1453

SEION WASTE WATER TREATMENT WORKS, SEION, GWYNEDD

Archaeological Assessment

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

Seion Waste Water Treatment Works, Seion, Gwynedd

Archaeological Assessment

Project No. G2563

Report No. 1453

Prepared for: Dwr Cymru & Caulmert Limited

August 2018

Written by: Robert Evans, Neil McGuinness, Stuart Reilly & John Roberts

Front Cover Image: General shot of Fields 1, 2 and 3 (taken from Field 2); proposed pipe route 1 (photographic archive ref. G2563_031)

Cyhoeddwyd gan Ymddiriedolaeth Achaeolegol Gwynedd
Ymddiriedolaeth Archaeolegol Gwynedd
Craig Beuno, Ffordd y Garth,
Bangor, Gwynedd, LL57 2RT

Published by Gwynedd Archaeological Trust
Gwynedd Archaeological Trust
Craig Beuno, Garth Road,
Bangor, Gwynedd, LL57 2RT

Approvals Table				
	Role	**Printed Name**	**Signature**	**Date**
Originated by	Document Author	STUART REILLY	Stuart Reilly	30/08/18
Reviewed by	Document Reviewer	JOHN ROBERTS		30/08/18
Approved by	Principal Archaeologist	JOHN ROBERTS		30/08/18

Revision History			
Rev No.	**Summary of Changes**	**Ref Section**	**Purpose of Issue**
01	Updates to non-technical summary and conclusions/recommendations	4	For GAPS approval
02	Changes throughout the text and figures to remove reference to pipeline routes.	Throughout	For Caulmert approval

CONTENTS

Figures

Plates

CRYNODEB AN-NHECHNEGOL

Comisiynwyd Ymddiriedolaeth Archeolegol Gwynedd gan Dŵr Cymru i ymgymryd asesiad archeolegol o waith trin dŵr gwastraff (WtDG) a'r isadeiledd cysylltiedig, gan gynnwys y llwybrau arfaethedig o bibell gollwng yn Seion, Gwynedd.

Roedd yr asesiad archeolegol yn cynnwys asesiad desg gyda asesiad maes o'r holl gynllun ac arolwg geoffisegol o'r safle arfaethedig ar gyfer y gwaith trin dŵr gwastraff.

I gyd nodwyd 2 o nodweddion trwy asesiad desg ac asesiad maes o'r cynllun. Nodweddion amaethyddol oeddynt yn bennaf, yn dyddio o ganol i ddiwedd yr 19eg ganrif a oeddynt yn gysylltiedig â hen ffermydd ystâd Faenol. Ni wnaeth yr arolwg geoffisegol nodi unrhyw olion archeolegol, ond mae'n argymelledig i gynnal briff gwylio archeolegol ar y tir cliriad o'r lleoliad awgrymedig o'r WtDG yn gysylltiedig efo'r isadeiledd.

NON-TECHNICAL SUMMARY

Gwynedd Archaeological Trust (GAT) was commissioned by Dwr Cymru to undertake an archaeological assessment of a proposed waste-water treatment works (WwTW) at Seion, Gwynedd.

The archaeological assessment consisted of a desk-based assessment with an accompanying walkover survey and a geophysical survey of the proposed location of the WwTW.

In total 2 features were identified through the desk-based assessment and walkover survey. These are predominantly agricultural in character, dating from the mid to late 19th century and are associated with the farms of the former Vaynol Estate. The geophysical survey did not identify archaeological remains but it is recommended an archaeological watching brief is conducted of the ground clearance of the proposed location of the WwTW and associated infrastructure.

1 INTRODUCTION

Gwynedd Archaeological Trust (GAT) was commissioned by *Dwr Cymru Welsh Water* (*DCWW*) to undertake an archaeological assessment of a proposed WwTW at Seion, Gwynedd (NGR SH54556684; Figure 01). The proposed location for the WwTW comprises a field of pasture, located to the south of the village of Seion and to the north of the Ty'n Ross Hotel. The proposed WwTW consists of an inlet, screen, septic tank and aeration reed bed along with a vehicular access from the main road (Figure 02).

It is anticipated that the final effluent from the works will discharge to the Nant y Garth via a new outfall pipeline. The route of the proposed outfall pipeline has yet to be determined.

The archaeological assessment was conducted in accordance with the approved GAT Written Scheme of Investigation (WSI) (Appendix I). However, following the approval of the WSI, DCWW determined to review further the available route options for the proposed outfall pipeline. Consequently, this archaeological assessment relates solely to the site of the proposed WwTW and consists of the following:

- A desk-based assessment (DBA) that incorporated the area of the proposed WwTW (Figure 03);
- A site walkover of the proposed WwTW site; and
- A geophysical survey conducted at the location of the proposed WwTW.

The project has been monitored by the Gwynedd Archaeological Planning Service (GAPS). *The content of this report by GAT must be approved by GAPS prior to final issue.*

The archaeological assessment was completed in accordance with the following guidance:

- *Standard and Guidance for Desk-Based Assessment* (Chartered Institute for Archaeologists, 2014);
- *Standard and Guidance for Archaeological Field Assessment* (Chartered Institute for Archaeologists, 2014);
- *Standard and Guidance for Geophysical Survey* (Chartered Institute for Archaeologists, 2014);

- *Standard and guidance for the collection, documentation, conservation and research of archaeological materials* (Chartered Institute for Archaeologists, 2014);

- *Management of Archaeological Projects* (English Heritage, 1991);

- *Management of Research Projects in the Historic Environment: The MoRPHE Project Managers' Guide* (Historic England, 2015);

- *Historic Environment Record (HER) Guidelines for Archaeological Contractors* (Version 1.3; draft) (Gwynedd Archaeological Trust, 2014); and

- *Guidelines for digital archives* (Royal Commission on Ancient and Historic Monuments of Wales, 2015).

Gwynedd Archaeological Trust is certified to ISO 9001:2015 and ISO 14001:2015 (Cert. No. 74180/B/0001/UK/En) and is a Registered Organisation with the Chartered Institute for Archaeologists and a member of the Federation of Archaeological Managers and Employers (FAME).

1.1 Assessment Aims and Objectives

The key aims and objectives were to:

- establish the extent to which archaeological remains survive at the location of the proposed WwTW and within the immediate vicinity;

- establish the date and nature of archaeological remains and assess their implications for understanding the historical development of the area;

- if previously unknown archaeological features are identified through the DBA and the accompanying walkover survey then they will need to be mitigated by, for example amending the layout of the WwTW; and

- if previously unknown archaeological features are identified through the geophysical survey then they will need to be evaluated with trial trenches to confirm the results. If the trenches confirm the presence of archaeology this may require preservation by record, i.e. further investigation, or preservation in-situ that may require amending the layout of the treatment works.

2 METHODOLOGY

2.1 Assessment (Desktop Study)

A desk-based assessment is defined as “a programme of study of the historic environment within a specified area or site on land, the inter-tidal zone or underwater that addresses agreed research and/or conservation objectives. It consists of an analysis of existing written, graphic, photographic and electronic information in order to identify the likely heritage assets, their interests and significance and the character of the study area, including appropriate consideration of the settings of heritage….Significance is to be judged in a local, regional, national or international context as appropriate” (CIfA 2014, 4).

The desk-based assessment involved a study of the following resources:

1. The regional Historic Environment Register ((HER) Gwynedd Archaeological Trust, Craig Beuno, Ffordd y Garth, Bangor, Gwynedd LL57 2RT) has been examined for information concerning the proposed location of the WwTW (Figure 01). The search included an examination of the core HER, the 1:2500 County Series Ordnance Survey maps and any secondary information held within the HER. All identified features have been mapped, described and added to a gazetteer of sites and the relative importance of sites have been defined;

2. The National Monuments Record of Wales (Royal Commission on the Ancient and Historical Monuments of Wales, Plas Crug, Aberystwyth SY23 1NJ) has been checked for sites additional to the HER;

3. Aerial photographs from the Historic Environment Register ((HER) Gwynedd Archaeological Trust have been examined for potential features;

4. On-line catalogue search of the National Library of Wales (Penglais Rd, Aberystwyth SY23 3BU);

5. Archive data, including primary and secondary sources, historic maps and estate maps have been examined at the regional archives (Gwasanaeth Archifau Gwynedd, Cyngor Gwynedd, Caernarfon LL55 1SH and Meirionnydd Record Office, Bala Rd, Dolgellau LL40 2YF);

6. Light Detection and Ranging (LiDAR) data has been examined from the Lle Geo-Portal at http://lle.gov.wales/home for information on potential surface features using digital terrain modelling and digital surface modelling.

2.2 Walkover Survey

A walkover survey was conducted at the proposed location of the WwTW and environs to supplement the DBA. The walkover survey was undertaken to identify any new archaeological features on the ground and accurately map and describe them on GAT pro-formas. The sites have been added to a gazetteer and their relative importance defined. The potential for sub-surface archaeology has been estimated and defined.

The walkover survey was documented using GAT pro-formas. Photographic images were taken using a digital SLR (Nikon D31000) camera set to maximum resolution (4608 x 3072; 14.1 effective megapixels) in RAW format and were converted to TIFF for archiving in accordance with *Guidelines for digital archives* (Royal Commission on Ancient and Historic Monuments of Wales, 2015). A total of 16 images were taken (archive reference: G2563_001 to G2563_016; cf. Appendix II).

2.3 Gazetteer

A gazetteer has been compiled for any identified sites within and within proximity to the specified route based on information sourced from the regional HER; the gazetteer will include:

1. Feature Number
2. Site name
3. PRN number
4. Grid reference
5. Period
6. Site type
7. Assessment category
8. Description
9. Impact
10. Recommendation for further assessment/assessment
11. Recommendation for mitigatory measures

2.4 Geophysical Survey

2.4.1 Technical Detail

The survey was carried out in a series of traverses within 8x20m grids covering the footprint of the proposed WwTW and access road. The grids were tied into the Ordnance Survey grid

using a Trimble high precision GPS system. The survey was conducted using a Bartington Grad 601-2 dual fluxgate gradiometer. The surveys were carried out at standard resolution with a 1.0m traverse interval and 0.25m sample interval.

2.4.2 Instrumentation

The Bartington Grad 601-2 dual fluxgate gradiometer uses a pair of Grad-01-100 sensors. These are high stability fluxgate gradient sensors with a 1.0m separation between the sensing elements, giving a strong response to deeper anomalies. The instrument detects variations in the earth's magnetic field caused by the presence of iron in the soil. This is usually in the form of weakly magnetized iron oxides which tend to be concentrated in the topsoil. Features cut into the subsoil and backfilled or silted with topsoil, therefore contain greater amounts of iron and can therefore be detected with the gradiometer. This is a simplified description as there are other processes and materials which can produce detectable anomalies. The most obvious is the presence of pieces of iron in the soil or immediate environs which usually produce very high readings and can mask the relatively weak readings produced by variations in the soil. Strong readings are also produced by archaeological features such as hearths or kilns as fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the soil leading to a more generalized magnetic enhancement around settlement sites. Not all surveys can produce good results as results can be masked by large magnetic variations in the bedrock or soil or high levels of natural background "noise" (interference consisting of random signals produced by material with in the soil). In some cases, there may be little variation between the topsoil and subsoil resulting in undetectable features. The Bartington Grad 601 is a hand held instrument and readings can be taken automatically as the operator walks at a constant speed along a series of fixed length traverses. The sensor consists of two vertically aligned fluxgates set 500mm apart. Their mu-metal cores are driven in and out of magnetic saturation by a 1,000Hz alternating current passing through two opposing driver coils. As the cores come out of saturation, the external magnetic field can enter them producing an electrical pulse proportional to the field strength in a sensor coil. The high frequency of the detection cycle produces what is in effect a continuous output. The gradiometer can detect anomalies down to a depth of approximately one meter. The magnetic variations are measured in nanoTeslas (nT). The earth's magnetic field strength is about 48,000 nT; typical archaeological features produce readings of below 15nT although burnt features and iron objects can result in changes of several hundred nT. The machine is capable of detecting changes as low as 0.1nT.

2.4.3 Data Collection

The gradiometer includes an on-board data-logger. Readings are taken along parallel traverses of one axis of a 20m x 20m grid. The traverse interval is 1.0 m. Readings are logged at intervals of 0.25m along each traverse. Marked guide ropes are used to ensure high positional accuracy during the survey. The data is transferred from the data-logger to a computer where it is compiled and processed using TerraSurveyor3 software. The data is presented as a grey-scale plot where data values are represented by modulation of the intensity of a grey scale within a rectangular area corresponding to the data collection point within the grid. This produces a plan view of the survey and allows subtle changes in the data to be displayed. This is supplemented by an interpretation diagram showing the main feature of the survey with reference numbers linking the anomalies to descriptions in the written report. It should be noted that the interpretation is based on the examination of the shape, scale and intensity of the anomaly and comparison to features found in previous surveys and excavations etc. In some cases the shape of an anomaly is sufficient to allow a definite interpretation e.g. a Roman fort. In other cases all that can be provided is the most likely interpretation. The survey will often detect several overlying phases of archaeological remains and it is not usually possible to distinguish between them. Weak and poorly defined anomalies are most 4 susceptible to misinterpretation due to the propensity of the human brain to define shapes and patterns in random background “noise”. An assessment of the confidence of the interpretation is given in the text.

2.4.4 Data Processing

The data is presented with a minimum of processing although corrections may be made to compensate for instrument drift and other data collection inconsistencies. High readings caused by stray pieces of iron, fences, etc. are usually modified on the grey scale plot as they have a tendency to compress the rest of the data. The data is however carefully examined before this procedure is carried out as kilns and other burnt features can produce similar readings. The data on some ‘noisy’ or very complex sites can benefit from ‘smoothing’. Grey-scale plots are always somewhat pixellated due to the resolution of the survey. This at times makes it difficult to see less obvious anomalies (Figure 02). The readings in the plots can therefore be interpolated thus producing more but smaller pixels and a small amount of smoothing based on a low pass filter can be applied. This reduces the perceived effects of background noise thus making anomalies easier to see. Any further processing is noted in relation to the individual plot.

3 RESULTS

3.1 Desk-based Assessment Results

3.1.1 Geology

The underlying bedrock geology in the vicinity of the location of the WwTW primarily consists of ash-flow tuff of the Padarn Tuff Formation (BGS 1985). This is Igneous Bedrock formed approximately 541 to 635 million years ago in the Ediacaran Period. In addition, there are veins of an Unnamed Igneous Intrusion, Ordovician Microgabbro, within the Padarn Tuff Formation. This Igneous Bedrock formed approximately 444 to 485 million years ago in the Ordovician Period (Smith and George 1961). To the south-east of the study area sandstone and conglomerate of the Minffordd Formation are noted (BGS 1985).

Soils in the study area consist of Typical Brown Earths of the Wick 1 Association, with some areas of Cambric Stagnogley soils of the Brickfield 2 Association on the lower ground (Soil Survey of England and Wales- Sheet 2, 1980).

3.1.2 Prehistoric and Roman Background

There are no known prehistoric or Roman archaeological features recorded by the Historic Environment Record (HER) within the proposed location of the WwTW. However there is significant prehistoric and Roman archaeological activity within the wider area. Of likely Bronze Age date is a burnt mound to the south of Ty Mawr which is adjacent to a small stream (PRN 15; NGR SH55186619). The mound is approximately 1m in height with a diameter of approximately 18m but the southern half has been destroyed by a modern ditch.

There are two settlement enclosures approximately 500m to the east of the site, the settlement enclosure of Ty Mawr (PRN 11; NGR SH 55256678) and the nearby Ty Mawr enclosure (PRN 8; 55116662). The former is an oval enclosure, that measures c.50m northwest - southeast by 37m northeast – southwest, defined by a degraded stone filled bank. Within this enclosure there are two hut circles set against the south circuit of the bank. The latter is a sub - circular enclosure, approximately 26m in diameter and is also defined by a stone filled bank, with a possible hut circle at the centre. These settlements are most likely Iron Age (700 BC to 74 AD) or Romano-British (74 to 410 AD) in date (RCAHMW 1960, 180-181).

Located between these settlements and the site, to the southeast of Seion, are parch marks that may represent remnants of Fachell Roman road (PRN 17566) part of the route from Caerhun to Caernarfon. In addition, there is another possible Roman road that extends north east between the farms Ty'n-yr-allt and Tan-yr-wylfa that formed part of the route between Segontium and Bangor (PRN 17829).

3.1.3 Medieval Background

The study area lies within the Parish of Llanddeiniolen, within the former Cantref of Arfon. There is little known of medieval settlement within the study area. The church of Llanddeiniolen, which has medieval origins, although the current church is a Victorian re-build south-west of the former church lies 930m south of the proposed WWTW (PRN6951; LB II 14927; NGR54576592). The exception to this is to the south east of Ty Mawr farm where there is a medieval moated site (PRN 6; NGR SH55556643), which is a Scheduled Monument (CN156) that consists of a rectangular earthwork set in a marshy valley bottom. It is comprised of two shallow ditches with a low central bank and there are possible traces of a rectangular building within the interior which measures 42m by 34m. There is an apparent entrance on the north west side, with a 4.5m wide stone causeway cutting through the two ditches. It is likely that the origins of the post-medieval settlement pattern of farmsteads was starting to develop in the late medieval period.

3.1.4 Post-medieval Background

The proposed location of the WwTW is set within the Arfon plateau (PRN 15849), an area made up of improved pasture, which was formerly Vaynol estate land. The origins of the parcelling out of the Vaynol estate farms of Rhos yr Hwylfa, Tynyrallt and Tan yr Hwylfa are unknown. This is due to the fact that they formed part of the core of the Vaynol estate from its earliest times. The farm of Rhose [Rhos yr Hwylfa] is noted on the earliest estate document to survive, an estate rental of the year 1696, when Robert Owen pays 14 shillings in rent per annum, and Humphrey Thomas pays £4 for Tan yr Hwylfa, with Ellis Morris paying £6 rent for Pen yr Hwylfa [this farm later became known as Tynyrallt] (X/Vaynol/3744). All three farms appear in subsequent surviving rentals, and in 1844 Tan yr Hwylfa is occupied by Ellis Williams, paying £23 in rent, Rhos yr Hwylfa is divided into many smaller parcels, and Tynyrallt is occupied by William Jones paying £17 15s in rent (X/Vaynol/3838). The farms are recorded in the 1832 Vaynol estate survey, although with little detail added (X/Vaynol/406) (it should be noted that this volume is a large folio book which cannot be copied). The tithe map and apportionment of 1838 shows only the main property boundaries

(Figure 03), but the apportionment details for the route and adjacent properties are given in the table below:

Landowners	**Occupiers**	**Numbers referring to the plan**	**Name and Description of Lands and Premises**	**Quantities in Statute Measure A R P**
Smith, Thomas Assheton Esquire	Davies, John and Humphrey	2	Ty'n y Coed	86 2 24
	Williams, Ellis	3	Tan yr Hwylfa	110 3 10
	Jones, William	4	Ty'n yr Allt alias Pen yr Hwylfa	2 1 33
	Williams, Jane	5	Bryn yr Hwylfa	10 1 12
	Jones, Hugh Jeffries	11	Rhos yr Hwylfa	40 - 20
	Owen, Owen Jeffries	9	Cottages and Land on Rhos yr Hwylfa	9 2 29

A large scale and detailed estate survey and valuation was carried out by Vaynol in 1867, which included a lot of detail concerning the properties in the vicinity of the proposed WwTW. The area is one of a patchwork of irregular older fields and farmsteads to the north-west, and post enclosure regular parcels in the former *rhos* area to the east, land which had clearly been improved. This is shown on Figure 04 with the proposed location of the WwTW overlain upon it (X/Vaynol/4138). The different occupancies are shown in several colours, and the fields, boundaries and woodland are shown in detail. Tan yr Hwylfa is described as being 'so infected with rabbits' that they needed to be destroyed before 'any value could be realised' (X/Vaynol/4089).

There are several post-medieval structures and outbuildings indicative of the wider rural setting of the Seion area (Figure 01), that are located within approximately 500m of the proposed site (PRN 28866 – 28868 and 56142). These include the Seion Wesleyan Methodist Chapel (NPRN 6951; NGR SH54716693) which was built in 1818 and repeatedly modified throughout the 19th century. The chapel is built in the Classical style with a gable entry plan. Documents relating to the life of the chapel are preserved in Gwynedd Archives (XD34/18-19, 599-602). There are also two quarries (PRN 28864 & 28865; NGR SH5486 and 54756629) along with a small rectangular structure (PRN 28866; NGR SH54766630) c.500m to the southeast of the site, along the B4366. These are of unknown, but likely to be

post-medieval date. A number of structures within the study area are noted on the Gwynedd HER, including a well (PRN 28870; NGR SH54626696) that is positioned adjacent to a field boundary that contains the existing septic tank for Seion; and a building to the north west of the farm Tan-yr-wylfa (PRN 56143; NGR SH54296732).

The 1st edition 25 inch Ordnance Survey map of 1889 (Figure 05) shows that the landscape of the area has changed in only a minor way from that shown in 1867. There was some amalgamation of the fields belonging to Tynrallt, although this was limited. No discernible changes were noted on the 2nd edition map of 1900 or the 3rd edition map of 1914 (Figures 06 and 07).

By 1925 the farm land holdings in the area had been rationalised into three larger holdings; Fachell, tenanted by Thomas Parry and paying £16 10s for a half years rent, Tynrallt, tenanted by T.G. Hughes and paying £2 11s, and Tyn y Coed, tenanted by the representatives of Owen B. Thomas paying £24 3s (X/Vaynol/3960). This indicates that the rationalisation, presumably to increase profits, took place between 1867 and 1925. In 1967 these properties, incorporating the entire study area, were sold in the major Vaynol estate sale of 28th July 1967, when the estate was substantially broken up and the farms sold into private hands (XSC/807). 'Tynnallt' farm is described at this time as having 37 acres of permanent pasture, 10½ acres of arable, 7½ of rough pasture, and 18 of rough grazing.

3.1.5 Lidar and Aerial Photographs

Lidar coverage was noted to extend over a small area at the north-western end of the study area, in the form of Digital Terrain Modelling at 2m and 1m intervals (DTM), seen at http://lle.gov.wales/Catalogue/Item/LidarCompositeDataset/?lang=en.This showed the topography and terrain of the area clearly for this small area, but no additional archaeological information was encountered.

ADAS Aerial Photography Unit, Cambridge Film 452 Frame 236 taken on 2nd May 1990 shows the study area clearly (it has not been reproduced due to copyright restrictions). No clear additional archaeological information could be obtained, and the topography and field patterns remained similar to that shown on the map evidence. There was however much evidence for the insertion of modern drainage and other recent ground disturbance. Possible evidence of paleo-channels was also observed within a field southwest of Tan-yr-wylfa which consisted of irregular and regular criss-crossed parch mark features (location noted on Figure 01). These are likely to be a mixture of palaeo-channels and drainage, but may represent archaeological activity.

3.2 Walkover Survey Results

3.2.1 Location of proposed Waste Water Treatment Works and associated infrastructure

A walkover survey of the field in which the proposed WwTW and access road is located was conducted in dry sunny conditions on Thursday 28th June 2018. The location of the field, together the extent of footprint of the proposed works within it, is shown on Figures 01 and 08.

The proposed works are located on the north and eastern side of a sub rectangular shaped field of improved pasture grassland (Plates 1 & 2). The field is 0.83 ha in area and bounded by minor roads to the east and south, and further agricultural fields to the north and west. It is enclosed by grown out post-medieval stone faced hedge banks, cloddiau, on all sides, with modern wooden post and wire fences set on, or inside of the cloddiau (Plates 3 & 4). Some semi mature trees have colonised the northwest-southeast aligned clawdd that forms the southern boundary (Plate 5). A wooden gate in the eastern corner of the field provides access from the road side (Plate 6), whilst access to the field to the north is via an adjacent gateway with a galvanised steel gate set at the eastern end of the northwest-southeast aligned northern boundary. A set of overhead power lines extends northeast-southwest above the eastern boundary, while a second extends approximately parallel to the first within the field, approximately 20m from the eastern boundary.

The highest point of the field, at approximately 132m AOD, is on its northern side, around 20m from the entrance gate. From here the ground gently falls away to the west and south, with the ground becoming progressively less well drained as the ground falls towards the lower northern and southern corners which lie at approximately 126.5m AOD. The ground across the whole field was dry at the time of the site visit which was conducted following an extended period of very hot dry weather.

The presence of patches of rushes (juncus) (Plate 7) in both the lower northern and southern corners suggests that under typical rainfall conditions, both of these areas are normally wetter than the rest of the field. This may be particularly significant in the northern corner as this lies within the footprint of the proposed WwTW and it may be that the potential for survival of peat deposits or organic material in any as yet unknown archaeological features here is increased.

With the exception of the post medieval cloddiau, no visible evidence for either upstanding or buried archaeological features was noted within the field.

3.3 Gazetteer of features

The sites identified in the DBA and on the walkover survey are listed below, and shown on Figure 09. Any recommendations given are based on the current understanding of the scheme route and methodology. Any amendments to this may result in a requirement to amend the recommendations. A 'C' after the grid reference indicates the central point of a larger or linear feature. In total 2 features were identified during the walkover survey and are outlined below.

Feature 01 (PRN 71220; Plates 01 - 07)
Site Name: Cloddiau
Grid Reference: SH5460666827 (Centre of northern boundary)
Period: Post-Medieval
Category: C
Impact: None
Description: The cloddiau define the boundaries of the field for the proposed location of the WwTW. It is currently a field of pasture located to the immediate north of the Ty'n n Rhos hotel and to the southwest of the village of Seion. The cloddiau are stone faced with modern wire and post fences set on top or within them as well as trees and bushes. On average the cloddiau have a height of 1.0m and width of 2.50m. Aside from widening the access to the field the cloddiau should not be affected by the groundworks associated with the WwTW.
Recommendations for further assessment: None
Recommendations for mitigatory measures: An archaeologist to be present to record the breach at the current access point.

Feature 02 (PRN 71221)
Site Name: Palaeo-channels and/or drainage
Grid Reference: SH5409867178 (centre of patch marks)
Period: Unknown
Category: C
Impact: None
Description: Located in a field of rough pasture to the southwest of Tan-yr-wylfa and under half a kilometre to the northwest of the proposed location of the WwTW. A series of irregular and regular criss-crossed parch mark features were identified on ADAS Aerial Photography Unit, Cambridge Film 452 Frame 236 taken on 2nd May 1990 in the field in question. The patch marks are predominantly to the west of a field boundary and south of Nant Cefn. They may represent a series of palaeo-channels and/or drainage. This field is not part of the

proposed WwTW development and as such should not be physically impacted upon by the proposed groundworks.

Recommendations for further assessment: None

Recommendations for mitigatory measures: None

3.4 Geophysical Survey Results

No likely archaeological anomalies were identified within the survey area.

A southwest-northeast aligned irregular linear positive anomaly with a strong negative response (1) most likely represents magnetic variation from a geological source as does a smaller irregular linear anomaly (2). The northern corner of the field (3) is noticeably less magnetically noisy than the ground to the south and east, possibly as a result of a greater depth of peaty organic soil in this lower, wetter corner of the field (see Figure 10 & Section 3.2.1).

A number of dipolar responses across the survey area are a result of ferrous metal debris in the topsoil.

The northern and eastern edges of the survey area showed high amplitude disturbance from modern ferrous metal objects in the form of the post and wire fencing along the northern edge of the field and gates, fencing and a feeding trough at the east. Disturbance from such sources can mask weaker archaeological anomalies however the area affected does not represent a significant proportion of the survey.

3.4.1 Discussion and recommendations

The geophysical survey results identified no likely archaeological anomalies, the identified anomalies most likely all represent magnetic variations from geological sources. The results do not preclude the possibility of archaeological activity being present at the site however, and it is recommended that a sample of both the seemingly archaeologically blank areas and the geological anomalies are tested by trial trenching to conclusively establish the presence or absence of archaeological features not identified during the survey.

4 CONCLUSIONS AND RECOMMENDATIONS

Gwynedd Archaeological Trust (GAT) was commissioned by *Dwr Cymru* to undertake an archaeological assessment of a proposed WwTW and associated infrastructure at Seion, Gwynedd.

The desk-based assessment identified no known archaeological features within the field for the proposed location of the WwTW.

The desk-based assessment and walkover survey confirmed the presence of field boundaries, farms and fields associated with the former Vaynol Estate. These features would be of at least mid to late 19th century date and are sites of local importance given their relation to the Vaynol Estate.

The magnetometer survey of the field for the proposed location of the WwTW did not identify likely archaeological anomalies.

Based on the results of the archaeological assessment of the proposed location of the WwTW and it is recommended that:

- An archaeological watching brief is conducted of the ground clearance of the proposed location of the WwTW and associated infrastructure.

5 SOURCES CONSULTED

5.1 Primary Sources

Gwynedd Archives, Caernarfon

Vaynol Estate papers;

X/Vaynol/3744 1696 *Estate Rental of Sir William Williams of Vaynol;*

X/Vaynol/3838 1844 *Michaelmas Rental;*

X/Vaynol/3838 1925 *Rental;*

X/Vaynol/4067 1832 *Estate Survey* [Large Volume];

X/Vaynol/4089 *Particulars for Valuation of Lands in the Northern part of the Parish of Llanddeiniolen the Property of the Trustees of George William Duff Assheton Smith* 1867;

X/Vaynol/4138-9 1867 *Plan of Farms in the north of the Parish of Llanddeiniolen*, part of the "Surveys of the Vaynol Estate made for the purposes of Valuation, begun by the late Robert Lloyd Ellis and completed by Frederick Jackson;

Other

XSC 807 Sale Catalogue of Portions of the Vaynol Estate, sold on 28th July 1967.

National Archives, Kew

Tithe Map and Apportionment of the Parish of Llanddeiniolen, 1838.

Aerial Photograph

ADAS Aerial Photography Unit, Cambridge Film No. 452, Frame No. 236 taken on 2nd May 1990.

5.2 Secondary Sources

1. British Geological Survey 1985 *England and Wales Sheet 106 Solid Edition;*
2. Chartered Institute for Archaeologists, 2014, *Standard and Guidance for Desk-based Assessment;*
3. Chartered Institute for Archaeologists, 2014, *Standard and Guidance for Geophysical Survey;*
4. Chartered Institute for Archaeologists, 2014, Standard and Guidance for Archaeological Field Assessment;
5. English Heritage, 1991, *Management of Archaeological Projects (MAP2);*
6. English Heritage, 2011, *Environmental Archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation;*
7. Gwynedd Archaeological Trust, 2014, *Historic Environment Record (HER) Guidelines for Archaeological Contractors* (Version 1.3; draft);
8. Gwynedd Historic Environment Record;
9. Historic England, 2015, *Management of Research Projects in the Historic Environment (MoRPHE);*
10. Ordnance Survey First Edition 1-inch to 25-mile County Series Map Sheet XI.7, 1889;
11. Ordnance Survey Second Edition 1-inch to 25-mile County Series Map Sheet XI.7, 1900;
12. Ordnance Survey Third Edition 1-inch to 25-mile County Series Map Sheet XI.7, 1914;
13. RCAHMW 1960 *An Inventory of the Ancient Monuments in Caernarfonshire. Volume II: Central. The Cantref of Arfon and the Commote of Eifionydd;*
14. Royal Commission on Ancient and Historic Monuments of Wales, 2015, *Guidelines for digital archives;*
15. Smith, B. and George T.N. 1961 *British Regional Geology-North Wales* (London);
16. Soil Survey of England and Wales 1980 *Sheet 2 Soils of Wales.*

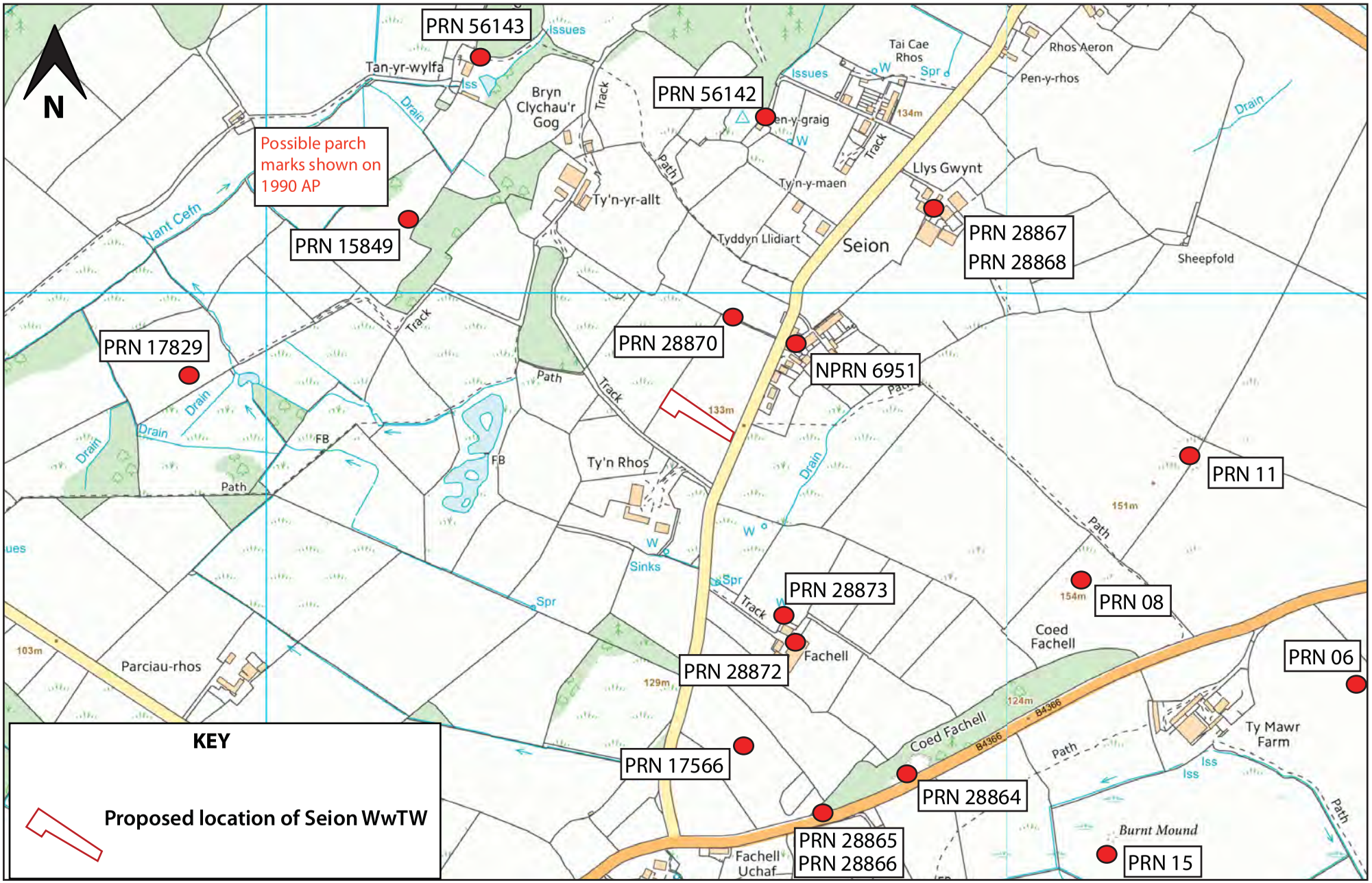

Figure 01: Location of archaeological features (red dots) in relation to development site (red outline). Scale 1:7,000 @ A4.

Base map taken from Ordnance Survey 1: 10,000 Series Sheet SH56 NW and NE.

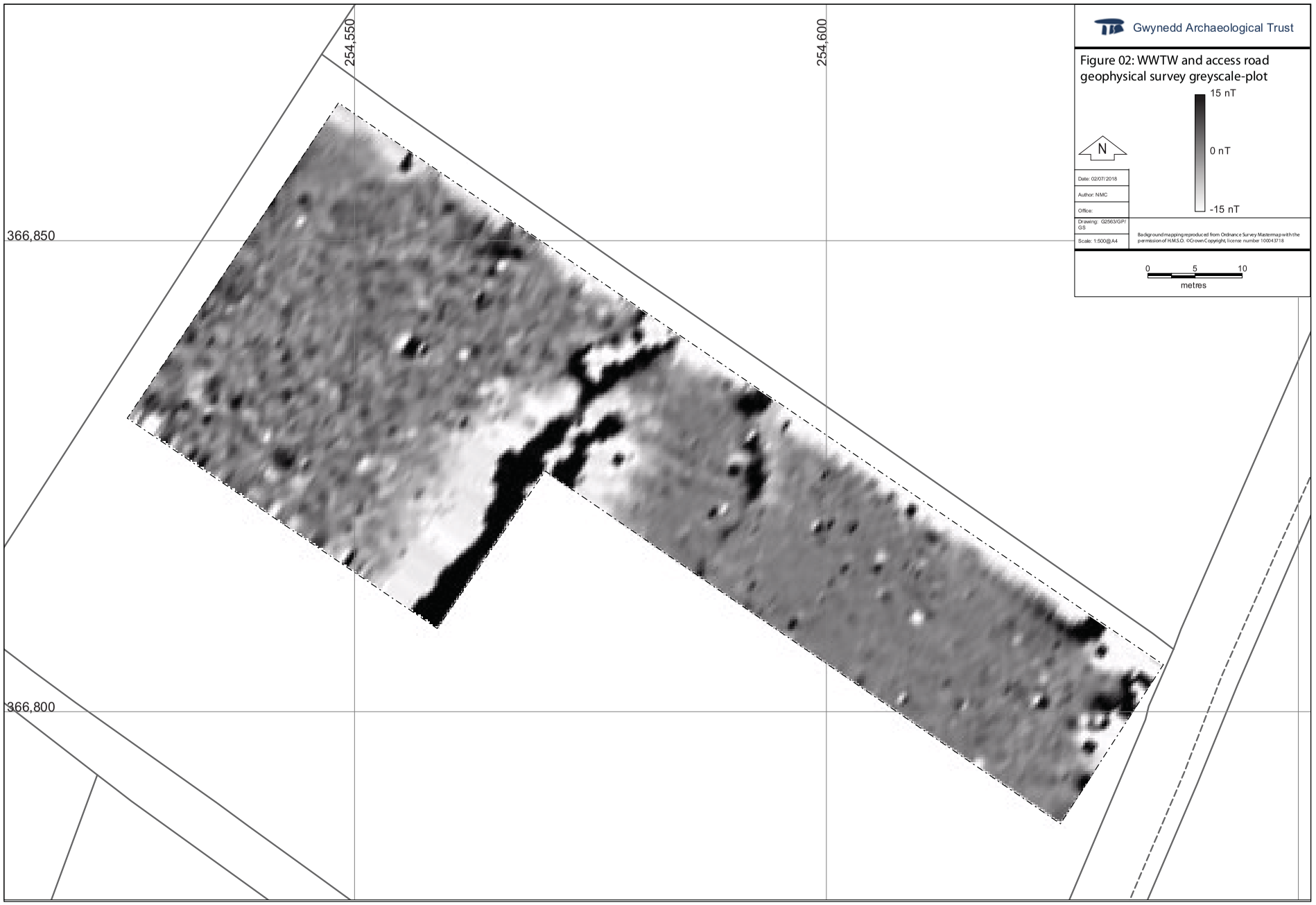
254,550
254,600
366,850
366,800
Gwynedd Archaeological Trust
Figure 02: WWTW and access road geophysical survey greyscale-plot
15 nT
0 nT
-15 nT
N
Date: 02/07/2018
Author: NMC
Office:
Drawing: G2563/GP/GS
Scale: 1:500@A4
Background mapping reproduced from Ordnance Survey Mastermap with the permission of H.M.S.O. ©Crown Copyright, license number 100043718
0
5
10
metres

Figure 03: Tithe Map and Apportionment of the Parish of Llanddeiniolen 1838, with the proposed location of the WwTW overlain (National Archives).
Scale 1:6000 @A4

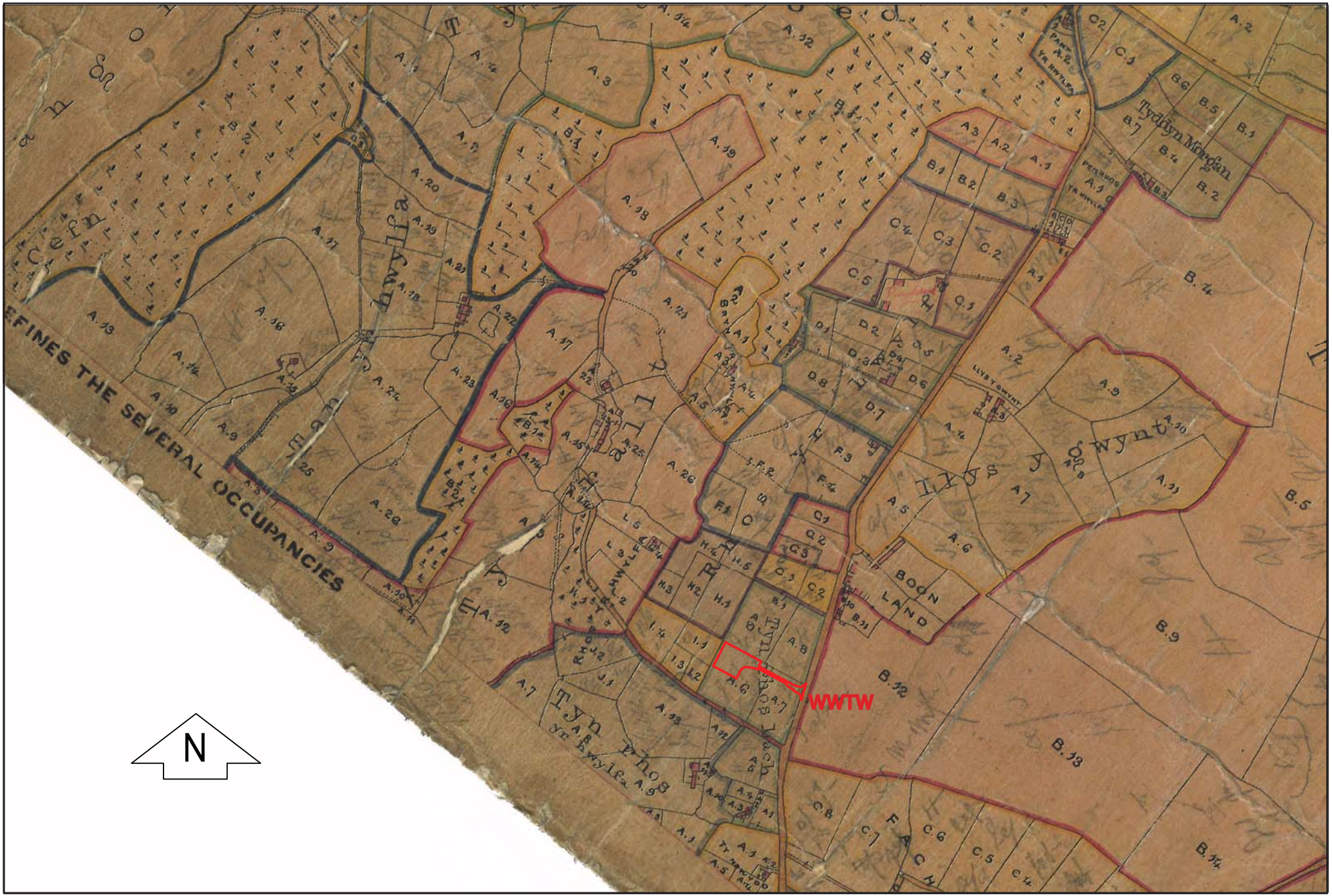

Figure 04: Plan of Farms in the north of the Parish of Llanddeiniolen, part of the "*Surveys of the Vaynol Estate made for the purposes of Valuation*", begun by the late Robert Lloyd Ellis and completed by Frederick Jackson (1867), with the proposed location of the WwTW overlain (Gwynedd Archives, X/Vaynol/4138-9). Scale 1:6000 @A4

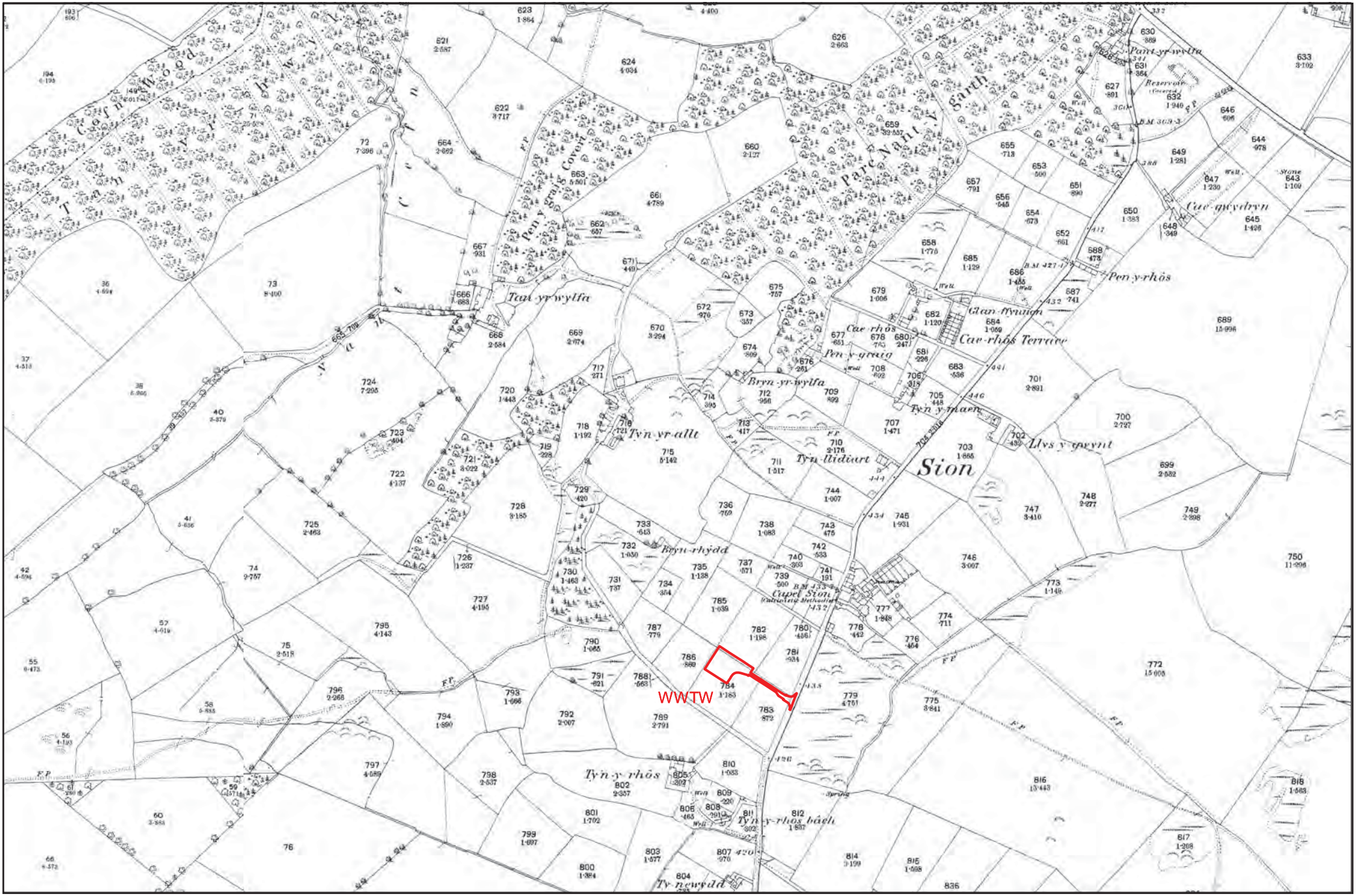

Figure 05: Ordnance Survey Caernarfonshire County Series 1st edition 25 inch map of 1889, sheet XI.7, the proposed location of the WwTW overlain. Scale 1:6000 @A4

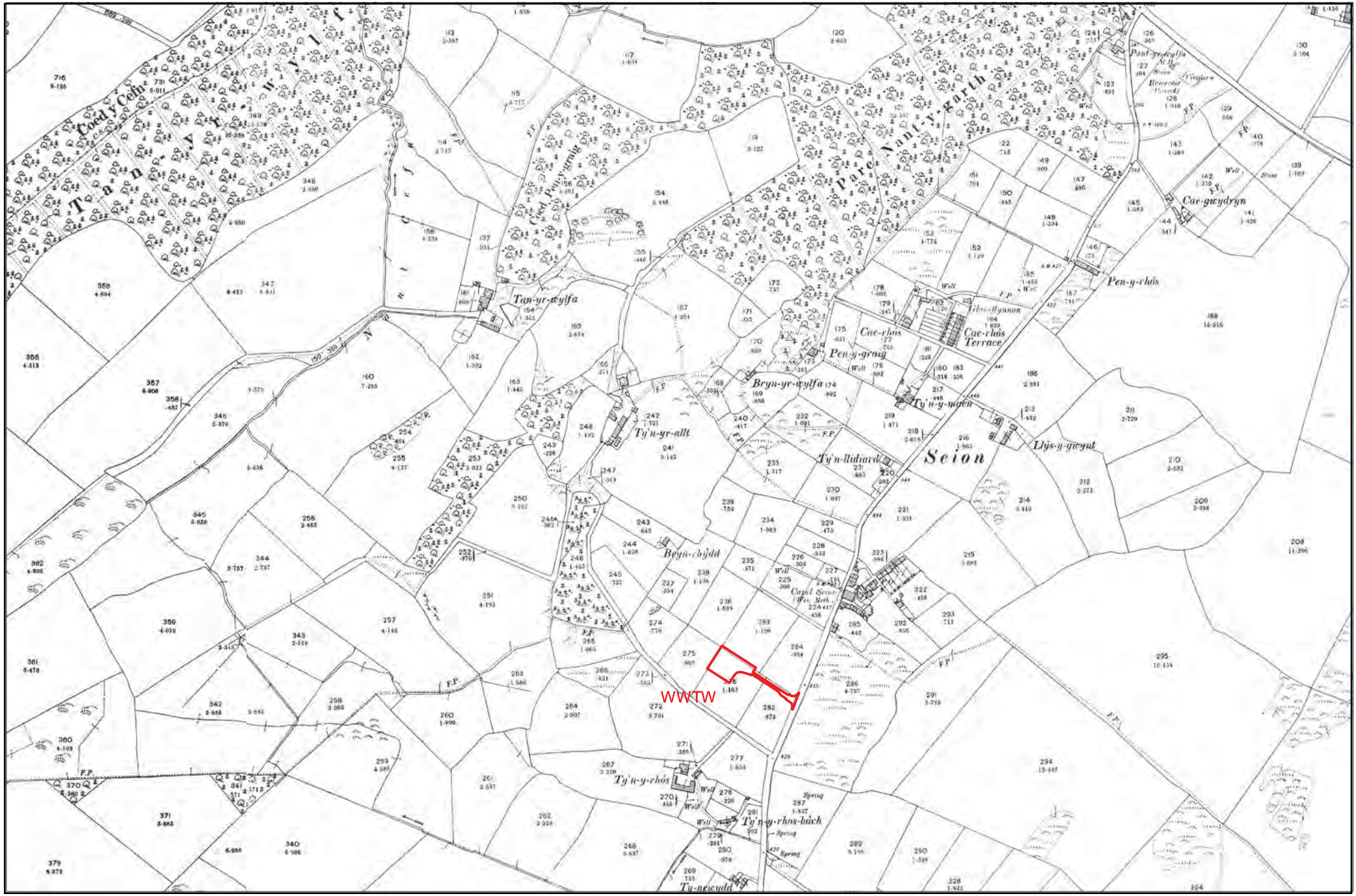

Figure 06: Ordnance Survey Caernarfonshire County Series 2nd edition 25 inch map of 1900, sheet XI.7, with the the proposed location of the WwTW overlain. Scale 1:6000 @A4

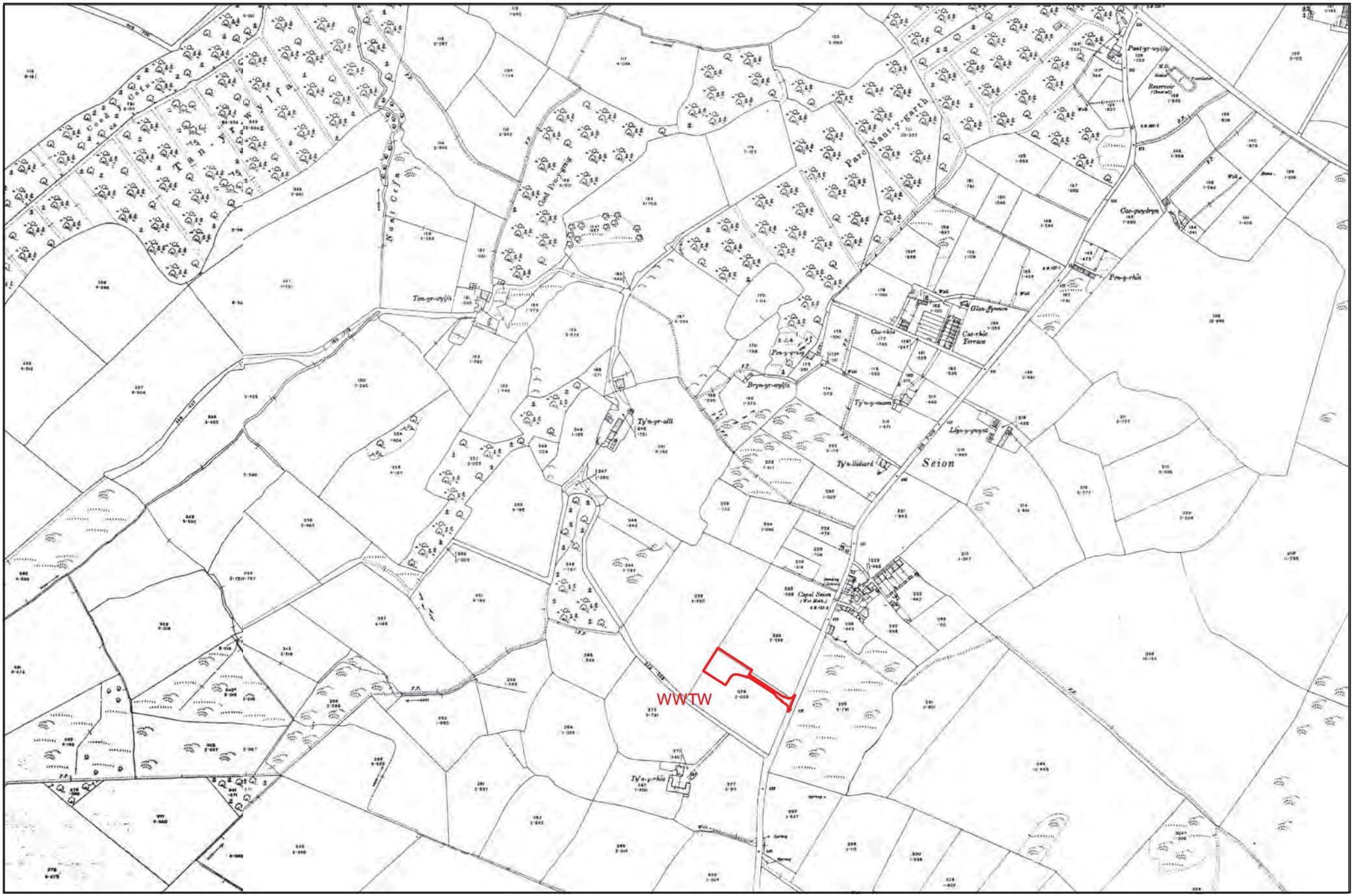

Figure 07: Ordnance Survey Caernarfonshire County Series 3rd edition 25 inch map of 1914, sheet XI.7, with the the proposed location of the WwTW overlain. Scale 1:6000 @A4

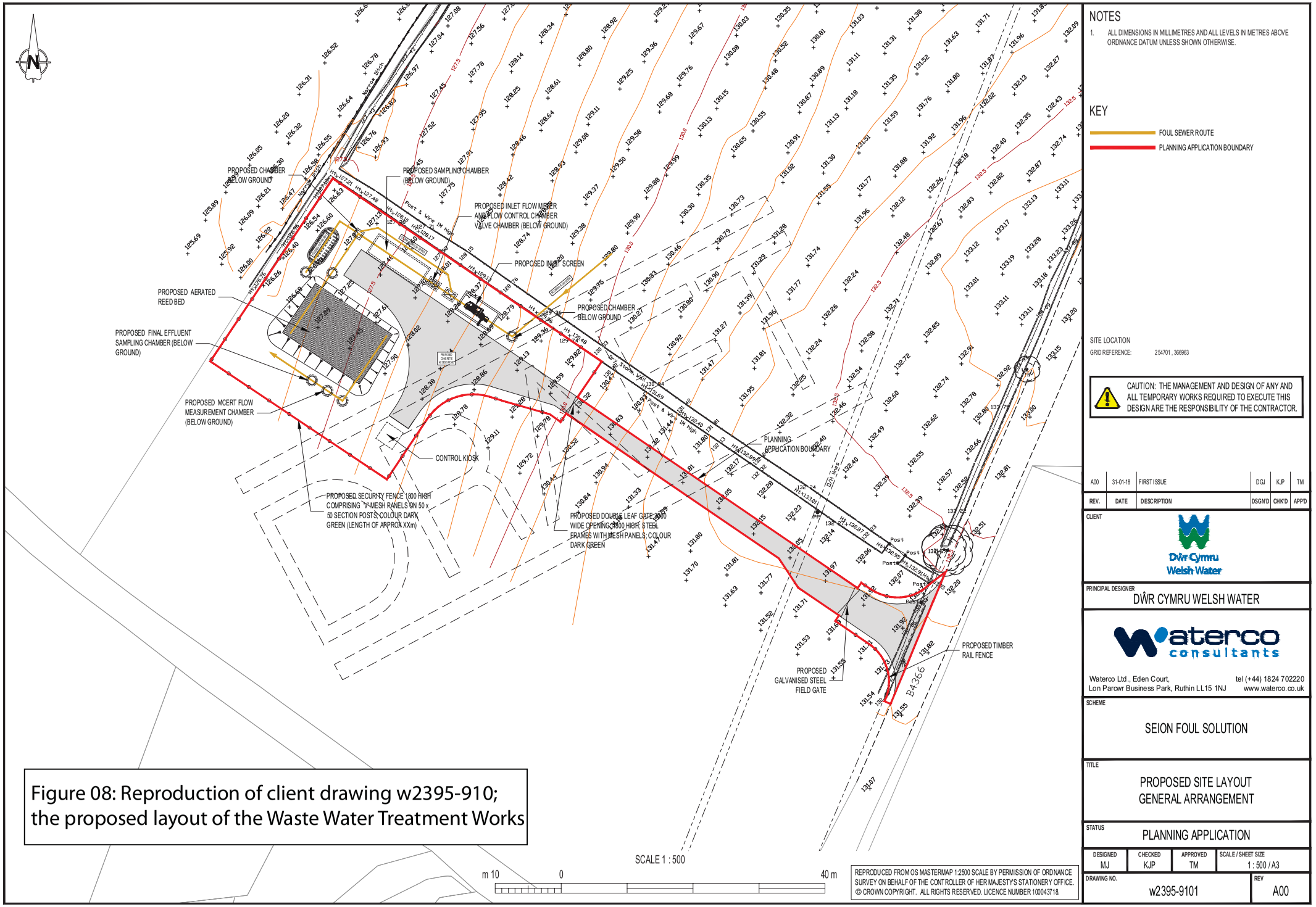

Figure 08: Reproduction of client drawing w2395-910; the proposed layout of the Waste Water Treatment Works

NOTES

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS SHOWN OTHERWISE.

KEY

FOUL SEWER ROUTE

PLANNING APPLICATION BOUNDARY

SITE LOCATION

GRID REFERENCE: 254701 , 366963

CAUTION: THE MANAGEMENT AND DESIGN OF ANY AND ALL TEMPORARY WORKS REQUIRED TO EXECUTE THIS DESIGN ARE THE RESPONSIBILITY OF THE CONTRACTOR.

REV.	DATE	DESCRIPTION	DSGN'D	CHK'D	APP'D
A00	31-01-18	FIRST ISSUE	DGJ	KJP	TM

CLIENT

Dŵr Cymru Welsh Water

PRINCIPAL DESIGNER

DŴR CYMRU WELSH WATER

waterco consultants

Waterco Ltd., Eden Court, Lon Parcwr Business Park, Ruthin LL15 1NJ

tel (+44) 1824 702220

www.waterco.co.uk

SCHEME

SEION FOUL SOLUTION

TITLE

PROPOSED SITE LAYOUT GENERAL ARRANGEMENT

STATUS

PLANNING APPLICATION

DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
MJ	KJP	TM	1 : 500 / A3

DRAWING NO. w2395-9101

REV A00

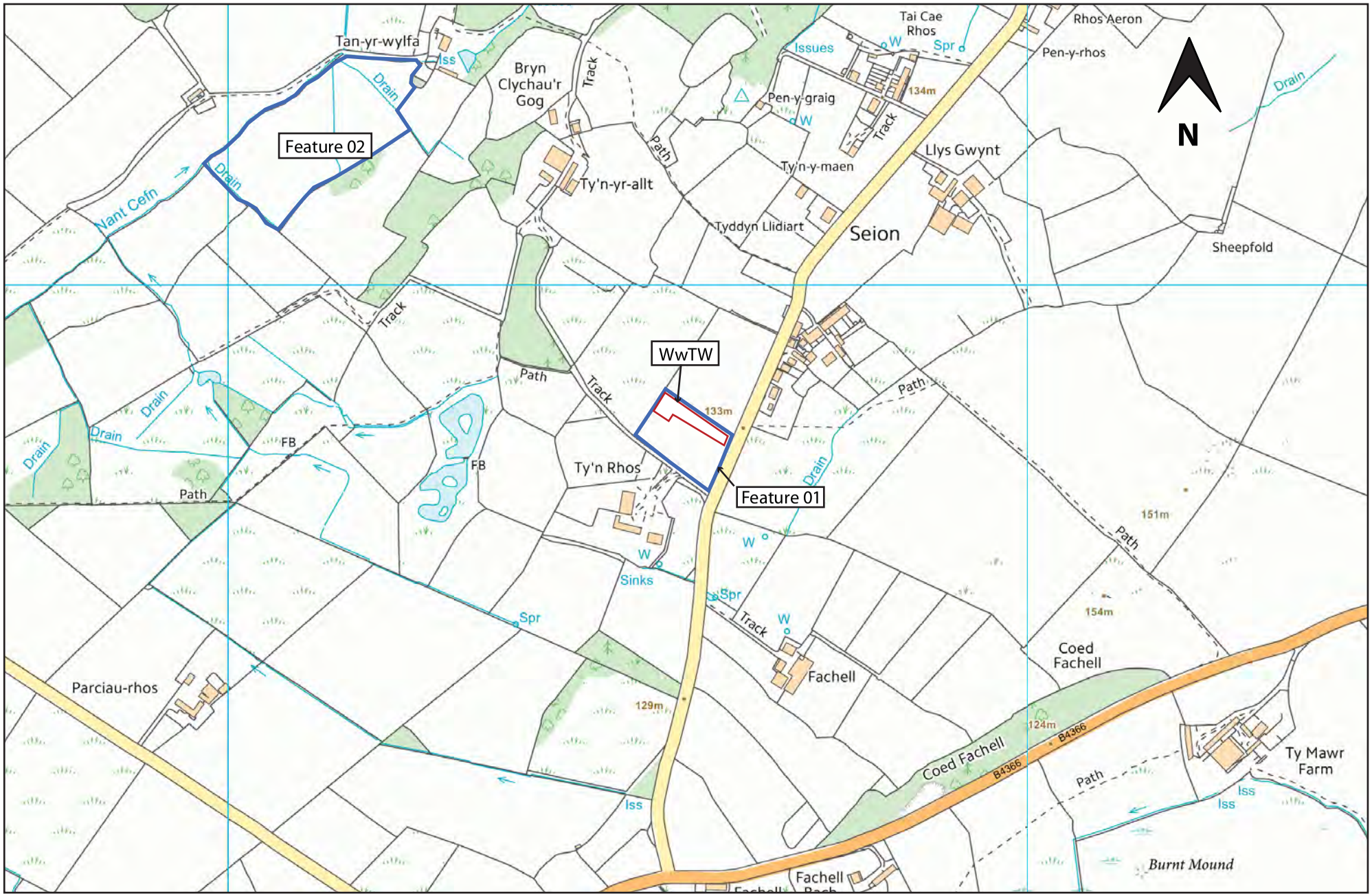

Figure 09: Location of Archaeological Features of the Desk-based Assessment and Walkover Survey in relation to the proposed location of the WwTW. Scale 1:6,500 @A4. Base map taken from Ordnance Survey 1: 10,000 Series Sheet SH56 NW and NE.

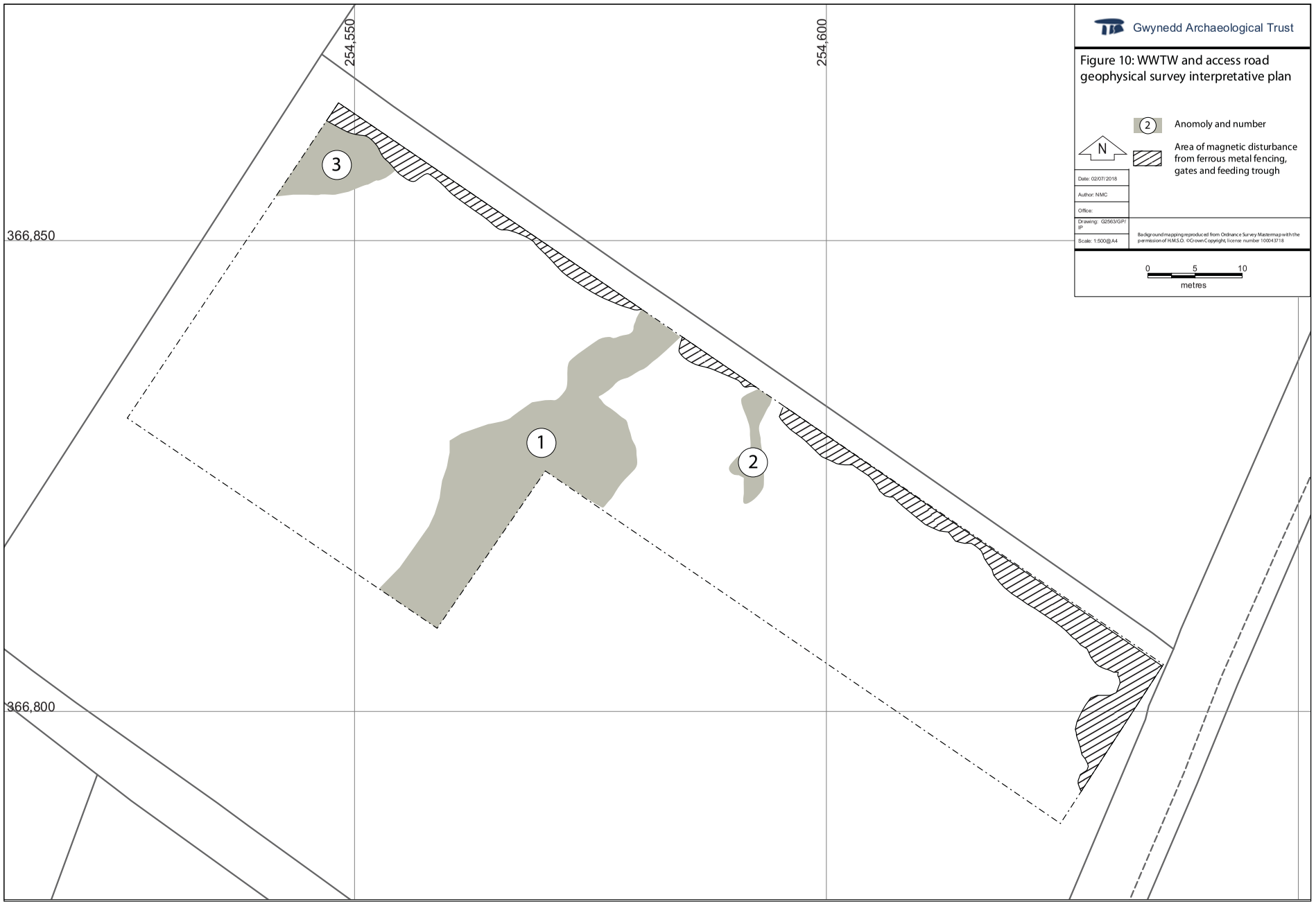
Gwynedd Archaeological Trust
Figure 10: WWTW and access road geophysical survey interpretative plan
2 Anomoly and number
Area of magnetic disturbance from ferrous metal fencing, gates and feeding trough
N
Date: 02/07/2018
Author: NMC
Office:
Drawing: G2563/GP/jlr
Scale: 1:500@A4
Background mapping reproduced from Ordnance Survey Mastermap with the permission of H.M.S.O. ©Crown Copyright, license number 100043718
0 5 10
metres
254,550
254,600
366,850
366,800
1
2
3

Plate 1 - View of field entrance and gateway to adjoining field to the north (archive reference: G2563_010).

Plate 2 - Proposed WWTW location in northern corner of field (archive reference: G2563_011).

Plate 3 - View along northern field boundary towards entrance along proposed access road route (archive reference: G2563_005).

Plate 4 - View along northern field boundary from entrance along route of proposed access road towards treatment plant location (archive reference: G2563_001).

Plate 5 - View along southern field boundary towards lower western corner of field (archive reference: G2563_012).

Plate 6 - Close up view of field entrance and clawdd wall field boundary on eastern side of field (archive reference: G2563_014).

Plate 7 - Wetter ground in northern corner of field (archive reference: G2563_009).

SEION WASTE WATER TREATMENT WORKS, SEION GWYNEDD
(G2563)

Historic Environment Record Event Primary Reference Number: 45274

PROJECT DESIGN FOR ARCHAEOLOGICAL EVALUATION

Prepared for

DWR CYMRU

June 2018

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

Approvals Table				
	Role	**Printed Name**	**Signature**	**Date**
Originated by	Document Author			
Reviewed by	Document Reviewer			
Approved by	Principal Archaeologist			

Revision History			
Rev No.	**Summary of Changes**	**Ref Section**	**Purpose of Issue**
01	Edited aims and objectives to reflect evaluation and future work Edits to Introduction to include walkover survey of all 3 pipe routes Inclusion of moated site Inclusion of geology	1.1 1.0 2.0 2.1	

All GAT staff should sign their copy to confirm the project specification is read and understood and retain a copy of the specification for the duration of their involvement with the project. On completion, the specification should be retained with the project archive:

Name	Signature	Date

SEION WASTE WATER TREATMENT WORKS, SEION GWYNEDD (G2563)

PROJECT DESIGN FOR ARCHAEOLOGICAL EVALUATION

Prepared for *Dwr Cymru*, June 2018

Historic Environment Record Primary Reference Number: 45274

CONTENTS

1 INTRODUCTION

Gwynedd Archaeological Trust (GAT) has been commissioned by *Dwr Cymru* to prepare a written scheme of investigation (WSI) for an archaeological evaluation of a proposed waste water treatment works at Seion, Gwynedd (NGR SH54556684; Figure 01). The location for the sewage works is currently a field of pasture located to the south of the village of Seion and to the immediate north of the Ty'n Ross Hotel. The proposed development will replace an existing septic tank with a waste water treatment works that will consist of an inlet channel with storm overflow, storm screen and a fully integral rotating biological contactor (RBC) along with access from the main road (Figure 02). The final effluent outfall from the works will discharge to the Nant y Garth via a newly installed final effluent outfall pipework.

The archaeological evaluation will be conducted in June 2018 and consist of the following:

- A desk-based assessment (DBA) that will incorporate the area of the proposed waste water treatment works and the potential gravity outfall pipe routes to the Nant y Garth (Figure 03);

- A site walkover that will encompass the location of the proposed waste water treatment works and the three proposed routes of the outfall pipe to supplement the DBA;

- A geophysical survey will be conducted of the location of the proposed waste water treatment works.

Once the route of the outfall pipe has been confirmed, this will require a separate WSI along with a geophysical survey. Dependant on the results of the geophysical surveys of the waste water treatment works and route of the outfall pipe, recommendations may be made for the excavation of trail trenches.

This WSI will focus solely on the DBA for the entirety of the project, an accompanying walkover survey of all of the elements of the project and the geophysical survey of the proposed location of the waste water treatment works.

The project will be monitored by the Gwynedd Archaeological Planning Service (GAPS). *The content of this WSI and all subsequent reporting by GAT must be approved by GAPS prior to final issue.*

The archaeological evaluation will be completed in accordance with the following guidance:

- *Standard and Guidance for Desk-Based Assessment* (Chartered Institute for Archaeologists, 2014);
- *Standard and Guidance for Archaeological Field Evaluation* (Chartered Institute for Archaeologists, 2014);
- *Standard and Guidance for Geophysical Survey* (Chartered Institute for Archaeologists, 2014);
- *Standard and guidance for the collection, documentation, conservation and research of archaeological materials* (Chartered Institute for Archaeologists, 2014);
- *Management of Archaeological Projects* (English Heritage, 1991);
- *Management of Research Projects in the Historic Environment: The MoRPHE Project Managers' Guide* (Historic England, 2015);
- *Historic Environment Record (HER) Guidelines for Archaeological Contractors* (Version 1.3; draft) (Gwynedd Archaeological Trust, 2014); and
- *Guidelines for digital archives* (Royal Commission on Ancient and Historic Monuments of Wales, 2015).

Gwynedd Archaeological Trust is certified to ISO 9001:2015 and ISO 14001:2015 (Cert. No. 74180/B/0001/UK/En) and is a Registered Organisation with the Chartered Institute for Archaeologists and a member of the Federation of Archaeological Managers and Employers (FAME).

1.1 Evaluation Aims and Objectives

The key aims and objectives are to:

- establish the extent to which archaeological remains survive at the location of the proposed waste water treatment works and within the immediate vicinity;
- establish the date and nature of archaeological remains at the site and assess their implications for understanding the historical development of the area;

- if previously unknown archaeological features are identified through the DBA and the accompanying walkover survey then they will need to be mitigated for, through altering the route of the pipeline or amending the layout of the treatment works, for example; and

- if previously unknown archaeological features are identified through the geophysical survey then they will need to be evaluated with trial trenches to confirm the results. If the trenches confirm the presence of archaeology this may require preservation by record, i.e. further investigation, or preservation in-situ that may require altering the route of the pipeline or amending the layout of the treatment works.

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

There are no known archaeological features recorded by the Historic Environment Record (HER) within the proposed location of the waste water treatment works but there are known features within close proximity of the proposed outfall pipeline routes (Figure 01):

- Archaeological features identified in close proximity to proposed outfall pipeline routes include a well (PRN 28870) that is positioned adjacent to a field boundary that demarcates the start of *Route One*; and

- a building to the north west of the farm Tan-yr-wylfa (PRN 56143) which is in close proximity to the terminal of *Route Three*.

It also worth noting that the pipe routes extend through the Arfon plateau (PRN 15849) an area made up of improved pasture, most of which was formerly Vaynol land.

There is also significant archaeological activity within the wider area, indicative of prehistoric and later activity (Figure 01), including the following:

- A burnt mound to the south of Ty Mawr (PRN 15) and adjacent to a small stream. The mound is approximately 1.0m in height with a diameter of approximately 18.0m but the southern half has been destroyed by a modern ditch;

- There are two settlement enclosures approximately 500m to the east of the site, the settlement enclosure of Ty Mawr (PRN 11) and the nearby Ty Mawr enclosure (PRN 8). The former is an oval enclosure, that measures c.50.0m northwest - southeast by 37.0m northeast – southwest, defined by a degraded stone filled bank. Within this enclosure there are two hut circles set against the south circuit of the bank. The latter is a sub - circular enclosure, approximately 26.0m in diameter and is also defined by a stone filled bank, with a possible hut circle at the centre. These settlements are most likely Iron Age (700 BC to 74 AD) or Romano-British (74 to 410 AD) in date;

- Located between these settlements and the site, to the southeast of Seion, are parch marks that may represent remnants of Fachell Roman road (PRN 17566) part of the route from Caerhun to Caernarfon. In addition, there is another possible Roman road that extends north east between the farms Ty'n-yr-allt and Tan-yr-wylfa that formed part of the route between Segontium and Bangor (PRN 17829);

- To the south east of Ty Mawr farm there is a medieval moated site PRN 6, a scheduled monument that consists of a rectangular earthwork set in a marshy valley bottom. It is comprised of two shallow ditches with a low central bank and there are possible traces of a rectangular building within the interior which measures 42m by 34m. There is an apparent entrance on the north west side, with a 4.5m wide stone causeway cutting through the two ditches;

- There are several post-medieval structures and outbuildings indicative of the rural setting of Seion, that are located within approximately 500m of the proposed site (PRN 28866 – 28868 and 56142) which also include Seion Methodist Chapel (NPRN 6951) which was built in 1818 and repeatedly modified throughout the 19th century. The chapel is built in the Classical style with a gable entry plan; and

- There are two quarries (PRN 28864 & 28865) along with a small rectangular structure (PRN 28866) c.500m to the southeast of the site, along the B4366.

An examination of the First to Third Edition Ordnance Survey 1-inch to 25-mile County Series Map Sheet of the area (Sheet XI.1, 1891, 1901 and 1920 respectively) shows the proposed area of development as two separate fields on the First and Second Editions (Figures 04 & 05). By the time of the publication of the Third Edition the division has been removed to form the field that is present today (Figure 06). The Ordnance Survey maps also show the gradual change from relatively small parcels of land to the creation of larger fields in the early 20th century.

2.1 Geology

The underlying bedrock geology in the vicinity of the location of the waste water treatment works primarily consists of Padarn Tuff Formation - Tuff, Felsic. This is Igneous Bedrock formed approximately 541 to 635 million years ago in the Ediacaran Period. In addition, there are veins of an Unnamed Igneous Intrusion, Ordovician – Microgabbro within the Padarn Tuff Formation. This Igneous Bedrock formed approximately 444 to 485 million years ago in the Ordovician Period.

3 METHODOLOGY

3.1 Assessment (Desktop Study)

A desk-based assessment is defined as “a programme of study of the historic environment within a specified area or site on land, the inter-tidal zone or underwater that addresses agreed research and/or conservation objectives. It consists of an analysis of existing written, graphic, photographic and electronic information in order to identify the likely heritage assets, their interests and significance and the character of the study area, including appropriate consideration of the settings of heritage….Significance is to be judged in a local, regional, national or international context as appropriate” (CIfA 2014, 4).

The desk-based assessment will involve a study of the following resources:

1. The regional Historic Environment Register ((HER) Gwynedd Archaeological Trust, Craig Beuno, Ffordd y Garth, Bangor, Gwynedd LL57 2RT) will be examined for information concerning the study area, defined as the power station and the extent of works on *First Hydro Company Drawing No*. SK01252 (Figure 01), along with a 50m assessment buffer. This will include an examination of the core HER, the 1:2500 County Series Ordnance Survey maps and any secondary information held within the HER. All identified features will be mapped, described and added to a gazetteer of sites and the relative importance of sites should be defined;

2. The National Monuments Record of Wales (Royal Commission on the Ancient and Historical Monuments of Wales, Plas Crug, Aberystwyth SY23 1NJ) will be checked for sites additional to the HER;

3. Aerial photographs from the National Monuments Record of Wales (Royal Commission on the Ancient and Historical Monuments of Wales, National Monuments Record of Wales, Plas Crug, Aberystwyth SY23 1NJ) will be examined for potential features;

4. On-line catalogue search of the National Library of Wales (Penglais Rd, Aberystwyth SY23 3BU);

5. Archive data, including primary and secondary sources, historic maps and estate maps will be examined at the regional archives (Gwasanaeth Archifau Gwynedd,

Cyngor Gwynedd, Caernarfon LL55 1SH and Meirionnydd Record Office, Bala Rd, Dolgellau LL40 2YF);

6. Light Detection and Ranging (LiDAR) data will be examined from the Lle Geo-Portal at http://lle.gov.wales/home for information on potential surface features using digital terrain modelling and digital surface modelling.

3.2 Walkover Survey

A walkover survey will be conducted of the proposed location of the waste water treatment works and the three proposed routes of the outfall pipe to supplement the DBA. The walkover survey will identify any new archaeological features on the ground and accurately map and describe them on GAT pro-formas. The sites will then be added to the overall gazetteer and their relative importance defined. The potential for sub-surface archaeology will be estimated and defined.

A photographic record will be maintained in RAW format using a digital SLR set to maximum resolution (Nikon D3000; resolution: 3,872 × 2,592 [10.2 effective megapixels]) and photographic metadata table will be completed and included in the report. Photographic images will be archived in TIFF format; the archive numbering system will start from **G2563_001**. A handheld GPS unit will also be used during the walkover survey.

3.3 Gazetteer

A gazetteer will be compiled for any identified sites within and within proximity to the specified route based on information sourced from the regional HER; the gazetteer will include:

1. Feature Number
2. Site name
3. PRN number
4. Grid reference
5. Period
6. Site type
7. Assessment category
8. Description
9. Impact
10. Recommendation for further assessment/evaluation
11. Recommendation for mitigatory measures

3.4 Geophysical Survey

3.4.1 Summary

The geophysical survey will include the field encompassing the proposed location of the waste water treatment works Figure 01 and will be carried out in a series of 20m grids, which will be tied into the Ordnance Survey grid using a Trimble high precision GPS system. The survey will be conducted using a Bartington Grad 601-2 dual fluxgate gradiometer with a 1.0m traverse interval and a 0.25m sample interval.

3.4.2 Instrumentation

The Bartington Grad 601-2 dual fluxgate gradiometer uses a pair of Grad-01-100 sensors. These are high stability fluxgate gradient sensors with a 1.0m separation between the sensing elements, giving a strong response to deeper anomalies. The instrument detects variations in the earth's magnetic field caused by the presence of iron in the soil. This is usually in the form of weakly magnetized iron oxides which tend to be concentrated in the topsoil. Features cut into the subsoil and backfilled or silted with topsoil, therefore contain greater amounts of iron and can therefore be detected with the gradiometer. This is a simplified description as there are other processes and materials which can produce detectable anomalies. The most obvious is the presence of pieces of iron in the soil or immediate environs which usually produce very high readings and can mask the relatively weak readings produced by variations in the soil. Strong readings are also produced by archaeological features such as hearths or kilns as fired clay acquires a permanent thermo-remnant magnetic field upon cooling. This material can also get spread into the soil leading to a more generalized magnetic enhancement around settlement sites. Not all surveys can produce good results as results can be masked by large magnetic variations in the bedrock or soil or high levels of natural background "noise" (interference consisting of random signals produced by material with in the soil). In some cases, there may be little variation between the topsoil and subsoil resulting in undetectable features. The Bartington Grad 601 is a hand held instrument and readings can be taken automatically as the operator walks at a constant speed along a series of fixed length traverses. The sensor consists of two vertically aligned fluxgates set 500mm apart. Their cores are driven in and out of magnetic saturation by a 1,000Hz alternating current passing through two opposing driver coils. As the cores come out of saturation, the external magnetic field can enter them producing an electrical pulse proportional to the field strength in a sensor coil. The high frequency of the detection cycle produces what is in effect a continuous output. The gradiometer can detect anomalies down

to a depth of approximately one meter. The magnetic variations are measured in nanoTeslas (nT). The earth's magnetic field strength is about 48,000 nT; typical archaeological features produce readings of below 15nT although burnt features and iron objects can result in changes of several hundred nT. The machine is capable of detecting changes as low as 0.1nT.

3.4.3 Data Collection

The gradiometer includes an on-board data-logger. Readings are taken along parallel traverses of one axis of a 20m x 20m grid. The traverse interval is 1.0m and readings are logged at intervals of 0.25m along each traverse. Marked guide ropes are used to ensure high positional accuracy during the high resolution survey. The data is transferred from the data-logger to a computer where it is compiled and processed using ArchaeoSurveyor2 software. The data is presented as a grey scale plot where data values are represented by modulation of the intensity of a grey scale within a rectangular area corresponding to the data collection point within the grid. This produces a plan view of the survey and allows subtle changes in the data to be displayed. This is supplemented by an interpretation diagram showing the main feature of the survey with reference numbers linking the anomalies to descriptions in the written report. It should be noted that the interpretation is based on the examination of the shape, scale and intensity of the anomaly and comparison to features found in previous surveys and excavations etc. In some cases the shape of an anomaly is sufficient to allow a definite interpretation e.g. a Roman fort. In other cases all that can be provided is the most likely interpretation. The survey will often detect several overlying phases of archaeological remains and it is not usually possible to distinguish between them. Weak and poorly defined anomalies are most 4 susceptible to misinterpretation due to the propensity of the human brain to define shapes and patterns in random background "noise". An assessment of the confidence of the interpretation is given in the text.

3.4.4 Data Processing

The data is presented with a minimum of processing although corrections are made to compensate for instrument drift and other data collection inconsistencies. High readings caused by stray pieces of iron, fences, etc. are usually modified on the grey scale plot as they have a tendency to compress the rest of the data. The data is however carefully examined before this procedure is carried out as kilns and other burnt features can produce similar readings. The data on some 'noisy' or very complex sites can benefit from 'smoothing'. Grey-scale plots are always somewhat pixellated due to the resolution of the

survey. This at times makes it difficult to see less obvious anomalies. The readings in the plots can therefore be interpolated thus producing more but smaller pixels and a small amount of smoothing based on a low pass filter can be applied. This reduces the perceived effects of background noise thus making anomalies easier to see. Any further processing is noted in relation to the individual plot.

3.4.5 Aims

The report will include a discussion of the grey scale plot and an interpretation of the any anomalies identified; these anomalies will be presented as either positive or negative, suggesting whether they could be cut features (ditches, pits etc.), or built sub-surface features (e.g., banks). Figures will be included for the grey scale plot and for the anomaly interpretation. The results of the geophysical survey will be used to inform the location of the trial trenching.

3.5 Data processing and report compilation

Following completion of the stages outlined above, a report will be produced incorporating the following:

1. Front cover;
2. Inner cover;
3. Figures and Plates List
4. Non-technical summary;
5. Introduction;
6. Methodology
    i. Desk-based assessment
    ii. Walkover survey
    iii. Geophysical survey
7. Results
    a. Desk based assessment
        i. Location and geological summary
        ii. Statutory and non-statutory designations
        iii. Environmental remains and soil morphology
        iv. Historical and archaeological background
        v. Cartographic evidence
        vi. Artefact potential
        vii. Aerial photographs and LiDAR;
    b. Gazetteer of features
    c. Walkover survey
    d. Geophysical survey
8. Conclusions and recommendations
    a. Conclusion
    b. Table of sites and recommendations
9. Acknowledgements
10. Bibliography
    a. Primary sources
    b. Secondary sources
11. Figures; inc.:
    - location plan;
    - historic mapping;
    - location plan with identified features
    - grey scale plot
    - anomaly identification and interpretation
12. Appendix I (approved written scheme of investigation)
13. Appendix II (Sites listed on GAT Historic Environment Record)
14. Appendix III (Definition of mitigation terms)
15. Appendix IV Photographic metadata (walkover survey)
16. Back cover

Illustrations will include plans of the location of the study area and archaeological sites. Historical maps, when appropriate and if copyright permissions allow, will be included.

A draft copy of the report will be completed by the end of July 2018 and will be sent to GAPS and *Dwr Cymru*. Once approved, a copy of the report will immediately be submitted to GAPS, *Dwr Cymru* and to the GAT HER. Submission of digital information to the Royal Commission on the Ancient and Historical Monuments of Wales will be undertaken in accordance with the RCAHMW Guidelines for Digital Archives Version 1 (2015). Digital information will include the photographic archive and associated metadata.

4 DISSEMINATION AND ARCHIVING

A full archive including plans, photographs, written material and any other material resulting from the project will be prepared. The archaeological evaluation outlined in this WSI will commence in June 2018. A draft report will be submitted within one month of fieldwork completion (end of July 2018); a final report will be submitted to the Historic Environment within six months of submitting the draft report (submission date tbc).

The following dissemination will apply:

- A paper report(s) plus digital report(s) will be provided to the client and GAPS (draft report then final report);

- A paper report plus a digital report will be provided to the regional Historic Environment Record, Gwynedd Archaeological Trust; this will be submitted within six months of project completion (final report only);

- If appropriate, digital information such as the project database, GIS table(s) and photographs, will be submitted to the regional Historic Environment Record at Gwynedd Archaeological Trust within six months of project completion. All digital datasets submitted will conform to the required standards set out in Gwynedd Archaeological Trust's *Historic Environment Record (HER) Guidelines for Archaeological Contractors* (Version 1.3; draft);

- A digital report and archive (including photographic and drawn) data will be provided to Royal Commission on Ancient and Historic Monuments, Wales (final report only);

- Submission of digital information to the Royal Commission on the Ancient and Historical Monuments of Wales shall be undertaken in accordance with the *RCAHMW Guidelines for Digital Archives Version 1*. Digital information will include the photographic archive and associated metadata;

- Dependent on the results of the evaluation, a summary note or a specific article will be included in the Council for British Archaeology Wales publication *Archaeology in Wales*. This shall be agreed with GAPS, and client in advance of publication along with all publication content. GAPS involvement in the project will be acknowledged therein.

5 PERSONNEL

The project will be managed by John Roberts, Principal Archaeologist GAT Contracts Section. The evaluation will be completed by a project officer who will have responsibility for completing the desk based assessment, maintaining the site archive, liaising with GAPS and *Dwr Cymru* and submitting the draft report and final report. Project archaeologists will conduct the walkover survey and geophysical survey and responsibility for maintaining the site archive and contributing to the draft and final report. The project manager will be responsible for reviewing and approving the report prior to submission.

6 HEALTH AND SAFETY

The GAT Project Archaeologist(s) will be CSCS certified. Copies of the site specific risk assessment will be supplied to the client and sub-contractor prior to the start of fieldwork. Any risks and hazards will be indicated prior to the start of work via a submitted risk assessment. All GAT staff will be issued with required personal safety equipment, including high visibility jacket, steel toe-capped boots and hard hat (where applicable). All GAT fieldwork is undertaken in accordance with the Trust's Health and Safety Manual, Policy and Handbook which were prepared by Ellis Whittam.

7 INSURANCE

The project is due to commence after the current insurance policies expire. The client will be sent the relevant details once these insurances have been renewed.

7.1 Public Liability

Limit of Indemnity- £5,000,000 any one event in respect of Public Liability
INSURER Aviva Insurance Limited
POLICY TYPE Public Liability
POLICY NUMBER 24765101CHC/000405
EXPIRY DATE 22/06/2018

7.2 Employers Liability

Limit of Indemnity- £10,000,000 any one occurrence.
The cover has been issued on the insurers standard policy form and is subject to their usual terms and conditions. A copy of the policy wording is available on request.
INSURER Aviva Insurance Limited
POLICY TYPE Employers Liability
POLICY NUMBER 24765101CHC/000405
EXPIRY DATE 22/06/2018

7.3 Professional Indemnity

Limit of Indemnity- £5,000,000 in respect of each and every claim
INSURER Hiscox Insurance Company Limited
POLICY TYPE Professional Indemnity
POLICY NUMBER
HU PI 9129989/1208
EXPIRY DATE 23/07/2018

8 SOURCES CONSULTED

1. Chartered Institute for Archaeologists, 2014, *Standard and Guidance for Desk-based Assessment;*

2. Chartered Institute for Archaeologists, 2014, *Standard and Guidance for Geophysical Survey;*

3. Chartered Institute for Archaeologists, 2014, Standard and Guidance for Archaeological Field Evaluation;

4. English Heritage, 1991, *Management of Archaeological Projects (MAP2);*

5. English Heritage, 2011, *Environmental Archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation;*

6. Gwynedd Archaeological Trust, 2014, *Historic Environment Record (HER) Guidelines for Archaeological Contractors* (Version 1.3; draft);

7. Historic England, 2015, *Management of Research Projects in the Historic Environment (MoRPHE);*

8. Ordnance Survey First Edition 1-inch to 25-mile County Series Map Sheet XI.1, 1891;

9. Ordnance Survey Second Edition 1-inch to 25-mile County Series Map Sheet XI.1, 1901;

10. Ordnance Survey Third Edition 1-inch to 25-mile County Series Map Sheet XI.1, 1920;

11. Royal Commission on Ancient and Historic Monuments of Wales, 2015, *Guidelines for digital archives*

FIGURE 01

Location of archaeological features (red dots) in relation to development site (red outline). Scale 1:7,000 @ A4.

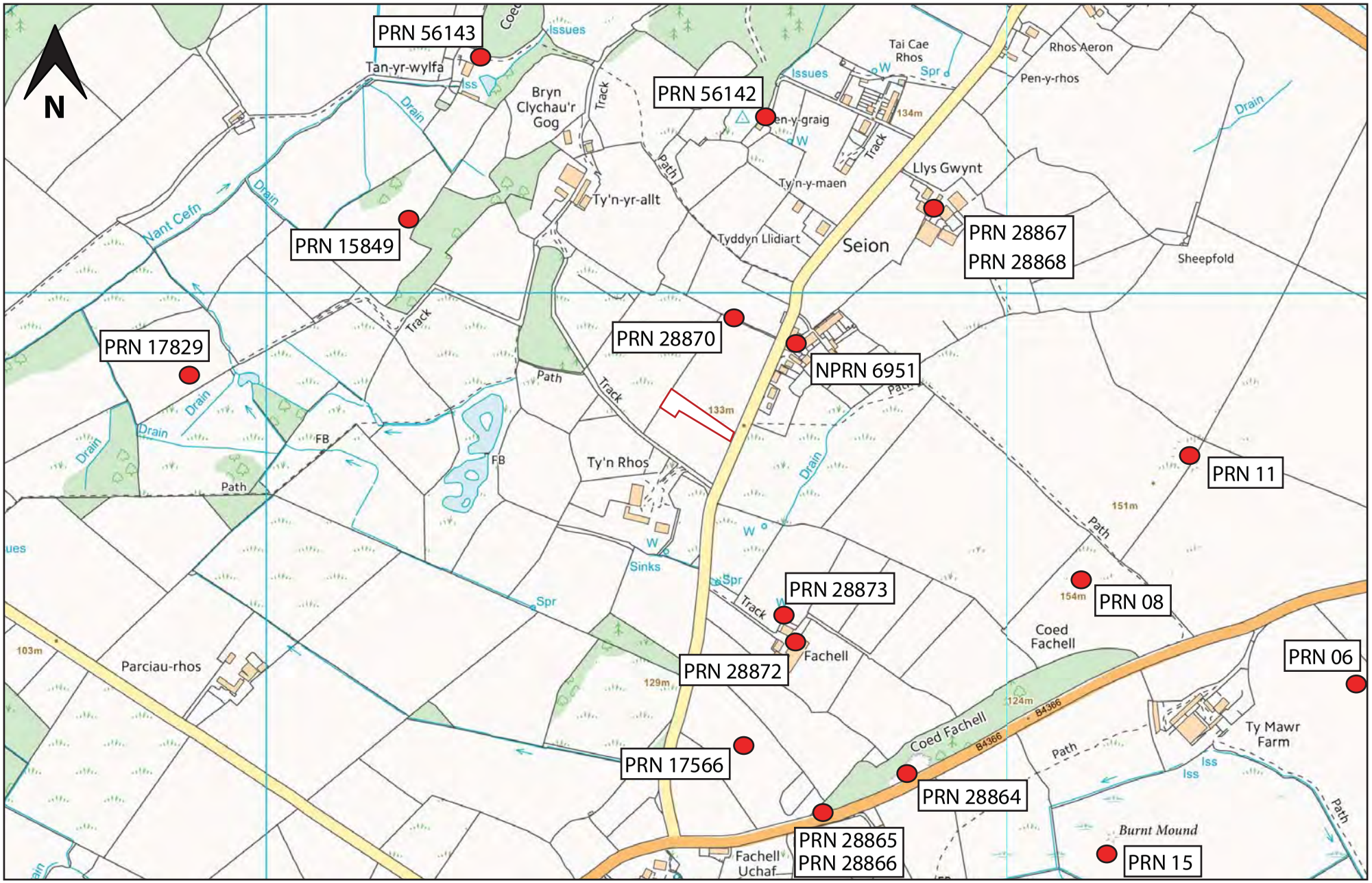

Figure 01: Location of archaeological features (red dots) in relation to development site (red outline). Scale 1:7,000 @ A4.

FIGURE 02

Reproduction of client drawing w2395-910; the proposed layout of the Waste Water Treatment Works

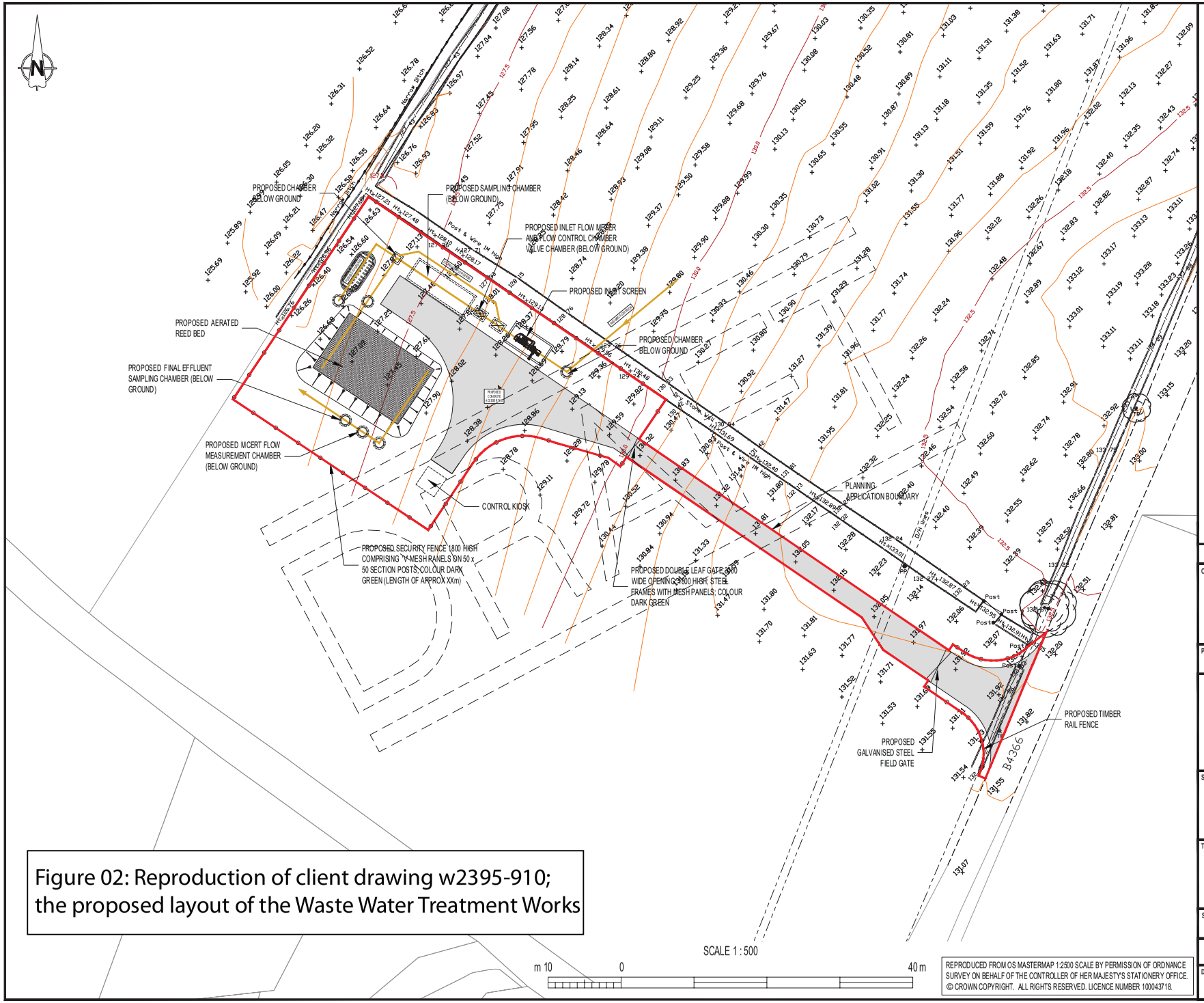

Figure 02: Reproduction of client drawing w2395-910; the proposed layout of the Waste Water Treatment Works

NOTES

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS SHOWN OTHERWISE.

KEY

FOUL SEWER ROUTE

PLANNING APPLICATION BOUNDARY

SITE LOCATION

GRID REFERENCE: 254701 , 366963

CAUTION: THE MANAGEMENT AND DESIGN OF ANY AND ALL TEMPORARY WORKS REQUIRED TO EXECUTE THIS DESIGN ARE THE RESPONSIBILITY OF THE CONTRACTOR.

REV.	DATE	DESCRIPTION	DSGN'D	CHK'D	APP'D
A00	31-01-18	FIRST ISSUE	DGJ	KJP	TM

CLIENT

Dŵr Cymru Welsh Water

PRINCIPAL DESIGNER

DŴR CYMRU WELSH WATER

waterco consultants

Waterco Ltd., Eden Court, Lon Parcwr Business Park, Ruthin LL15 1NJ

tel (+44) 1824 702220

www.waterco.co.uk

SCHEME

SEION FOUL SOLUTION

TITLE

PROPOSED SITE LAYOUT GENERAL ARRANGEMENT

STATUS

PLANNING APPLICATION

DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
MJ	KJP	TM	1 : 500 / A3

DRAWING NO. w2395-9101

REV A00

FIGURE 03

REPRODUCTION OF CLIENT DRAWING NO W2395-0001 AND LOCATION OF POSSIBLE PIPE ROUTES.

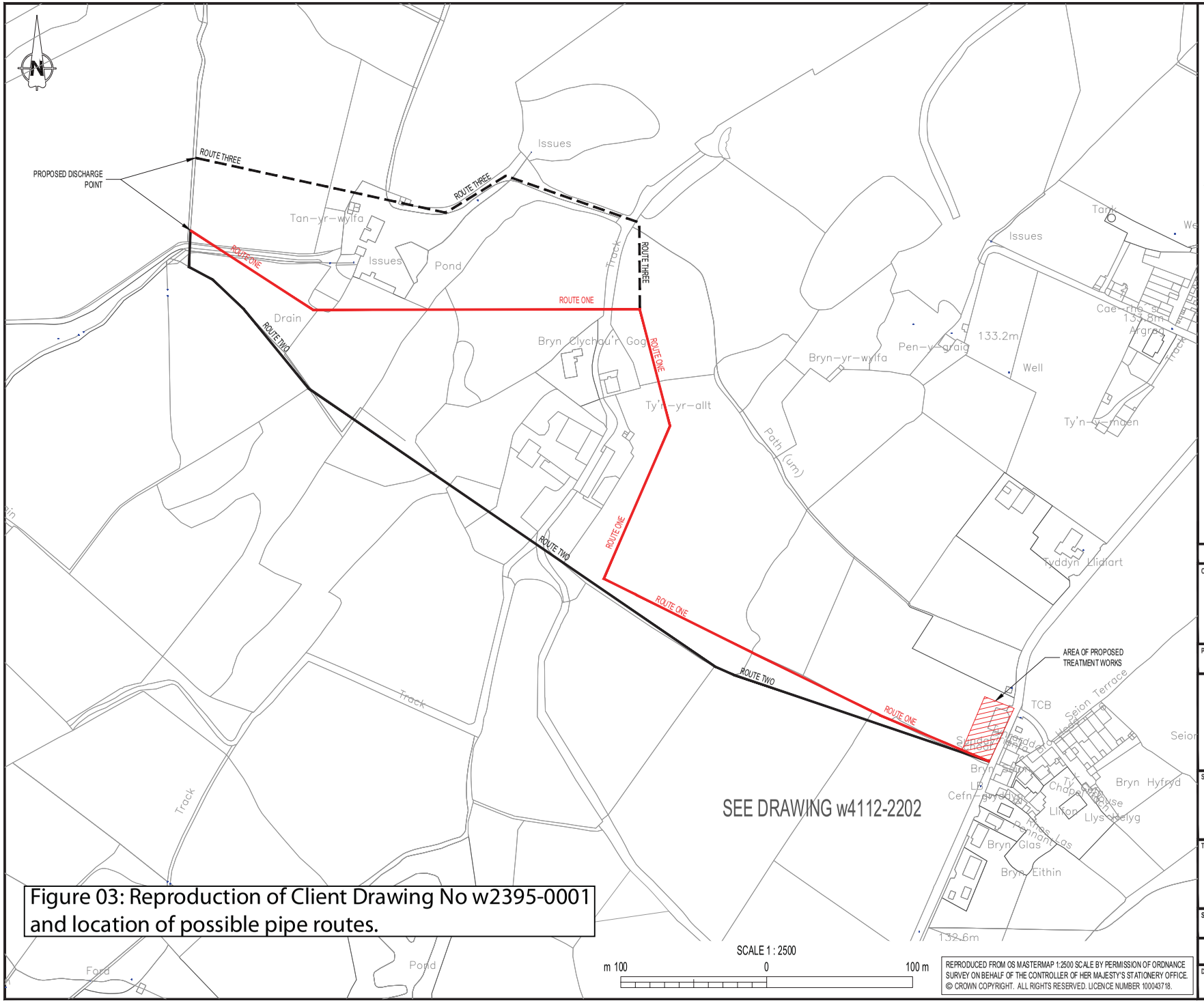

Figure 03: Reproduction of Client Drawing No w2395-0001 and location of possible pipe routes.

KEY

ROUTE ONE
ROUTE TWO
ROUTE THREE

SITE LOCATION

GRID REFERENCE: 254701 , 366963

CAUTION: THE MANAGEMENT AND DESIGN OF ANY AND ALL TEMPORARY WORKS REQUIRED TO EXECUTE THIS DESIGN ARE THE RESPONSIBILITY OF THE CONTRACTOR.

REV.	DATE	DESCRIPTION	DSGN'D	CHK'D	APP'D
P00	21/12/17	FIRST ISSUE	CJC	KJP	TM

CLIENT

Dŵr Cymru Welsh Water

PRINCIPAL DESIGNER

DWR CYRMU WELSH WATER

waterco consultants

Waterco Ltd., Eden Court, Lon Parcwr Business Park, Ruthin LL15 1NJ

tel (+44) 1824 702220

www.waterco.co.uk

SCHEME

SEION FOUL SOLUTION

TITLE

POTENTIAL GRAVITY OUTFULL ROUTES

STATUS

PRELIMINARY

DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
CJC	KJP	TM	1 : 2500 / A3

DRAWING NO. w2395-0001

REV P00

FIGURE 04

Caernarvonshire County Series 25 inch map Sheet XI.1 First (1891) Edition Ordnance Survey. Scale 1: 6,500 @ A4. Red outline represents boundary of the proposed Waste Water Treatment Works.

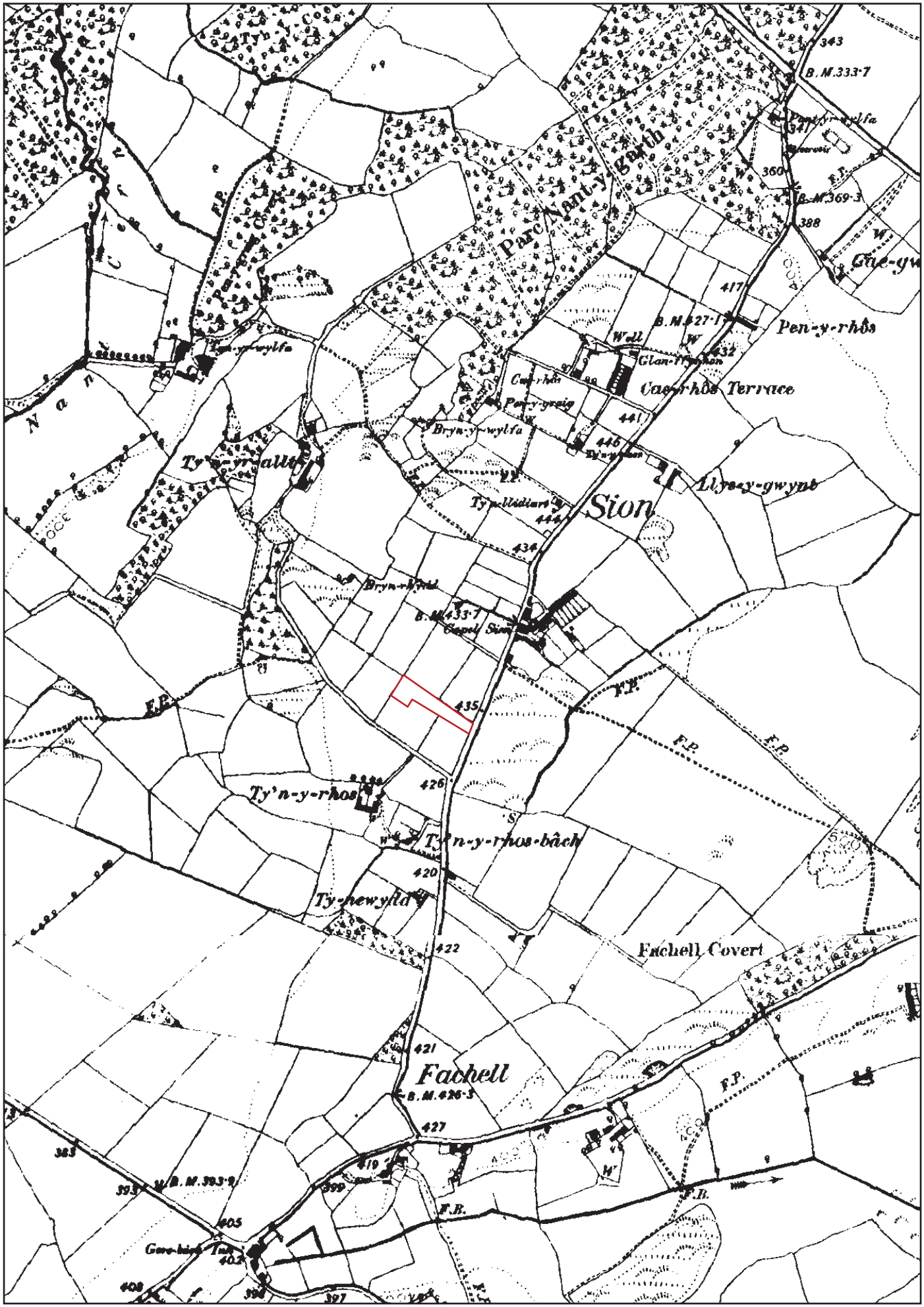

Figure 04: Caernarvonshire County Series 25 inch map Sheet XI.1 First (1891) Edition Ordnance Survey. Scale 1: 6,500 @ A4. Red outline represents boundary of the proposed Waste Water Treatment Works.

FIGURE 05

Caernarvonshire County Series 25 inch map Sheet XI.1 Second (1901) Edition Ordnance Survey. Scale 1: 6,500 @ A4. Red outline represents boundary of the proposed Waste Water Treatment Works.

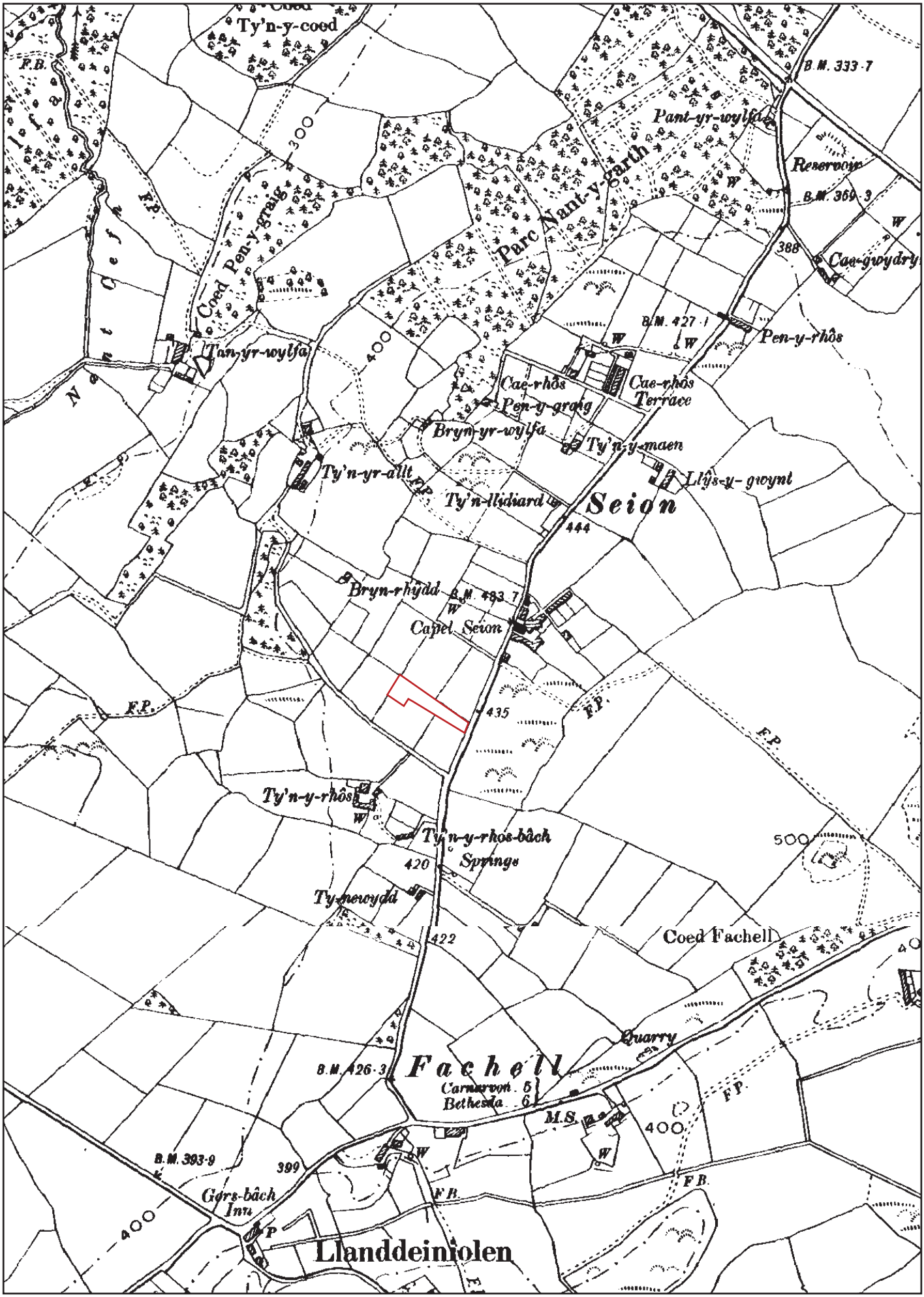

Figure 05: Caernarvonshire County Series 25 inch map Sheet XI.1 Second (1901) Edition Ordnance Survey. Scale 1: 6,500 @ A4. Red outline represents boundary of the proposed Waste Water Treatment Works.

FIGURE 06

Caernarvonshire County Series 25 inch map Sheet XI.1 Third (1920) Edition Ordnance Survey. Scale 1: 6,500 @ A4. Red outline represents boundary of the proposed Waste Water Treatment Works.

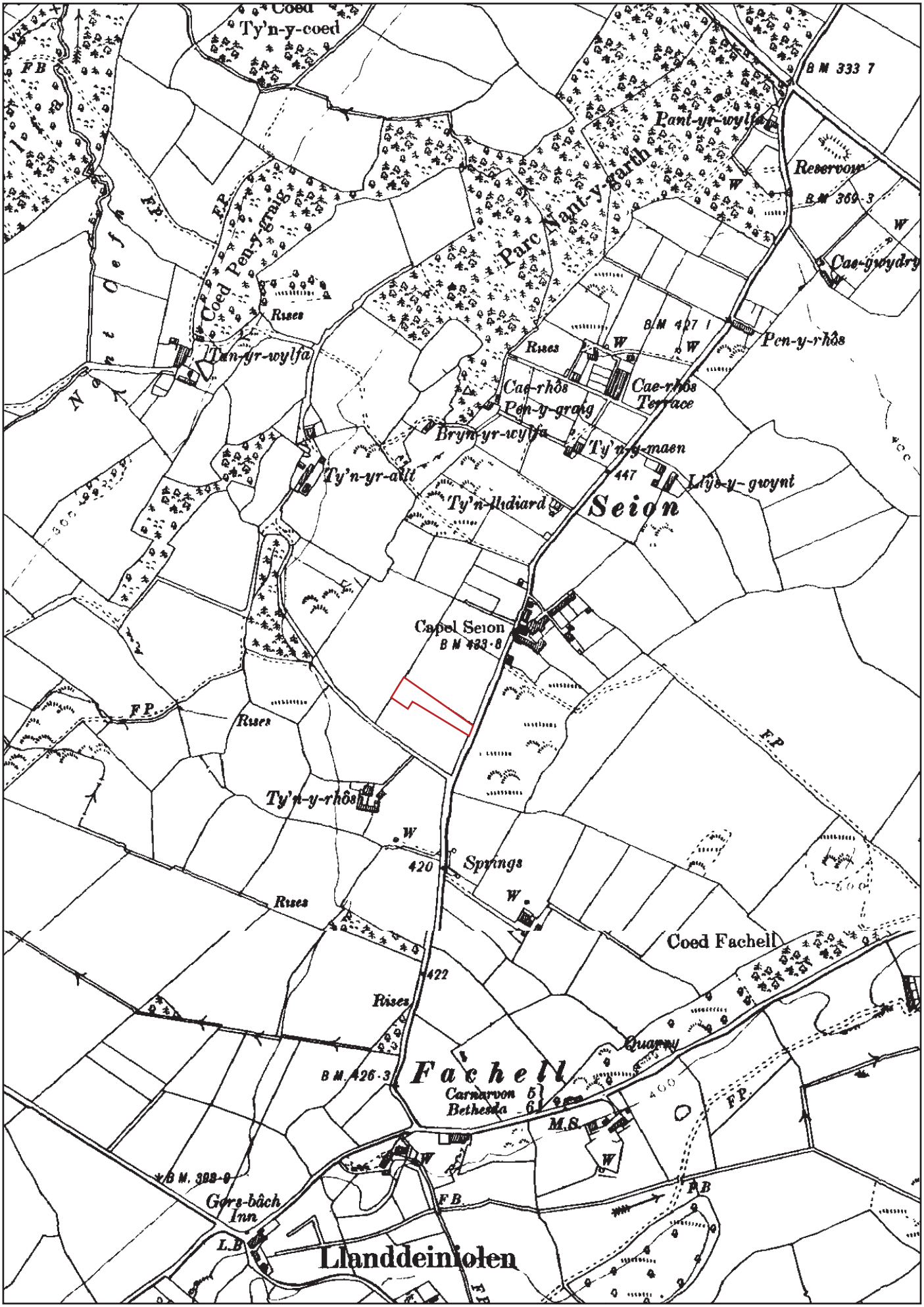

Figure 06: Caernarvonshire County Series 25 inch map Sheet XI.1 Third (1920) Edition Ordnance Survey. Scale 1: 6,500 @ A4. Red outline represents boundary of the proposed Waste Water Treatment Works.

APPENDIX I

Gwynedd Archaeological Trust photographic metadata pro-forma

Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

Digital Photographic Record

Include main context numbers for each shot, drawing numbers for sections and any other relevant numbers for cross referencing.
Delete any unwanted photos **immediately** from the camera. Regularly upload photographs to computer.

Project Name:			Project Number:				
Photo No.	**Trench**	**Description**	**Contexts**	**Scales**	**View From**	**Initials**	**Date**

APPENDIX II – Photographic Metadata for GAT Project G2563 Seion WWTW

PRN*	PHOTO RECORD NUMBER*	PROJECT NAME	PROJECT PHASE	DESCRIPTION*	VIEW FROM	SCALE(S)	CREATOR OF DIGITAL PHOTO*	DATE OF CREATION OF DIGITAL PHOTO*	ORIGINATING ORGANISATION	PLATES
45274	G2563_002	Seion_WWTW	WWTW Walkover Survey	View along eastern field boundary from entrance looking towards the entrance to Tyn Rhos	NNE	-	MSL	28/06/2018	Gwynedd Archaeological Trust	4
45274	G2563_003	Seion_WWTW	WWTW Walkover Survey	View from the highest part of the field towards the western corner showing the ground falling away	E	-	MSL	28/06/2018	Gwynedd Archaeological Trust	
45274	G2563_004	Seion_WWTW	WWTW Walkover Survey	Proposed WWTW location in northern corner of field	SE	-	MSL	28/06/2018	Gwynedd Archaeological Trust	
45274	G2563_005	Seion_WWTW	WWTW Walkover Survey	View along northern field boundary towards entrance along proposed access road route	NW	-	MSL	28/06/2018	Gwynedd Archaeological Trust	5
45274	G2563_006	Seion_WWTW	WWTW Walkover Survey	View along western field boundary towards location of proposed WWTW	SW	-	MSL	28/06/2018	Gwynedd Archaeological Trust	
45274	G2563_007	Seion_WWTW	WWTW Walkover Survey	View across field from its western corner showing the ground rising to the east	W	-	MSL	28/06/2018	Gwynedd Archaeological Trust	
45274	G2563_008	Seion_WWTW	WWTW Walkover Survey	View from the centre of the field towards proposed WWTW location in in northern corner	S	-	MSL	28/06/2018	Gwynedd Archaeological Trust	
45274	G2563_009	Seion_WWTW	WWTW Walkover	Wetter ground in northern corner of field	S	-	MSL	28/06/2018	Gwynedd	7

PRN*	PHOTO RECORD NUMBER*	PROJECT NAME	PROJECT PHASE	DESCRIPTION*	VIEW FROM	SCALE(S)	CREATOR OF DIGITAL PHOTO*	DATE OF CREATION OF DIGITAL PHOTO*	ORIGINATING ORGANISATION	PLATES
			Survey						Archaeological Trust	
45274	G2563_010	Seion_WWTW	WWTW Walkover Survey	View of field entrance and gateway to adjoining field to the north	W	-	MSL	28/06/2018	Gwynedd Archaeological Trust	1
45274	G2563_011	Seion_WWTW	WWTW Walkover Survey	Proposed WWTW location in northern corner of field	SE	-	MSL	28/06/2018	Gwynedd Archaeological Trust	2
45274	G2563_012	Seion_WWTW	WWTW Walkover Survey	View along southern field boundary towards lower western corner of field	SE	-	MSL	28/06/2018	Gwynedd Archaeological Trust	5
45274	G2563_013	Seion_WWTW	WWTW Walkover Survey	View along eastern field boundary towards entrance from southern corner of field	SW	-	MSL	28/06/2018	Gwynedd Archaeological Trust	
45274	G2563_015	Seion_WWTW	WWTW Walkover Survey	View of entrance to field and route of proposed access road from the road side	SE	-	MSL	28/06/2018	Gwynedd Archaeological Trust	6
	G2563_016	Seion_WWTW	Pipe route walkover survey	View of southern end of Field 1; entry point for proposed pipe routes 1 & 2	NNW	1x1m	Stuart Reilly	03/07/2018	Gwynedd Archaeological Trust	

Gwynedd Archaeological Trust
Ymddiriedolaeth Archaeolegol Gwynedd

Craig Beuno, Ffordd y Garth, Bangor, Gwynedd. LL57 2RT
Ffon: 01248 352535. Ffacs: 01248 370925. email:gat@heneb.co.uk