depth of 0.5-0.6m. The turf and humic topsoil averaged 0.2m deep and below this was a greybrown fine-fractioned alluvial silt which in turn overlay a yellow clay. Two features were noted in SE end of the trench as follows:

F1 comprised a patch of charcoal 0.75m wide and extending under the SE corner of the trench. The feature appeared to have no depth and there was little sign of *in situ* burning.

F2 comprised a patch of charcoal 0.5m wide and extending under the NE corner of the trench. The feature appeared to have no depth and there was little sign of *in situ* burning.

Charcoal samples were taken from both these features but there were no chronologically diagnostic finds and the charcoal has not been analysed. It is retained in the site archive.

5.1.3 Trench 2 was orientated roughly N-S, parallel with and close to the E side of the way-leave corridor and was located to the W of Carnedd Farm (Fig 9). This also measured 20m by 2m and averaged 0.6m deep increasing to 0.8m at the S end where there was a greater build-up of hillwash. The turf, humus and hillwash were removed mechanically under close archaeological supervision but no features were noted in these layers. Crossing the trench between 5m and 7m S of the N end was a broad ditch visible as a dark-brown line through the yellow clayey subsoil. The ditch was also visible as a slight earthwork outside the wayleave corridor as a slight depression running E towards the rear of Carnedd Farm.

The ditch was filled with a dark-brown fine fractioned clayey loam soil (Fig 9.4, context 3) which contained abundant charcoal flecks, particularly in the upper levels. The ditch was 1.75m wide at subsoil level, had a shallow V-section and measured 0.7m deep below the yellow clay subsoil. It was not visible in the soil profile above this layer. The fill was uniform and homogenous with no silting patterns visible. There were no finds but a bulked charcoal sample was taken from the upper levels of the ditch fill and remains in the site archive.

5.1.4 Trench 3 was slightly to the S of trench 2 and on the W side of the wayleave corridor. It too measured 20m by 2m and was orientated approximately N-S. The trench gradually deepened from 0.5m at the N end to 0.9m at the S end where the depth of fine-fractioned dark brown hillwash increased. This hillwash overlay a mixed layer of yellow clay and ill-sorted gravel. Investigation of these contexts indicated that they were most likely alluvial in origin and probably represent a former stream course some 18m wide as revealed in the excavation trench.

F1 lay in the extreme S end of the trench and extended below the S section. It comprised a patch of charcoal and *in situ* burning (Fig 9). This is of unknown date and function but a charcoal sample was recovered from this context and is retained in the site archive.

6 CONCLUSIONS

- 6.1 Archaeologically sensitive Area 1 was divided into Areas A and B for convenience. The rectification and mapping of aerial photographs of archaeological sites in proximity to Area 1A confirmed that all known archaeological sites lay outside the wayleave and therefore would not be affected by the pipeline works. Geophysical survey over Area 1A located no certain features of archaeological activity. Trial trenching of Area 1A confirmed that the geophysical anomalies were of probable natural origin or of low archaeological importance.
- 6.2 The rectification and mapping of aerial photographs of archaeological sites in proximity to Area 1B indicated that the wayleave crossed a rectilinear enclosure of presumed iron age date (PRN 2509). The ditches of this site as well as a large circular feature were also located during the geophysical survey of Area 1B. The wayleave corridor was accordingly moved to the E and consequently this site would not be affected by the pipeline works.
- 6.3 The rectification and mapping of aerial photographs of archaeological sites in proximity to Area 2 confirmed that all known archaeological sites lay outside the wayleave and therefore would not be affected by the pipeline works. However, a previously recorded ditched enclosure and two short linear ditches were identified on the aerial photographs. Geophysical survey over Area 2 also located anomalies which may be considered to represent these features. Trial trenching of Area 2 located features of archaeological origin though they cannot be directly related to the geophysical survey anomalies. Finds from the excavations as well as stratigraphy noted on the aerial photographs suggested that these features might date to the neolithic period, perhaps 4000-3000 BC. This site is potentially of national importance and it is recommended that a suitable archaeological response be mounted in this area.
- 6.4 The trial trenching in Area 3 revealed evidence for a V-sectioned ditch which was noticeable outside the excavation area as a slight earthwork. While no dating evidence was recovered, this is interpreted as a field boundary of comparatively modern date. Charcoal patches were recorded in trenches 1 and 3 but are likely to be of low archaeological significance.

7 ACKNOWLEDGEMENTS

The writer would like to thank Mr S Nash of Bnnie, Black & Veatch for his co-operation throughout the project, Mr D Thomas and Mr G Owen of CPAT for undertaking some of the evaluation excavations, and to Mr N Jones of CPAT for his help with the EDM survey and AP rectification.

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APPENDIX 1

ARCHAEOLOGICAL EVALUATION/MITIGATION: LLANDINAM-LLANWRIN WATER MAIN - LLANDINAM TO TALERDDIG.

SPECIFICATION FOR ARCHAEOLOGICAL WORK BY CLWYD-POWYS ARCHAEOLOGICAL TRUST

1 Introduction

- 1.1 The proposed development involves the construction of a 300mm water pipeline
- 1.2 This area has already been subject to an Archaeological Assessment by the Contracts Section of the Clwyd-Powys Archaeological Trust (CPAT Contracts) when a number of sites were identified along the route of the proposed pipeline.
- 1.3 The Curatorial Section of the Clwyd-Powys Archaeological Trust (CPAT Curatorial) in their capacity as archaeological advisors to Severn Trent Water have determined that a field evaluation is necessary to assess the implications of the proposed development on the identified archaeological resource. Accordingly a brief (No EVB191 dated 14th October 1996) has been prepared by CPAT Curatorial which describes the scheme of archaeological works required.
- 1.4 This brief has been divided into three stages:
 - 1 Evaluation
 - 2 Exclusion Zone Marking
 - 3 Watching Brief.

2 Evaluation Objectives

- 2.1 The objectives of the evaluation are:
- 2.1.1 to reveal by means of a combination of air-photograph assessment, geophysical survey and evaluation trenches, the nature, condition, significance and, where possible, the chronology of the archaeology within the area of the proposed development in so far as these aims are possible;
- 2.1.2 to record any archaeology revealed in the evaluation trenches and to rectify aerial photographs of archaeological sites within 50m of the line of the proposed pipeline;
- 2.1.3 to prepare a report outlining the results of the field evaluation and incorporating sufficient information on the archaeological resource for a reasonable planning decision to be taken regarding the archaeological provision for the area affected by the proposed development;
- 2.1.4 to identify and recommendations options for the management of the archaeological resource, including any further provision for that resource where it is considered necessary.

3 Methods

- 3.1 Stage one of the evaluation will involve the computer-rectification of all available aerial photographs of cropmarks, soil marks and shadow marks within 50m of the proposed route.
- 3.2 Stage two will take the form of resistivity and magnetometer survey of two areas. The first measuring 800m x 20m approx. and the second 800m x 20m approx.
- 3.3 Stage three will take the form of three evaluation trenches each 20m x 2m at locations to be agreed with the curator. These evaluation trenches will be undertaken using standard evaluation procedures:
- 3.3.1 removal of modern overburden by machine;
- 3.3.2 evaluation of the archaeological deposits by hand trowelling to establish their importance and integrity, but avoiding any unnecessary disturbance of the deposits. All features encountered will be examined as fully as appropriate to fulfil the requirements of the evaluation and within the constraints imposed by time and safety considerations.
- 3.3.3 all archaeological contexts recorded using the standard numbered context system employed by CPAT. All significant contexts to be planned and/or drawn in section at appropriate scales (as defined in the Curatorial Brief), and photographed in monochrome and colour. All drawn records will be related to control points depicted on modern maps.
- 3.3.4 all archaeological artefacts and environmental samples recorded and processed in a manner appropriate to the material involved. Those requiring conservation or other specialist treatment will be stored in a stable environment until such times as they can examined by a specialist. All finds, except those deemed to be Treasure Trove, are the property of the landowner. It is anticipated that they will be donated to the appropriate local or regional museum, subject to agreement being reached with the landowner and the museum curator.
- 3.4 Following the on-site work an illustrated and bound report will be prepared according to the principles laid out in the Curatorial Brief (Page 5). This will be in A4 format and contain conventional sections on: Site location, Topography and Geology; Historic Background; Excavation; Conclusions and Recommendations and References, together with appropriate appendices on archives and finds.
- 3.5 The site archive will be prepared to specifications laid out in Appendix 3 in the <u>Management of Archaeological Projects</u> (English Heritage, 1991).

4 Resources and Programming

- 4.1 The evaluation will be undertaken by a small team of 3 skilled archaeologists under the direct supervision of an experienced field archaeologist, who will also be responsible for undertaking the desk-based assessment. Overall supervision will be by Dr A Gibson, a senior member of CPAT's staff who is also a member of the Institute of Field Archaeologists.
- 4.2 All report preparation will be completed by the same field archaeologist who conducted the evaluation.
- 4.3 It is anticipated that the assessment and evaluation will take no more than 10 days in all and that the subsequent report would be prepared immediately thereafter,

dependent on the client's instructions and the arrangement of a suitable timetable. The date of commencement, at the time of writing, has yet to be agreed with the client, and will be dependent on the state of the site and negotiated access. The archaeological curator will be informed of the detailed timetable and staffing levels when agreement has been reached with the client.

- 4.4 Requirements relating to Health and Safety regulations will be adhered to by CPAT and its staff.
- 4.5 CPAT is covered by appropriate Public and Employer's Liability insurance.

A.M. Gibson 24th October 1996

APPENDIX 2

SITE ARCHIVE

Site Data

19 Context Record forms 2 A1 annotated site plans/sections 1 A3 annotated site plan/sections EDM survey including trench locations for Area 3 1 black and white negative film, prints and contact prints 1 colour slide film Photographic catalogue Correspondence

Finds

Area 1 No finds

Area 2 1 sherd of neolithic pottery from F1

Area 3 Charcoal samples from Trench 1, F1 and 2; Trench 2, ditch; Trench 3, F1.



Fig 1. Location of the Llandinam-LLanwrin Pipeline Corridor: stage I, Llandinam-Talerddig.





Fig 2. Areas of archaeological sensitivity.









Fig 6. Geophysical survey: summary of the results for Area 2. Scale 1:1000









APPENDIX 3

GEOPHYSICAL SURVEY RESULTS

(REPORT BY STRATASCAN)

A Report for

CLWYD-POWYS ARCHAEOLOGICAL TRUST

on a

Geophysical Survey

carried out at

LLANDINAM-LLANWRIN pipeline, CAERSWS, POWYS

June/July 1997

Author P P Barker C.Eng MICE MIWEM AIFA



A Report for

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- 2 Introduction
 - 2.1 Site location
 - 2.2 Description of site
 - 2.3 Site history and archaeological potential
 - 2.4 Survey objectives
 - 2.5 Survey methods
- 3 Methodology
 - 3.1 Date of fieldwork
 - 3.2 Grid locations
 - 3.3 Descriptions of techniques and equipment configuration
 - 3.4 Sampling interval, depth of scan, resolution and data capture
 - 3.5 Processing, presentation of results and interpretation
- 4 Results
- 5 Conclusions

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Figure 7 -	1:1000	Plot of processed magnetometer data - Area A
Figure 8 -	1:1000	Plot of raw resistivity data - Area A
Figure 9 -	1:1000	Plot of processed resistivity data - Area A
Figure 10 -	1:1000	Abstraction of magnetic and resistance anomalies Area A

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Figure 17 -	1:1000	Plot of processed resistivity data - Area B	
Figure 18 -	1:1000	Abstraction of magnetic and resistance anomalies Area B	
Figure 19 -	1:1000	Site plan showing location of survey grids and referencing - Area C	
Figure 20 -	1:1000	Plot of raw magnetometer data - Area C	
Figure 21 -	1:1000	Trace plot of raw magnetometer data showing positive values only - Area C	
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1 SUMMARY OF RESULTS

The geophysical survey has found a number of linear features which are thought to be ditches. An Iron Age enclosure is known to lie along the route corridor of the pipeline and it is likely that some of these ditches are associated with this enclosure. Several discrete features were also found which may have archaeological potential.

2 INTRODUCTION

2.1 Site location

The sites are located approximately 1.5km north-west of Caersws in Powys. The OS References for the approximate centre of each site are given below.

Area A	SO 0170 9215
Area B	SO 0190 9190
Area C	SO 0165 9320

2.2 Description of site

The sites are

Area A	Grazing
Area B	0-140m (approx.) grazing, 140m onwards stripped topsoil
Area C	Grass

2.3 Site history and archaeological potential

Area B contains a rectilinear Iron Age enclosure visible on several aerial photographs. The enclosure contains a ring-ditch cropmark to the west of the survey area and a large pit or well. We are not aware of the history or archaeological potential of the other survey areas.

2.4 Survey objectives

The objective of the survey was to assess the archaeological potential of areas affected by the Llandinam to Llanwrin pipeline.

2.5 Survey methods

The combined methods of resistivity and magnetometer were used on the three sites. Each technique is described in a little more detail below.

3 METHODOLOGY

3.1 Date of fieldwork

Areas A and B were surveyed during the period 12 June to 20 June 1997, and Area C during 8 and 9 July 1997.

3.2 Grid locations

The referencing for the survey grids has been plotted onto Figures 3, 11 and 19.

3.3 Description of techniques and equipment configurations

3.3.1 Magnetometer

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTesla (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using an FM36 Fluxgate Gradiometer, manufactured by Geoscan Research. The instrument consists of two fluxgates mounted 0.5m vertically apart, and very accurately aligned to nullify the effects of the earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.

3.3.2 Resistance Meter

This method relies on the relative inability of soils (and objects within the soil) to conduct an electrical current which is passed through them. As resistivity is linked to moisture content, and therefore porosity, hard dense features such as rock will give a relatively high resistivity response, while features such as a ditch which retains moisture give a relatively low response.

The resistance meter used was an RM15 manufactured by Geoscan Research incorporating a mobile Twin Probe Array. The Twin Probes are separated by 0.5m and the associated remote probes were positioned approximately 15m outside the grid. The

instrument uses an automatic data logger which permits the data to be recorded as the survey progresses for later downloading to a computer for processing and presentation.

Though the values being logged are actually resistances in ohms they are directly proportional to resistivity (ohm-metres) as the same probe configuration was used through-out.

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

3.4.1 Sampling interval

Magnetometer

Readings were taken at 0.5m centres along traverses 1m apart. This equates to 800 sampling points in a full 20m x 20m grid. All traverses are surveyed in a "parallel" rather than "zigzag" mode.

Resistivity

Readings were taken at 1.0m centres along traverses 1.0m apart. This equates to 400 sampling points in a full 20m x 20 grid. All traverses were surveyed in a "zigzag" mode.

3.4.2 Depth of scan and resolution

Magnetometer

The FM36 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. The collection of data at 0.5m centres provides an optimum resolution for the technique.

Resistivity

The 0.5m probe spacing of a twin probe array has a typical depth of penetration of 0.5m to 1.0m The collection of data at 1m centres with a 0.5m probe spacing provides an optimum resolution for the technique.

3.4.3 Data capture

Magnetometer

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

Resistivity

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

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Magnetometer

Processing is performed using specialist software known as *Geoplot 2*. This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies...

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

Zero mean grid	Threshold = 0.25 std. dev.		
Zero mean traverse	Last mean square fit = off		
Despike	X radius = 1 $Y radius = 1$		
	Threshold = 3 std. dev.		
	Spike replacement = mean		

Resistivity

The processing was carried out using specialist software known as *Geoplot 2* and involved the 'despiking' of high contact resistance readings and the passing of the data though a high pass filter. This has the effect of removing the larger variations in the data often associated with geological features. The nett effect is aimed at enhancing the archaeological or man-made anomalies contained in the data.

The following schedule shows the processing carried out on the processed resistance plots.

Despike	X radius = 1		
	Y radius = 1		
	Spike replacement		
High pass filter	X radius = 10		
	Y radius = 10		
	Weighting = Gaussian		

3.5.2 Presentation of results and interpretation

Magnetometer

The presentation of the data for each site involves a print-out of the raw data both as grey scale and trace plots, together with grey scale plots of the processed data, and, if appropriate, after further processing to emphasise various aspects within the data. Magnetic anomalies have been identified and plotted onto the 'Abstraction of Anomalies' drawing for each site (Figures 10, 18 and 26), numbered for ease of reference and prefixed with the letter 'M'.

Resistivity

The presentation of the data for the site involves a print-out of the raw data as a grey scale plot, together with grey scale plots of the processed data. Anomalies have been identified and plotted onto the 'Abstraction of Anomalies' drawing for each site (Figures 10, 18 and 26), numbered for ease of reference and prefixed with the letter 'R'.

4 RESULTS

AREA A (see Figure 10)

Running parallel with the direction of the pipeline is the negative linear magnetic anomaly M5. This becomes the double linear anomaly M6 towards the centre of the survey area. The position of the linear higher resistance anomaly R1 coincides with that of the magnetic anomalies and all are thought to relate to one feature such as an access track.

Crossing this feature are several magnetic and resistance anomalies. M2 and M3 are similarly curved positive anomalies which are probably ditches. R2 and R3 are two low resistance anomalies again indicating hollows or ditches.

There are also several discrete magnetic anomalies notably M1 and M4. M1 is likely to be buried metal while the two positive anomalies M4 may be pits.

AREA B (see Figure 18)

Few anomalies were found in this area apart from the two parallel linear ones seen by both techniques M7/R5 and M8/R7. These are thought to be parts of the ditch of the Iron Age enclosure site known to be in this area. The discrete low resistance anomaly R6 between the two ditches may be a pit associated with the enclosure.

The resistance anomalies R4 and R8 appear unrelated to the other features and may be short sections of a ditch and track respectively.

AREA C (see Figure 26)

Both techniques have picked up a wide ditch crossing the centre of the area from east to west. M13 is a wide (6 metre) positive linear anomaly flanked on either side by twin negative anomalies 2/3 metres wide. The resistance survey shows a wide (10 metre) low resistance anomaly at the same position. This suggests a substantial ditch or hollow.

The magnetometer shows several minor linear anomalies M12 and M14 which have the same alignment as the ditch. These look like cultivation marks. There are also four areas of magnetic disturbance M9, M10, M15 and M17 which are all probably effects from modern surface features.

R11 is a discrete low resistance anomaly which is probably a backfilled hollow. The weak linear anomaly M16 running into R11 may be part of this feature.

5 CONCLUSIONS

Area B and C have both produced features which appear to be archaeological. In particular, the two parallel ditches in Area B are likely to be the Iron Age enclosure seen in this in area.





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SCALE: 1:1000	SUBJECT:	Geophysical Survey - Llandinam-L Plot of raw magnetometer data - A	Llanwrin pipeline, Caersws, Powys rea A			GEOPHYSICAL & SPEC SURVEY SERVICE
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DATE June 1007				
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Plotting parameters Minimum -10nT (white) Maximum +10nT (black) Image: Comparison of the second				
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SCALE: 1:1000 Geophysical Survey - Llandinam-Llanwrin pipeline, Caersws, Powys Plot of processed magnetometer data - Area A	DATE: June 1997	CLIENT: CLWYD-POWYS ARCHAEOLOGICAL TRUST	GURE: 7	STRATASC
	SCALE: 1:1000	SUBJECT: Geophysical Survey - Llandinam-Llanwrin pipeline, Caersws, Powys Plot of processed magnetometer data - Area A		GEOPHYSICAL & SPE SURVEY SERVIC

Plotting parameters Minimum 190Ω (white)		
Maximum 350Ω (black)		

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NUR DUT CE DENVIO	SCALE: 1:1000 Plot of processed resistivity data - Area A	ATE: June 1997	CLIENT: CLWYD-POWYS ARCHAEOLOGICAL TRUST	FIGURE: 9	STRATASC

Symbol	<i>Type of anomaly</i> Linear positive magnetic a	anomaly			M5
Symbol	<i>Type of anomaly</i> Linear positive magnetic a Weak linear positive mag Linear negative magnetic Discrete positive magnetic	anomaly netic anomaly anomaly c anomaly			M ⁴ M ⁵
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Date June 1997	Client CLWYD-POWYS ARCHAEOLOGICAL TRUST	STRATASCAN.
Scale 1:1500	Subject Geophysical Survey Llandinam-Llanwrin pipeline, Caersws, Powys Site plan showing location of survey grids	TILTRIDGE FARM UPPER HOOK ROAD UPTON UPON SEVERN WORCESTERSHIRE WR8 0SA UK
Figure 11	and referencing - Area B	TELEPHONE (01684) 592266 FAX (01684) 594142

Plotting	parameters
	Minimum -25nT (white)
	Maximum +20nT (black)

Date June 1997	Client CLWYD-POWYS ARCHAEOLOGICAL TRUST	STRATASCAN.	
Scale 1:1000	Subject Geophysical Survey Llandinam-Llanwrin pipeline, Caersws, Powys	TILTRIDGE FARM UPPER I IOOK ROAD UPTON UPON SEVERN WORCESTERSTIINE WR8 OSA UK	
Figure 12	Plot of raw magnetometer data Area B	TELEPHONE (01684) 592266 FAX (01684) 594142	

Plotting parameters Positive values displac Hidden lines have not b	497nT/cm e above the trace line been plotted		
Date June 1997	Client CLWYD-POWYS ARCHAEOLOGICAL TRUST	STRATASCAN.	- KIIH
Scale 1:1000	Subject Geophysical Survey Llandinam-Llanwrin pipeline, Caersws, Powys	TILTRIDGE FARM UPPER HOOK ROAD UPTON UPON SEVERN WORCESTERSHIRE WR8 0SA UK	
Figure 13	showing positive values only - Area B	TELEPHONE (01684) 592266 FAX (01684) 594142	

Plotting parameters Negative values displac Hidden lines have not b	497nT/cm ce above the trace line been plotted		F
Date June 1997	Client CLWYD-POWYS ARCHAEOLOGICAL TRUST	STRATASCAN.	TECT F
Scale 1:1000	Subject Geophysical Survey Llandinam-Llanwrin pipeline, Caersws, Powy	TILTRIDGE FARM UPPER HOOK ROAD UPTON UPON SEVERN VS WORCESTERSHIRE WR8 OSA UK	
Figure 14	showing negative values only - Area B	TELEPHONE (01684) 592266 FAX (01684) 594142	

Plotting parameters Minimum 200Ω Maximum 525Ω	(white) (black)	
Date June 1997	Client CLWYD-POWYS ARCHAEOLOGICAL TRUST	STRATASCAN
Scale 1:1000	Subject Geophysical Survey Llandinam-Llanwrin pipeline, Caersws, Powys	TILTRIDGE FARM UPPER HOOK ROAD UPTON UPON SEVERN WORCESTERSHIRE WR8 0SA UK
Figure 16	Area B	TELEPHONE (01684) 592266 FAX (01684) 594142

Plotting parameters Minimum -30 Maximum +30	nT (white) OnT (black)	1		
Date June 1997	Client	CLWYD-POWYS ARCHAEOLOGICAL TRUST	STRATASCAN.	H.K. M.F
Scale 1:1000	Subject	Geophysical Survey Llandinam-Llanwrin pipeline, Caersws, Powys	TILTRIDGE FARM UPPER HOOK ROAD UPTON UPON SEVERN WORCESTERSHIRE WR8 0SA UK	
Figure 17		Plot of processed resistivity data Area B	TELEPHONE (01684) 592266 FAX (01684) 594142	

			х.		
Date	June 1997	Client	CLWYD-POWYS ARCHAEOLOGICAL TRUST	STRATASCAN.	HKMP
Scale	1:1000	Subject	Geophysical Survey Llaninam to Llanwrin pipeline, Caersws, Powys	TILTRIDGE FARM UPPER HOOK ROAD UPTON UPON SEVERN WORCESTERSHIRE WR8 0SA UK	
Figure	e 18		Abstraction of magnetometer and resistivity anomalies - Area A	TELEPHONE (01684) 592266 FAX (01684) 594142	$\langle \rangle$

