Plas Power Solar and Energy Storage Project

4.3 Environmental Statement Volume 3: Appendices

Part 13 of 14

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Schedule of appendices included in this document

Document Ref	Document Title
4.3.36	Appendix 7.2 Built Heritage Desk Based Assessment
4.3.37	Appendix 8.1 FCA & Conceptual Drainage Strategy

Appendix 7.2
Built Heritage Desk Based Assessment

PLAS POWER SOLAR AND ENERGY STORAGE PROJECT

Built Heritage Statement

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Quality Management

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Contents

1 INTRODUCTION

1.1 This Built Heritage Statement has been researched and prepared by RPS, on behalf of Lightsource bp, in order to identify and assess the significance of built heritage assets potentially affected by the development of land at Plas Power Estate ('the Site') as a solar farm with battery energy storage system, and to consider the possible impacts of the Proposed Development on these built heritage assets.

1.2 This report is intended to provide the baseline information required to inform decisions about the design and layout of the Proposed Development and any mitigation measures that may be required.

1.3 The full extent of the Site considered in this report is illustrated in Figure 1. The Site is centred at NGR SJ 30160 50380 and covers an area of approximately 145ha. The Site is very irregular in shape. For ease of reference throughout this report, the Site has been divided into Zones A-D that reflect both the topographic variation across the Site. These Zones are shown in Figure 2.

1.4 This report makes reference to the relevant legislation contained within the Historic Environment (Wales) Act 2016 and both Welsh government and local planning policy. In addition, relevant guidance documents have been consulted to inform the judgements made, notably *Technical Advice Note (TAN) 24: The Historic Environment* (2017), Setting of Historic Assets in Wales (2017) and *Conservation Principles for the Sustainable Management of the Historic Environment in Wales (Conservation Principles)* (2011). Relevant information including the listed citations for relevant heritage assts have also been consulted in preparing this Built Heritage Statement. The conclusions reached in this report are the result of detailed historic research, a walkover survey of the Site and publicly accessible locations in the surrounding area, map studies, and the application of professional judgement.

2 LEGISLATIVE AND PLANNING POLICY FRAMEWORK

Legislation

The Historic Environment (Wales) Act 2016

2.1 The Historic Environment (Wales) Act 2016 was passed by the Welsh National Assembly on 9th February 2016 and became law after receiving Royal Assent on 21st March 2016. This Act amends the two pieces of UK legislation, the Ancient Monument and Archaeological Areas Act 1979 and the Planning (Listed Buildings and Conservation Areas) Act 1990, which currently provide the framework for the protection and management for the Welsh historic environment. These amendments predominantly relate to the transference of a number of existing powers, including the designation of scheduled monuments and listed buildings, from the Secretary of State to Welsh Ministers. The key provisions of the Act can be summarised as the following:

- amendments to the procedure for determining scheduled monument consent;
- provision for Welsh Ministers to enter into a Heritage Partnership Agreement with the owner of a scheduled monument, or any associated land, within Wales;
- provision for Welsh Ministers to compile and maintain a register of historic parks and gardens of special historic interest; and
- provision for Welsh Ministers and/or local authorities to enter into a Heritage Partnership Agreement with the owner of a listed building, or part of such a building, situated in Wales.

2.2 The Act also contains new stand-alone provisions for the compilation of a list of historic place names in Wales; for the compilation of an historic environment record for each local authority area in Wales; and for the establishment of an Advisory Panel for the Welsh Historic Environment.

2.3 A new Historic Environment (Wales) Act was given Royal Assent on June 14th 2023. The purpose of this Act is to consolidate existing Welsh and UK-wide legislation in one place. The 2023 Act consolidates enactments in or made under the following:

- the Historic Buildings and Ancient Monuments Act 1953;
- Parts 1 and 3 of the Ancient Monuments and Archaeological Areas Act 1979;
- Parts 14 and 15 of the Town and Country Planning Act 1990;
- the Planning (Listed Buildings and Conservation Areas) Act 1990;
- Part 5 of the Planning and Compulsory Purchase Act 2004;
- the Historic Environment (Wales) Act 2016.

2.4 Although the Act has received Royal Assent, it will not come into force until supporting secondary legislation has been made and guidance and administrative documents have been revised and updated to reflect its passage. It is expected that the Act will come into force in the latter part of 2024.

Planning (Listed Buildings and Conservation Areas) Act 1990 and the Planning (Listed Buildings and Conservation Areas) (Wales) (Amendment No.2) Regulations 2017

2.5 Where any development may affect designated heritage assets, there is a legislative framework in place to ensure that due regard is given to its impact on the historic environment. Notwithstanding

the amendments made in the Historic Environment (Wales) Act 2016, this extends from primary legislation under the Planning (Listed Buildings and Conservation Areas) Act 1990.

2.6 Section 66(1) states that special regard must be given by the planning authority in the exercise of planning functions to the desirability of preserving or enhancing listed buildings and their setting.

2.7 The meaning and effect of these duties have been considered by the courts in recent cases, including the Court of Appeal decision in relation to Barnwell Manor Wind Energy v East Northamptonshire District Council [2014] EWCA Civ 137.

2.8 The Court agreed with the High Court's judgement that Parliament's intention in enacting Section 66(1) was that decision-makers should give 'considerable importance and weight' to the desirability of preserving (i.e. keeping from harm) the setting of listed buildings.

2.9 Additionally, Section 72 of the 1990 Act states that in exercising all planning functions, local planning authorities must pay special attention to the desirability of preserving or enhancing conservation areas, with this duty applying to any buildings or land within a conservation area.

2.10 The mechanisms for implementation of the 1990 UK Act were updated for a Welsh context in The Planning (Listed Buildings and Conservation Areas) (Wales) Regulations 2012. These Regulations have most recently been amended in the Planning (Listed Buildings and Conservation Areas) (Wales) (Amendment No.2) Regulations 2017. In this most recent amendment, the requirement that an application for listed building consent is accompanied by a design and access statement has been replaced with the requirement that an application for listed building or conservation area consent is accompanied by a heritage impact statement.

National Planning Policy

Planning Policy Wales (Edition 12)

2.11 Chapter 6 of PPW12, entitled 'Distinctive and Natural Places', has a section entitled 'The Historic Environment' (section 6.1 - pp. 125-131) which provides policy for planning authorities, property owners, developers and others on the conservation and investigation of heritage assets. Overall, the objectives of Section 6.1 in relation to the historic environment can be summarised as seeking to:

- protect the Outstanding Universal Value of the World Heritage Sites;
- conserve archaeological remains, both for their own sake and for their role in education, leisure and the economy;
- safeguard the character of historic buildings and manage change so that their special architectural and historic interest is preserved;
- preserve or enhance the character or appearance of conservation areas, whilst the same time helping them remain vibrant and prosperous;
- preserve the special interest of sites on the register of historic parks and gardens; and
- protect areas on the register of historic landscapes in Wales.

2.12 Section 6.1 of PPW12 describes the historic environment as comprising all the surviving physical elements of previous human activity and illustrates how past generations have shaped the world around us. The historic environment is made up of individual historic features, archaeological sites, historic buildings and historic parks, gardens, townscapes and landscapes, collectively known as historic assets.

2.13 Welsh planning legislation and policy guidance outlines that the conservation of archaeological remains and their settings is a material consideration in the determination of a planning application, whether those remains are scheduled or not (PPW12 Para. 6.1.23). In order to take account of archaeological considerations and deal with them from the beginning of the development control process, Local Planning Authorities in Wales need to be fully informed about the nature and importance of archaeological remains, and their setting, and the likely impact of any Proposed Development upon them.

2.14 Paragraphs 6.1.26 of PPW12 states that where archaeological remains are known to exist or there is a potential for them to survive, an application should be accompanied by sufficient information, through desk-based assessment and/or field evaluation, to allow a full understanding of the impact of the proposal on the significance of the remains. The needs of archaeology and development may be reconciled, and potential conflict very much reduced, through early discussion and assessment.

2.15 Paragraph 6.1.27 of PPW12 states that if the planning authority is minded to approve an application and where archaeological remains are affected by proposals that alter or destroy them, the planning authority must be satisfied that the developer has secured appropriate and satisfactory provision for their recording and investigation, followed by the analysis and publication of the results and the deposition of the resulting archive in an approved repository. On occasions, unforeseen archaeological remains may still be discovered during the course of a development. A written scheme of investigation should consider how to react to such circumstances or it can be covered through an appropriate condition for a watching brief.

2.16 In considering any planning application for development, the planning authority will be mindful of the framework set by government policy, in this instance PPW12, by current Development Plan Policy and by other material considerations.

National Guidance

Technical Advice Note (TAN) 24: The Historic Environment (2017)

2.17 TAN 24 is one of a suite of documents designed to aid the application of PPW. TAN 24 was adopted in May 2017, and supersedes pre-existing Welsh Office Circular concerning the historic environment.

2.18 TAN 24 provides specific guidance on how the planning system considers each aspect of the historic environment during development plan preparation and decision making on planning and Listed Building (LBC) applications. It also sets out that it is for an applicant to provide the LPA with sufficient information to allow the assessment of their proposal in respect of historic assets, irrespective of their designation, which may take the form of a heritage impact statement.

Technical Advice Note (TAN) 12: Design (2016)

2.19 TAN 12 provides advice on the good design of new development. Alongside promoting sustainability, it sets out that the context of a development should be appraised, including the historic environment, to inform design. Section 5.6 Historic Environment highlights that design should have regard to the desirability of preserving or enhancing the character and appearance of areas of special character, such as conservation areas. It also highlights that specialists are needed to accurately assess areas of architectural or historic character.

Conservation Principles for the Sustainable Management of the Historic Environment in Wales (Conservation Principles) (2011)

2.20 Conservation Principles provides the basis upon which Cadw discharges certain statutory duties on behalf of the Welsh Ministers. It is also for use by others (including owners, developers and other

public bodies) to assess the potential impacts of development proposals on the significance of historic assets, and assist in the decision-making process where the historic environment is affected by the planning process.

2.21 The document echoes PPW in the emphasis it places upon the importance of understanding significance as a means to properly assess the effects of change to heritage assets. The guidance describes a range of heritage values which enable the significance of assets to be established systematically, with the four main component values being:

- **Evidential value**: which derives from those elements of an historic asset that can provide evidence about past human activity, including its physical remains or historic fabric. These may be visible and relatively easy access, or may be buried below ground, under water or be hidden by later fabric. These remains provide the primary evidence for when and how an historic asset was made or built, what it was used for and how it has changed over time.
- **Historical value**: derives from the ways an historic asset might illustrate a particular aspect of past life or be associated with a notable family, person, event or movement. These illustrative or associative values of an historic asset may be less tangible than its evidential value but will often connect past people, events and aspects of life with the present. As the functions of an historic asset are likely to have changed over time, the full range of changing historical values might not become clear until all the evidential values have been gathered together.
- **Aesthetic value**: which derives from the ways in which people draw sensory and intellectual stimulation from a place. Aesthetic values can be the result of the conscious design of a place, including artistic endeavour, or they can be the seemingly fortuitous outcome of the way in which a place has evolved and been used over time, or a combination of both.
- **Communal value**: which derives from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory. Communal values are closely bound up with historical (particularly associative) and aesthetic values, but tend to have additional and specific aspects. Commemorative and symbolic values reflect the meanings of a place for those who draw part of their identity from it, or have emotional links to it. Social value is associated with places that people perceive as a source of identity, distinctiveness, social interaction and coherence. Spiritual value attached to places can emanate from the beliefs and teachings of an organised religion or reflect past or present-day perceptions of the spirit of a place.

Best Practice Guidance Overview

2.22 Cadw publishes a wide range of Best Practice Guidance documents (BPGs). This guidance relates to: the care and understanding of historic buildings, scheduled monuments and other archaeological remains; understanding the significance of, and managing, conservation areas; managing local lists, historic parks and gardens, wider historic landscapes, and World Heritage Sites; the role of the planning system in the management of the historic environment; and technical guidance for conservation.

2.23 This Best Practice Guidance is intended to complement the Historic Environment (Wales) Act 2016 and recent planning policy and advice. In particular, it is designed to provide information on good conservation practice to assist LPAs, planning and other consultants, owners, applicants, and other interested parties when implementing Welsh policy. BPGs of particular relevance are discussed below:

Heritage Impact Assessment in Wales (May 2017)

2.24 This document sets out the general principles to consider when planning changes to historic assets and applying for listed building, conservation area, and scheduled monument consent. In particular,

it emphasises the purpose and value of undertaking Heritage Impact Assessments in order to help identify the most appropriate way to accommodate change within the historic environment. The guidance echoes PPW by stressing that understanding the significance of historic assets is key to making decisions regarding the historic environment.

Setting of Historic Assets in Wales (May 2017)

2.25 This guidance document focuses on the management of change within the setting of heritage assets. It explains what setting is, how it contributes to the significance of a historic asset, and why it is important, in order to aid practitioners with the implementation of Welsh national policies and guidance relating to the historic environment.

2.26 This document defines setting as 'including the surroundings in which it is understood, experienced and appreciated, embracing present and past relationships to the surrounding landscape. Its extent is not fixed and may change as the asset and its surroundings evolve'. The guidance emphasises that setting is not a heritage asset in itself, although land within a setting may contain other historic assets. Instead, the importance of setting is noted to lie in what it contributes to the significance of a historic asset. The document also states that elements of setting may make a positive, negative or neutral contribution to the significance of an asset.

2.27 Whilst views to and from an historic asset are often the most obvious consideration in any assessment of the contribution that setting makes to the significance of an asset, other sensory elements can also affect setting, including noise, vibration, and odour. Setting may also incorporate perceptual and associational attributes pertaining to the asset's surroundings.

2.28 This document provides guidance on practical and proportionate decision making with regards to the management of Proposed Development and the setting of heritage assets. It is stated that the protection of the setting of a heritage asset need not prevent change, and also that the scale of an assessment needs to be proportionate to the likely impact of the proposal. Although not prescriptive in setting out how this assessment should be carried out, section four of the document outlines the general principles that both assessors and decision makers should consider when assessing the impact of a proposed change or development within the setting of historic assets. It identifies four key stages:

1. Identification of the historic assets that might be affected by a proposed change or development;
2. Defining and analysing the settings to understand how they contribute to the significance of the historic assets and, in particular, the ways in which the assets are understood, appreciated and experienced;
3. Evaluation of the potential impact of a proposed change or development on that significance; and
4. If necessary, considering options to mitigate or improve the potential impact of a proposed change or development on that significance.

2.29 The guidance states that the introduction of offsetting or compensatory proposals, such as public access or interpretation panels, will not reduce the impact of the development within the setting of the historic asset, and thus should not be accepted as mitigation. However, these may be considered when the decision-making body weighs up the benefits of the scheme.

Local Planning Policy

2.30 In considering any planning application for development, the planning authority will be mindful of the framework set by government policy, in this instance PPW, by current Development Plan Policy and by other material considerations.

2.31 The Site is located within the Wrexham County Borough Council area, which has adopted the Wrexham Local Development Plan (LDP) 2013 – 2028. The relevant policy of the LDP is:

Policy SP15 Historic and Cultural Environment *– Development will only be supported where it conserves, protects, preserves or enhances the following cultural and historic assets of the County Borough and their setting:*

i. Listed Buildings;

ii. Conservation Areas;

iii. Pontcysyllte Aqueduct and Canal World Heritage Site;

iv. Registered Historic Parks, Gardens and Landscapes; and

v. Scheduled Monuments and Archaeological Remains.

Local Planning Guidance

2.32 The Council have approved a series of Local Planning Guidance Notes. Local Planning Guidance Note No 4 – Conservation Areas has been referred to in the production of this report; although, the main objective of this document is to provide guidelines to improve design standards in Conservation Areas and does not address issues relating to the setting of Conservation Areas. The Bersham Conservation Area Assessment and Management Plan (adopted December 2009) has also been referred to in the production of this report.

3 HISTORIC BUILT ENVIRONMENT APPRAISAL

Introduction

3.1 The full extent of the Site considered in this report is illustrated in Figure 1. The Site is centred at NGR SJ 30160 50380 and covers an area of approximately 145ha. The Site is very irregular in shape and takes in arable fields to the north of the A525 (Zone A) and to its south (Zones C-D). The fields are bounded by hedgerows with a shelter belt between Zones C and D.

3.2 Height Above Ordnance Datum (AOD) at the western boundary of the site in Zone B is 180m, in Zone A 170m. The lowest parts of the site are along the eastern boundary of Zone D, where height AOD is approximately 105-110m. As a result, from some western parts of the Site there are long-distance views east over Wrexham. The valley of the River Clywedog which runs along the southern boundary of Zone C and D and in which the village of Bersham is steep-sided and wooded.

3.3 Within the study site there are minor variations in this broad topography.

Historic Development

Bersham and Surrounding Area

3.4 Activity in the Bersham area can be traced back to the Roman period, when lead and other minerals were mined in the Esclusham and Minera Mountains. Evidence of later Anglo-Saxon influence in the area is provided by Offa's Dyke, which was constructed in the mid- to late-eighth century by King Offa of Mercia and runs broadly north-south past the Site. Further evidence of Anglo-Saxon influence is provided by local place names incorporating 'Ham', an English word meaning settlement or manor, and 'Esclus', probably an English corruption of the Welsh 'Ystlys' that refers to the side or flank of a hillside.

3.5 By the Medieval period, Bersham formed part of the manor of Esclusham. This was later separated into Esclusham above the dyke and Esclusham below the dyke, and Bersham then became a separate township within the parish of Wrexham. The settlement at Bersham was formed during the Medieval period from two adjacent groups of cottages known as Pentre Dybenni and Dol Cuhelyn.

3.6 Industry has played an important role in the history of Bersham and the surrounding area. The topography of the riverbank at Bersham made it ideal for iron production: the natural cliff formation allowed furnaces to be charged from the top and for the molten metal to run off below at road level; the surrounding woodlands supplied them with plentiful fuel; and the fast flow of the River Clywedog provided a power supply to drive the water wheels. Bersham also lay in a favourable position between the busy ports at Liverpool and Chester, the mineral deposits of North Wales, and the rich markets of central England. Evidence suggests that there were already several iron furnaces and foundries along the Clywedog Valley by the seventeenth century, and in the late-eighteenth century the settlement prospered from, and was shaped by, its booming iron industry.

3.7 In 1763 Isaac Wilkinson diverted the course of the River Clywedog and built a number of weirs along its length in order to better supply power to his mills. Whilst now dry, these leats remain visible in Plas Power woods and the meadow leading to Papermill Cottage. In 1774, his son, John Wilkinson, patented the first machine to accurately bore cannon, and in 1775 the village's Octagonal Building (Grade II* listed, ref. 1568) (plate 1) was built to keep up with the huge demand. In the same year, Wilkinson also began producing bored cylinders for the Boulton and Watt steam engine, thereby placing Bersham at the heart of the Industrial Revolution.

3.8 From 1777 to 1795 the Bersham ironworks prospered as international conflicts such as the American War of Independence ensured a strong demand for Wilkinson's cannon. However, increased competition from rival iron works and Wilkinson's focus on other more profitable sites led to the

closure of the ironworks in Bersham in 1812. Following the ironwork's decline, paper and corn mills came to re-use redundant ironwork buildings. Two paper mills were located in Bersham during the nineteenth-century and the blast furnace on the west side of the village was converted to a corn mill in 1829 and worked until 1933.

3.9 Through both the nineteenth and twentieth centuries, mining was another important local industry, with 38 collieries operating in the Wrexham area at peak. During the twentieth century, a large area of land to the north of Bersham, which encompassed much of Zone D of the Site, was used for opencast mining (see Figure 8).

Plas Power

3.10 Plas Power Estate has origins in the fifteenth-century, when it was owned by Robert Bellow. In the seventeenth century, the Estate passed by inheritance to the Power family, after whom it was re-named. The estate's relationship to the Power family was short-lived, however, as by 1847 it was under the ownership of William Lloyd, who replaced the original house with a new red-brick mansion (demolished after World War II). Lloyd also made a number of other 'improvements' to the estate, and it was Lloyd who was responsible for enclosing the associated parkland with the imposing stone wall that remains a strong character feature of the local area to this day. St Mary's Church (Grade II*, ref. 16553) (plate 2), which is a local landmark building, was commissioned by Lloyd's descendants in the later-nineteenth century. The distinctive 'estate architecture' style that is a feature of the surrounding area, comprising sandstone walling, slate roofing, cast-iron latticed windows and decorative timber barge-boards, is characteristic of the influence of the Plas Power Estate.

Map Regression

3.11 The earliest available detailed mapping of the Site is the Bersham Township tithe map (1841) not illustrated). The tithe map and their associated apportionment shows that in the early 1840s Zones C and D comprised parkland associated with Plas Power, with Plas Power shown to be enclosed to the north, south and west by plantations. Zones A and B were also owned by Thomas Fitzhugh of Plas Power but comprised smaller field parcels which are recorded as being agricultural land (predominantly arable and pasture) variously associated with Rhos Berse, Upper Berse, and Ty'n Ddol.

3.12 Ordnance Survey (OS) mapping from 1879 (Figure 4) provides evidence of the 'improvements' made to the Plas Power Estate by William Lloyd. In this mapping, Zone B no longer comprises smaller agricultural field parcels but instead forms part of the parkland. This parkland stretches from Rhos Berse Road to the west, to what is now the A525 to the north, and the old Berse Road to the east. The re-building of Plas Power itself is also shown, with the new mansion in a similar position to the old but now enclosed to a greater extent, on all sides, by more substantial plantation. The West Drive is also shown to have been constructed. An Estate Map dated 1899 that uses the 1879 OS map as a base (Figure 5) indicates all of Zones B, C and D, except a small parcel of land adjoining Bersham at the south of Zone D, were 'in hand'. Zone A was occupied by S. J. Reeves, Robert Morris, and Sarah Pritchard.

3.13 The 1938 OS mapping (Figure 6) shows the extent of Plas Power Park shaded in grey, reflecting the change in Ordnance Survey practice. This is largely the same as in the late-nineteenth century, except that the south-eastern part of Zone D, adjacent to Bersham, is no longer shown as part of the Park. The Site seems otherwise broadly unchanged. Within the surrounding area, however, some expansion of Coedpoeth is evident. Similarly, to the north-east, Broughton is shown to have expanded after the arrival of a second railway line.

3.14 In the Post-War period, however, both the Site and its surrounds underwent considerable change. In 1946-7 Plas Power was demolished; although, as illustrated in the 1963-4 OS mapping (Figure 7), a number of adjacent estate buildings and the plantation in which it was enclosed remained.

Zone A, which had previously been farmed independently, is largely unchanged in this mapping. Zone B also appears to be largely unchanged. However, the former parkland to the east of Plas Power, including much of Zones C and D was being used for opencast mining by this time. Within the surrounding area, both Coedpoeth and Broughton display further expansion.

3.15 The extent of the opencast mining on the former Plas Power parkland is illustrated in an aerial photograph from 1966 (Figure 8), which shows these opencast workings extending right up to the plantation in which Plas Power had formerly stood.

3.16 By 1974-1979 OS mapping (Figure 9), however, this opencast mining is shown to have ceased, with made ground in the area of the former workings, displaying the field boundaries, linear tree belt, overflow pond and tracks now present. Zone B also appears to be in agricultural use with a number of new field boundaries dividing the formerly open land. Zone A appears largely unchanged. Along the eastern boundary of the Site, the A435 is shown to have been constructed, dividing Bersham in two.

3.17 Ordnance Survey mapping from 2000 (Figure 10) shows no changes to the Site, with only a small number of field boundary changes evident. No substantial changes to the surrounding area are apparent either. Although, to the north-east of the Site, the railway lines to the south of Broughton are shown to be disused and part has been built over with residential development at ‘New Broughton’.

Assessment of Heritage Assets

3.18 In order to identify and assess those built heritage assets potentially affected by the Proposed Development, an initial 3-kilometre search-radius was used over which a Zone of Theoretical Visibility (ZTV) was produced (Figure 3). This along with site visits have informed the identification of those assets that may be affected by the Proposed Development, i.e. Stage 1 of the four stage assessment process laid out in guidance (Cadw 2017).

3.19 The Site contains no designated or non-designated built heritage assets.

3.20 There are 287 Listed Buildings in the 3km study area. These comprise two Grade I, 24 Grade II* and 261 Grade II. Of these, 141 lie in Wrexham, in excess of 1km to the east of the Site. The ZTV demonstrates that there will be no intervisibility between these, their immediate surroundings and the Proposed Development. It is it is considered that there is no potential for their settings to be affected and they are not considered further.

3.21 Fifteen Listed Buildings are in Brynteg and the ZTV demonstrates that there will be no intervisibility between these, their immediate surroundings and the Proposed Development. It is concluded that there is no potential for the Proposed Development to affect their setting and they are not considered further.

3.22 Thirty Listed Buildings are in Minera, Coedpoeth, New Brighton and Rhossllannerchrugog. The ZTV demonstrates that there will be no intervisibility between these, their immediate surroundings and the Proposed Development. It is concluded that there is no potential for the Proposed Development to affect their setting and they are not considered further.

3.23 There are 35 Listed Buildings in the Erddig Registered Park, including the Grade I Erddig itself (1533), which is 1.9km from the Site. The ZTV indicates that the Proposed Development will not be visible from most of the Listed Buildings, including Erddig, and the greater part of the park. It suggests some intervisibility from the eastern part of the park. However, in practice, trees in the park result in there being no intervisibility between those parts of the park within the ZTV and the Site. It is concluded that there is no potential for the Proposed Development to affect their settings and they are not considered further.

3.24 A further 11 Listed Buildings lie scattered to the south of the Site at Talwrn and to the south of Rhostyllen. The ZTV demonstrates that there will be no intervisibility between these, their immediate

surroundings and the Proposed Development. It is concluded that there is no potential for the Proposed Development to affect their setting and they are not considered further.

3.25 A further 28 Listed Buildings are scattered across the study area, outside the ZTV. As the Proposed Development will not be visible from them or their surroundings it is concluded that there is no potential for their settings to be affected and they are not considered further.

3.26 The remainder of the Listed Buildings comprise 16 in the Bersham Conservation Area, immediately to the south of the Site, a group of five at Plas Power close to the western limit of the Site, a group of four on Rhos Berse Road to the west of the Site, two farmhouses to the north of the Site. Whilst some of these lie outside the ZTV, they have been taken through to assessment owing to proximity.

3.27 There are six Conservation Areas in the study area. The nearest of these is Bersham, which lies adjacent to the Site. This has been taken through to assessment. The remaining Conservation Areas are a minimum of 1.9km from the Site and the ZTV indicates that the Proposed Development will not be visible from them or their surroundings. It is concluded that there is no potential for their settings to be affected and they are not considered further.

3.28 There are two Registered Parks and Gardens in the study area. These are approximately 1.5km to the east of the Site. As discussed above, Erddig lies partially within the ZTV. However, trees mostly within the park screen these views and consequently there is no potential for the Proposed Development to affect the setting of the park and it is not considered further. Similarly, the ZTV indicates a degree of intervisibility between Wrexham Cemetery and the Proposed Development. However, trees surrounding the cemetery screen these views and it is concluded that the there is no potential for the setting of either of these assets to be affected by the Proposed Development

3.29 Scheduled Monuments are considered in a separate archaeological report (RPS 2023).

3.30 Following the Stage 1 assessment, the following listed buildings and conservation areas that lie within a 3-kilometre search radius of the Site are considered below. Where appropriate, namely where the Site is considered to make the same contribution to the significance of a number of assets, these assets have been grouped, as indicated below. For the same reason, those listed buildings situated within the Bersham Conservation Area (including the Grade II* listed Octagonal Building at Bersham Ironworks Site (ref. 1586), Single Storeyed Building to SE of Octagonal Building at Bersham Ironworks Site (ref. 16539), and Church of St Mary (ref. 16553)) will be assessed below in conjunction with the Conservation Area.

- Bersham Conservation Area and listed buildings within.
- Plas Power Grouping - comprising the Ice House (Grade II, ref. 1793), Stable Block (Grade II, ref. 16452), Bath House (Grade II, ref.16453), Game Larder (Grade II, ref. 1737), and Dairy (Grade II, ref. 1738).
- Walls, railings, gates and entrance lodge to Plas Power Park – comprising the Walls to Plas Power Park including Park Cottage (Grade II, ref. 16455), Wall to Plas Power Park SW of Rhosberse Lodge (Grade II, ref. 16456), Rhosberse Lodge at Entrance to West drive at Plas Power (Grade II, ref. 1740), and Railings and Gates to West Entrance Drive at Plas Power (Grade II, ref. 16454).
- Higher Berse Farmhouse (Grade II, ref. 16457).
- Tyn-y-Coed (Grade II, ref. 1562).

Bersham Conservation Area

3.31 **Description:** Bersham Conservation Area was first designated in August 1975, with its boundary later amended in 2003. It is situated approximately 2.5 miles to the south-west of Wrexham city centre, within the wooded part of the upper reaches of the Clywedog Valley, which runs from Minera to Wrexham. It is broadly linear, with its eastern reaches situated due north of Rhostyllen and its

wooded western reaches extending a little way beyond Bersham Lodge (Grade II listed, Ref: 16556). The A483 fly-over passes north-south through the centre of the Conservation Area.

3.32 A Conservation Area Appraisal and Management Plan (CAAMP) was adopted by Wrexham County Borough Council in December 2009. As detailed in the CAAMP, the Conservation Area possess four distinctive character areas: the lane from the west boundary to Mill Farm; the area of the West Ironworks Site; the East Ironworks; and Bunkers Hill and Y Ddol. However, the overall character and appearance of the Conservation Area is largely of a rural settlement that has been heavily influenced by both its industrial past and the nearby Plas Power estate. Built form within the Conservation Area demonstrates a variety of architectural styles and is generally of a high quality, with many listed buildings and structures. The remains of Wilkinson's Ironworks - which includes the Grade II* listed Octagonal Building at Bersham Ironworks Site (ref. 1586) and the Single Storeyed Building to SE of Octagonal Building at Bersham Ironworks Site (ref. 16539) – in addition to structures relating to historic water management, and workers' cottages, provide an important link to the Area's industrial past. The architectural influence of the Plas Power Estate is also evident in the Area's built form, with the Romanesque-style Church of St Mary (Grade II*, ref. 16553) (plate 2) built for the use of the Plas Power household forming a landmark building within the Conservation Area, and with a number of buildings within the Conservation Area displaying the distinctive 'estate architecture' style that indicates their origins as part of the Plas Power Estate (plate 3).

3.33 There is also a great sense of enclosure throughout the Conservation Area, with buildings, boundary walls, and mature trees closely abutting the routeways through the Conservation Area, relieved only in its central part where the Conservation Area briefly opens up to allow occasional glimpsed views of the surrounding countryside to the south. The western reaches of the Conservation Area are the mostly tightly enclosed, with the valley sides and dense woods on its north side and the hedges and mature trees to the south creating a strong sense of enclosure and shadow along the lane from the west boundary to Mill Farm (plate 4). Being well treed throughout, particularly along its boundaries, has resulted in Bersham being a discrete, visually enclosed settlement.

3.34 The CAAMP provides the following summary of the special character of the Conservation Area: '*The special character of the area has been greatly influenced by the valley landscape setting and the historical and architectural association with John Wilkinson's ironworks and the Plas Power Estate. A number of factors contribute to the special character of the area and these are now outlined below:*

- *The Iron work buildings and sites – The remains of Wilkinson's Ironworks are an important link with the area's industrial past. The old blast furnace, now known as The Mill, and the octagonal foundry are both particular landmark buildings, built of hand made bricks in contrast to other structures in the area.*
- *The numerous bridges and remains of the river weirs, sluice gates and leats – The weirs situated at various points along the River Clywedog contribute greatly to the character and distinctiveness of the area. The differing styles and varying materials used in the construction of the bridges and weirs contribute to the visual diversity of the area and assist in the integration of the built with the natural environment.*
- *The wooded valley sides and banks of the River Clywedog – Plas Power Wood is a striking landscape feature that dominates the upper part of the Conservation Area. It gives the site a feeling of enclosure and contributes to the setting of a number of buildings. It is a designated wildlife site that contains ancient woodland managed by the Woodland Trust. The Clywedog Trail runs through the wood, along the path of Wilkinson's wagon way, originally used to transport raw materials to the works from the mines in Minera.*
- *The strong architectural influence of the Plas Power Estate – Bersham Lodge, St Mary's Church, and the Estate Cottages are landmark buildings creating a strong sense of place and identity. The distinctive 'estate architecture' style, comprising sandstone walling, slate roofing, heavy cast-iron latticed windows and carved decorative barge-boards, is characteristic of the influence of the Plas Power Estate.*

- *Boundary details – Sandstone boundary walls of various types with differing capping styles are a common and distinctive feature of the Conservation Area. In particular, the high boundary wall to the Plas Power Estate dominates long stretches of the roadside. Elsewhere the walls are lower in height, creating a more open feel. There is a long stretch of historic cast iron park railings along the roadside from Bersham Lodge to the entrance to Bersham Bank. The heavily decorated railings and gates surrounding Bersham Lodge are particularly good examples. In some places, stone boundary walls are softened by natural vegetation with hedges grass verges and the absence of pavement and kerbs, creating a distinctly rural feel. The hedging consists of a variety of mixed indigenous species including hawthorn, holly, hazel, yew, and sycamore. In the Ddol area, Ruabon red engineering brick walls and cast iron railings and gates take precedence.*
- *The historic place, street and house names – Various historic place names have survived (ed. Bunkers Hill, Ballistics Bank, The Smith, Pentre Dybenni and Y Ddol).*
- *Y Ddol – A compact area of high-density buildings set into the steep valley side close to the river, creating a sense of compactness. Very characteristic of the 19th and 20th century style industrial housing using terraces, semi-engineering and red brick, slate roofs with red ridge tiles, brick boundary walls and cast iron gates.'*

3.35 **Setting and contribution of the Site:** The Conservation Area abuts the northern edge of the village of Rhostyllen to the south-east but is otherwise surrounded by agricultural land and areas of woodland. As discussed above, and in the CAAMP, the Conservation Area's landscape setting within the wooded upper reaches of the Clywedog Valley has had a formative impact on the special architectural and historic interest of the Conservation Area, in particular its historically significant contribution to the Industrial Revolution. The Conservation Area's historic connection to the Plas Power Estate, of which the Site forms a part, has also contributed to the special character of the Conservation Area.

3.36 However, whilst the agricultural land (including the Site) that now largely surrounds the Conservation Area makes a contribution to the rural character of the settlement, it makes no contribution to an appreciation of the significance of Bersham's industrial heritage. Moreover, as noted above and in the CAAMP (2009), the Conservation Area is characterised by a strong sense of enclosure and is heavily wooded/enclosed by trees. As such, there is very little intervisibility between the Conservation Area and the surrounding countryside.

3.37 As the Conservation Area lies adjacent to the Site, the Site forms part of the agricultural surroundings. It therefore makes some contribution to its character as a rural settlement. However, those parts of the Conservation Area the Site abuts are particularly well enclosed by the local topography, woodland to the north, and trees and hedgerow to the south. As such, '*there are no vistas or glimpses of distant hills, surrounding countryside of the adjacent Plas Power Estate'* (CAAMP, 2009). Nor is the Site visible when approaching the Conservation Area from the west. Moreover, available views of the Conservation Area from the Site do not take in any of the Conservation Area's built form. As such, there is no appreciation of the historic and architectural special interest of the Conservation Area, or the listed buildings that lie within the Conservation Area, from the Site. The present appearance of the Site is such that Zones C and D are not readily discernible as former parkland. The Site is not, therefore, considered to contribute to the sense of place and identify the influence of Plas Power has provided the Conservation Area. Overall, it is therefore considered that the Site presently makes only a very small positive contribution to the significance of the Conservation Area and the listed buildings within it.

Plas Power Grouping

3.38 **Description:** The Plas Power Grouping comprises five listed estate buildings situated in close proximity to the site of the former Plas Power country house (demolished 1946-7). As detailed above, the Plas Power Estate has fifteenth-century origins, but the House was remodelled in 1858 by

architect John Gibson for the then-owner Thomas Lloyd Fitzhugh. All five listed estate buildings appear to be largely contemporary with this remodelling and period of improvements to the estate. For a full description of the assets, reference should be made to their statutory listing descriptions (appendix A). During the Site walkover survey, it was apparent that, with the exception of the Stables (plate 5) which remain in use, these listed buildings are in a particularly poor state of repair, with undergrowth preventing close inspection.

3.39 **Significance:** The significance of these assets is largely derived from their historic form and fabric, and from their historic interest as surviving architectural elements of the Plas Power Estate. The assets possess historic illustrative value as mid-nineteenth century estate buildings, with the Bath House being a rare example of an architecturally conceived well-house and the Stables remaining largely intact and in their original use. The assets also possess associative value with both the Plas Power Estate and notable architect John Gibson, and evidential value as they provide evidence of the layout and form of Thomas Lloyd Fitzhugh's remodelling of the Estate. The assets possess some aesthetic value due to their high-quality design and construction; although with the exception of the Stables this has been significantly detracted from by their poor state of repair (plates 6 and 7). The assets share group value.

3.40 **Setting and contribution of the Site:** With the exception of the Stables, these assets are surrounded by the plantation that (as demonstrated above) has enclosed them since they were constructed alongside the main house in the mid-nineteenth century. Within the plantation, in addition to the assets themselves, a number of other historic features survive (albeit in dilapidated condition) such as the walled garden and pond (plate 7) and, to their south, a ha-ha (plate 8). It is considered that this immediate setting contributes positively to the assets' historic illustrative, associative and evidential values as constituent elements of Thomas Lloyd Fitzhugh's Estate, and by providing further evidence of its historic form and layout. Although, if left to further overwhelm the assets, this surrounding vegetation may put the assets' significance at risk.

3.41 The Stables lie immediately north of the plantation, just off the bottom of the steep access route from the west introduced contemporaneously by Thomas Lloyd Fitzhugh. The immediate setting of the Stables is defined by clipped hedges to the west, mid-twentieth century buildings to the north-east, and mature trees to the south-east. Some aspects of the Stables' immediate setting are considered to detract from the asset's significance, such as the adjacent mid-twentieth-century built form that detracts from an appreciation of the Stables' aesthetic value. Other elements, such as the contemporary West Drive and the plantation and the surviving historic features within, contribute positively to the Stables' significance. This is because they help to place the asset within its historic setting, thereby providing historic illustrative and evidential value. They also share group value with the asset as constituent parts of the Plas Power Estate as remodelled in the mid-nineteenth century.

3.42 The wider setting of the assets comprises agricultural land to the north-west, north-east and south-east, much of which lies within the Site, interspersed with tree belts. Much of this agricultural land, including the Site, shares an historic functional connection to the assets as part of the Plas Power Estate. Zones B, C and D of the Site historically formed part of the parkland surrounding Plas Power and the assets. When approaching the assets from the west, having passed through the listed walls, railings and gates, and past Rhosberse entrance lodge (assessed below), there is some appreciation of the historic functional connection between the assets and parts of the Site visible from this approach. However, on the whole, the current appearance of this agricultural land means it is not readily discernible as historic parkland. Furthermore, there is no intervisibility between the assets and Zones A and D, or all but the south-westernmost part of Zone B. Due to its position to the north of the plantation, there is intervisibility between Zone B and the Stables. However, the other assets are almost entirely enclosed by plantation and have little to no intervisibility with Zone C. Overall, the assets' wider setting, of which the Site forms a part, is considered to make only a low-moderate contribution to the significance of the assets. This contribution is secondary to the contribution made by the assets' immediate setting and their historic form and fabric.

Walls, railings, gates and entrance lodge to Plas Power Park

3.43 **Description**: The walls with cottage, railings, gates, and Rhosberse Lodge are Grade II listed assets broadly contemporary to the remodelling of Plas Power in 1848 by the then-owner Thomas Lloyd Fitzhugh, and are all associated with his enclosure of the Parkland around this time too. As with much of the mid-nineteenth century work at Plas Power, these assets, situated along Rhosberse Road, are examples of the Picturesque style of architecture. For a full description of the assets, reference should be made to their statutory listing descriptions (appendix A) (see also plates 9 and 10).

3.44 **Significance**: The significance of these assets is largely derived from their historic form and fabric, and from their historic interest as surviving architectural elements of the Plas Power Estate. The assets possess historic illustrative value and aesthetic value as fine examples of estate architecture adopting the Picturesque architectural style, in particular the striking boundary wall. The assets provide evidence of Lloyd Fitzhugh's ambitions to extensively remodel the Plas Power Estate in the mid-nineteenth century. They also possess associative value with the Estate, and share group value with each other and with other surviving elements of Lloyd Fitzhugh's works (such as the Plas Power Grouping assessed above).

3.45 **Setting and contribution of the Site**: The assets are situated along Rhosberse Road, forming the western boundary of the former area of parkland at Plas Power. This setting makes an important contribution to the significance of the assets, as they were originally constructed to enclose this parkland, and were intended to be experienced when passing along Rhosberse Road. It remains the case that the historic illustrative and aesthetic values of these assets as structures in the Picturesque style can be mostly readily appreciated passing along Rhosberse Road. However, the appearance of this this former parkland, of which Zones B, C and D of the Site are comprised, has undergone great change. Its present appearance is as parcels of agricultural land rather than as parkland, and this detracts from the ability to understand the assets as having been built to enclose an estate parkland. Indeed, the ability to recognise them as part of a country estate is largely derived from their highly distinctive architectural form and style, rather than the character and appearance of the surrounding landscape. Although, a number of specimen trees adjacent to the listed Wall and within the plantation surrounding the Plas Power Grouping provide some indication of this as former parkland. Overall, it is considered that the Site - and in particular Zones B, C and D as former parkland - makes a low-moderate positive contribution to the significance of the assets.

Higher Berse Farmhouse (Grade II, ref. 16457)

3.46 **Description**: Higher Berse Farmhouse is a fine example of an early-nineteenth century farmhouse retaining much of its original fabric and design. It was built in 1814 on the site of an earlier farmhouse that was purchased and immediately demolished by the Plas Power Estate. The asset appears to be largely constructed of roughly coursed and squared rubble stone, although the main front is tooled ashlar. It is arranged over two storeys, with a double pile plan under a hipped slate roof with bold overhanging eaves and three stacks. The front (south) elevation is of three bays, with a full-height recessed central arch in which the doorway is set. The building's fenestration is of a mixture of sizes and styles. There is a recent single-storey rear extension under a hipped slate roof to the rear of the property. The interior of the building was not inspected, but the listing description (Appendix A) notes the building retains much of its original interior detailing.

3.47 **Significance**: The significance of Higher Berse Farmhouse is as an early-nineteenth century gentry farmhouse retaining a relatively high degree of integrity. The asset possesses historic illustrative value as a substantial farmhouse of some status, typical of a period when many landowners were undertaking agricultural 'improvement'. Its surviving original interior features likely illustrate tastes in décor in this period also. The asset's pleasing design and architectural detailing provides the asset with aesthetic value, and the asset may possess some evidential value as further investigation may reveal more about the previous farmhouse that stood on the site.

3.48 **Setting and contribution of the Site**: The immediate setting of Higher Berse Farmhouse comprises the sizeable garden plot in which it is situated and the former farmyard to the east. This immediate setting makes a positive contribution to the significance of the listed building, contributing to its aesthetic value in reinforcing its domestic character as a residence of some status. This garden plot appears in historic mapping to have long been well-planted. Some of the current structures within the area of the former farmyard appear to be of some age, potentially contemporary to the Farmhouse, sharing an historic functional connection to the asset. Although, the legibility of the relationship between these former outbuildings and the Farmhouse has been somewhat eroded by their conversion to residential use.

3.49 Return views from the field immediately south of the farmhouse take in the southern (front) elevation of the asset, in conjunction with the adjacent former agricultural buildings. These views allow for an experience of the asset's aesthetic and historic illustrative values and significance as the centrepiece of a nineteenth-century farmstead.

3.50 The wider setting of the asset can be considered to include the surrounding open fields, which include Zone A approximately 350m to the west. This agricultural land helps to place the asset in its historic rural context, making a positive contribution to its historic illustrative value and significance. However, as illustrated in the 1899 Estate Map, Zone A is not a part of Higher Berse Farm's historic landholding. This part of the Site therefore has a very slight historic functional connection to the asset. The raised twentieth-century reservoir to the south-west of the asset, which adjoins the primary approach to the asset from the south, has also partly eroded the rural character of the assets' wider setting.

3.51 The remainder of the Site possesses a similarly loose functional connection to the asset, both having once been part of the historic Plas Power Estate. It forms part of the extended rural setting of the asset, but there is no intervisibility or sequential views of the asset and Zones B, C and D. Due to the rising topography to the west, there are some views of the asset from within Zone A, but these views take in only the roof and chimneys of the asset which provides a very limited appreciation of the historic and architectural significance of the asset. Overall, the remainder of the Site is considered to make only a negligible positive contribution to the significance of the asset and the ability to appreciate that significance.

Tyn-y-Coed (Grade II, ref. 1562)

3.52 **Description**: Tyn-y-Coed is an example of a mid-eighteenth century dwelling house that appears to represent a single phase of building, albeit with some twentieth-century alterations to the exterior. It is constructed of brown brick with a slate roof, coped gables, and multi-pot end stacks. The rear of the building has been rendered and painted. The asset is arranged over three storeys with its primary front (being of three bays with a central entranceway). The asset's fenestration is original, but the windows themselves are modern.

3.53 **Significance:** The listed description for the asset notes that its significance and reason for designation is as '*a significant survivor of a mid C18th house in this area, notwithstanding extensive alteration to exterior detail*'. The asset possesses historic illustrative and evidential values as a substantial mid-eighteenth-century farmhouse, demonstrating local design practices and vernacular materials employed at this time. Its materials and architectural detailing also provide the asset with some aesthetic value, notwithstanding the modern alterations that detract somewhat from its appearance.

3.54 **Setting and contribution of the Site**: The immediate setting of the asset is defined to the north by a collection of agricultural outbuildings arranged around a former yard. The present use of these outbuildings is not clear, but a number of them appear to be of some age. This aspect of the asset's immediate setting helps to place the asset in its historic and functional context, contributing to its historic illustrative value as an historic farmhouse. To the south, east and west, the asset's immediate setting comprises a well-treed garden plot and areas of hardstanding surrounded by a

random rubblestone wall approximately 1.8m in height. The well-treed garden plot garden in which the asset is situated reinforces the domestic character of the asset and contributes positively to the aesthetic value of the asset. Conversely, the sizeable areas of hardstanding are considered unsympathetic and detract slightly from the ability to appreciate the asset's aesthetic value.

3.55 The asset is situated on the eastern edge of Coedpoeth and its wider setting is varied both in its character and the contribution it makes to the asset's significance. To the east, this wider setting comprises agricultural land, hedgerows and some isolated developments such as Adwy Grange, which on the whole helps to place the asset in its historic rural setting, contributing to its historic illustrative value as an historic farmhouse. However, to the west, the asset's wider setting comprises Post-War residential development, the suburban character and appearance of which detracts from the above.

3.56 The Site is considered to contribute positively to the significance of the asset insofar as Zone A forms part of the asset's wider rural setting. It is experienced as such when approaching the asset from the east along Tan Llan (plate 11), and the elevated westernmost parts of Zone A are also likely to be visible in the long-distance eastward views available from the asset due to its elevated position and orientation. Available return views of the asset from the Site are, however, distant and partial and therefore provide little meaningful appreciation of the significance of the asset. Overall, it is considered that the Site, and specifically Zone A, makes a minor positive contribution to the significance of the asset as part of its rural setting.

4 PROPOSALS AND POTENTIAL IMPACTS

Proposed Development

4.1 The proposals are for the development of the Site as a solar farm with Battery Energy Storage System (BESS) and associated infrastructure of access roads, transformers, cable trenches, lighting and security fencing.

Potential Impacts

4.2 The Proposed Development will have no direct impacts on any identified built heritage assets. All impacts will arise as a result of change within the respective settings of the heritage assets.

Bersham Conservation Area

4.3 The Proposed Development will result in change in the setting of the Conservation Area, insofar as it will be visible at short range from the Conservation Area's northern fringes. This will erode the currently rural character of the Conservation Area's surroundings. The affected views, however, make a negligible contribution to the Conservation Area. Indeed, the CAAMP notes '*there are no vistas or glimpses of distant hills, surrounding countryside of the adjacent Plas Power Estate'* (CAAMP, 2009). Nor are there any views of the Conservation Area and the assets within it from the land their south that contribute to their significance. It is concluded that the Proposed Development will result in a neutral change in the setting of the Conservation Area and no change in the setting of the assets within it. It is concluded that there will be no impact.

Plas Power Grouping

4.4 This group of listed buildings is largely enclosed by plantation. Consequently, the only parts of the Proposed Development will be visible are the southernmost part of Zone B, from The Stables (ref. 16452), and parts of Zone C, from the Game Larder (1737) and Dairy (1738). Views from the Game Larder and Dairy are filtered through trees, whilst the solar arrays have been pulled back from the Stables up the slope to their north to minimise visual impact.

4.5 As a part of the Plas Power Estate, the agricultural surroundings of these assets, including the Site, are historically connected with them. However, these fields are no longer readily discernible as parkland and consequently make only a low to moderate contribution to their significance. Owing to the very limited intervisibility between The Stables and the Site, it is considered that the Proposed Development will have a negligible impact upon this grouping.

Walls, railings, gates and entrance lodge to Plas Power Park

4.6 This group of Listed Buildings lies approximately 500m to the west of the Site. The ZTV demonstrates that the Proposed Development will not be visible from the lodge (ref. 1740), gates (ref 16454) and southern wall (ref. 16456). However, the Proposed Development will be visible from the northern wall and Park Cottage (ref. 16455). The Site and these assets are components of the Plas Power Estate and hence historically linked, but the affected views make minimal contribution to their significance as the Site retains little of its historic parkland character. It is concluded that the Proposed Development will have a negligible impact upon this grouping.

Higher Berse Farmhouse (Grade II, ref. 16457)

4.7 The Proposed Development will result in slight change to the wider setting of Higher Berse Farmhouse appearing in incidental views to the south and south-west at a minimum distance of approximately 470m. It will be seen filtered through trees in the foreground and middle distance. The affected views make a minimal contribution to the house's significance and the change will be

slight. It is concluded that the Proposed Development will have a negligible impact upon the farmhouse.

Tyn-y-Coed (Grade II, ref. 1562)

4.8 The ZTV indicates that the Proposed Development will be visible from the farmhouse at a distance of approximately 130m. However, trees immediately adjacent to the farmhouse largely screen the Site from view. There is potential that the solar arrays will be glimpsed from the upper storeys of the house. These views make a minimal contribution to the farmhouse's significance and it is concluded that the Proposed Development will have a negligible impact upon the farmhouse.

5 CONCLUSION

5.1 This Built Heritage Statement has been prepared by RPS on behalf of Lightsource bp. It addresses built heritage considerations in relation to the development of a solar farm and Battery Energy Storage System (BESS) on land at Plas Power, Wrexham.

5.2 The assessment provides a description of the built heritage assets potentially affected by the development and addresses the information requirements of Government's Planning Policy Wales and the Council's Local Development Plan in relation to built heritage.

5.3 The impact of the development on archaeological heritage assets and the archaeological potential of the site is considered separately in the accompanying Archaeological Desk-Based Assessment (RPS, 2023).

5.4 There are no designated or non-designated built heritage assets located within the site. Located within the study area are 287 Listed Buildings, six Conservation Areas and two Registered Parks and Gardens.

5.5 Following a Stage 1 assessment, informed by a Zone of theoretical Visibility (ZTV) and site visits, to identify those assets that might be affected, the following have been taken through to assessment:

- Bersham Conservation Area and listed buildings within;
- Plas Power Grouping - comprising the Ice House (Grade II, ref. 1793), Stable Block (Grade II, ref. 16452), Bath House (Grade II, ref.16453), Game Larder (Grade II, ref. 1737), and Dairy (Grade II, ref. 1738);
- Walls, railings, gates and entrance lodge to Plas Power Park – comprising the Walls to Plas Power Park including Park Cottage (Grade II, ref. 16455), Wall to Plas Power Park SW of Rhosberse Lodge (Grade II, ref. 16456), Rhosberse Lodge at Entrance to West drive at Plas Power (Grade II, ref. 1740), and Railings and Gates to West Entrance Drive at Plas Power (Grade II, ref. 16454);
- Higher Berse Farmhouse (Grade II, ref. 16457); and
- Tyn-y-Coed (Grade II, ref. 1562).

5.6 In all cases it is considered that the Proposed Development will have a negligible impact upon the assets taken through to assessment. It is not considered that the impact of the proposals will be '*critically damaging'* to any listed building or conservation area vista and, as such, the proposals should be supported.

PLATES

Plate 1: Octagonal Building, Bersham (Grade II*, ref.1568)

Plate 2: St Marys Church, Bersham (Grade II*, ref.1170764)

Plate 3: Bersham Lodge (Grade II, ref.16556), illustrates the influence of Plas Power and its 'estate architecture' on the Conservation Area

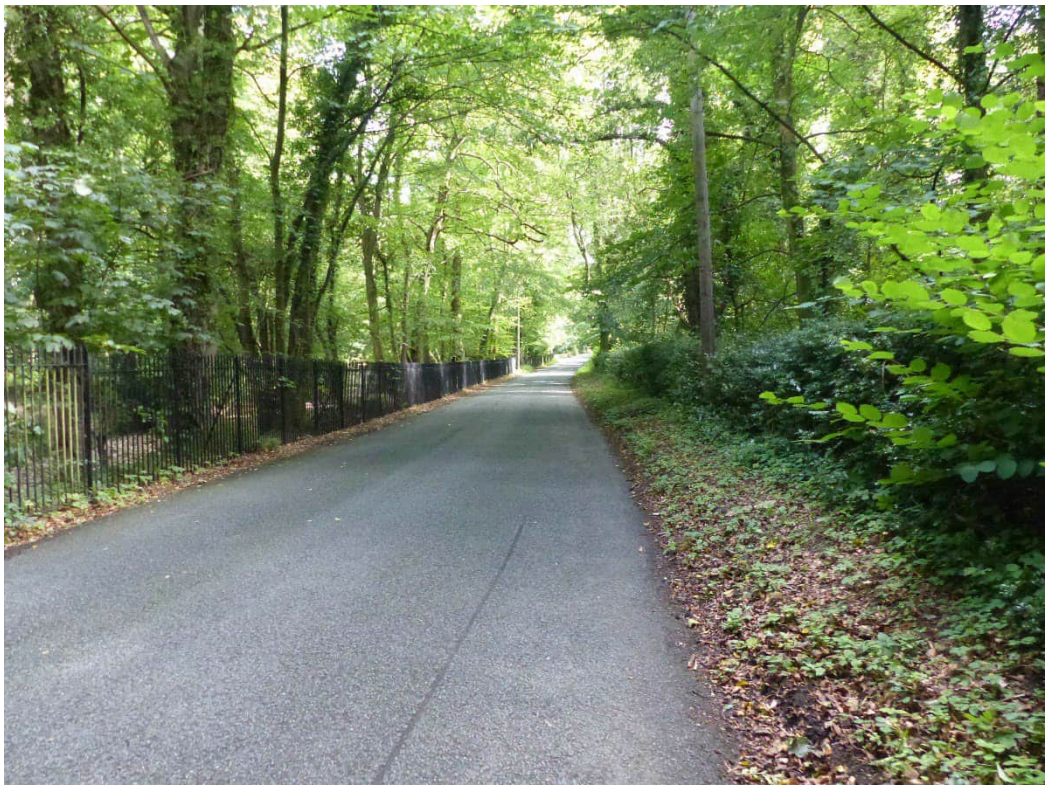


Plate 4: Trees forming a strong sense of enclosure in the west of the Conservation Area

Plate 5: Stables (Grade II, ref.16452) at Plas Power remain in their original use

Plate 6: Dairy (Grade II, ref. 1738) at Plas Power, in poor condition and threatened by undergrowth

Plate 7: Walled Garden at Plas Power, in very poor condition but sharing group value with the listed assets

Plate 8: Ha-ha to the south of Plas Power grouping (outside Application Site)

Plate 9: Rhosberse Lodge (Grade II, ref. 1740) and Railings and Gates to West Entrance Drive at Plas Power (Grade II, ref. 16454)

Plate 10: Wall to Plas Power Park SW of Rhosberse Lodge (Grade II, re.16456)

Plate 11: Distant view of Tyn-y-Coed across Zone A from Tan Llan

APPENDICES

Appendix A

Statutory Listing Descriptions

Ice-House at Plas Power

Grade II

Ref. 1739

Designated 30/01/1992 (amended 26/10/1995)

Remotely sited, set into a man-made bank on the edge of woodland close to Offa's Dyke; to NW of site of Plas Power house and to E of Garden Cottages.

Circular, red brick structure with conical slate roof. N (upper) side has large, gable ended porch with coursed rubble base; the change to brickwork probably indicates later enlargement. Stone lintel over outer entrance to steps down to ice chamber.

Domed and brick lined ice chamber with round-headed entrance arch that slopes and curves inwards resulting in complex brickwork; stone sill. Either side of this are concave recesses.

Listed as a rare example of an intact ice house and for its special interest as a surviving estate building at Plas Power.

Stable Block at Plas Power

Grade II

Ref. 16452

Designated 26/10/1995

Plas Power Estate lies NW of Bersham and SE of Coedpoeth; the stables are near the southern end of the park and reached 1km along N drive off A525. They lie immediately to the NW of the drive.

Brick with stone dressings and slate roof carried forward on moulded timber eaves cornice. The stables are built as 3 sides of a blue-brick lined courtyard, with a small rear wing offset to the NW housing domestic accomodation above tack rooms etc. Main range facing courtyard entrance articulated as 5 bays with segmental arches on plain brick pilasters with stone impost band. Outer arches have glazed tympana; central doorway has entablature carried on brackets. Advanced ranges to either side are similarly articulated, but with narrow outer bays housing doorways with overlights at either end, and wider segmental arches to centre. In the right-hand range, one of these arches is blind, and the other has double doors with glazed overlight; in the left hand range, both arches have full-height doors into the head of the arch.

Original fittings survive in stabling in main range: hexagonal tiled walls, with lined-out stucco above, boarded and iron railed stall dividers, and blue brick flooring. Loose boxes in right hand range; left hand range open, probably as coach house.

Listed as a well-detailed architecturally designed stable range which retains its original character intact, and for its special interest as a surviving estate building at Plas Power.

Bath House in Plas Power

Grade II

Ref. 16453

Designated 26/10/1995

In woodland immediately S of the stables in Plas Power Park.

Plas Power was completely remodelled by John Gibson, architect, for Thomas Lloyd Fitzhugh in 1858, and many ancillary buildings in the park were remodelled or newly built at that time. It is likely that the Bath House is contemporary. The building is said to have been used as a shower house in association with the adjacent hunting stables, but may have been built as a well house.

Small circular structure; coursed and squared stone with shallow domed roof recessed behind rusticated embattled parapet. Ogee headed doorway facing S, with cast-iron barred gate, and segmentally arched window towards E.

The building is lined with quartzite in the manner of agrotto. It contains a cast-iron pump.

Listed as a rare example of an architecturally conceived well-house, which has group value with other structures in the park at Plas Power.

Game Larder at Plas Power

Grade II

Ref. 1737

Designated 30/01/1992

Amended 26/10/1995

Immediately to SW of the site of Plas Power house, adjoining brick wall that formerly bordered the service courtyard.

Plas Power estate lies NW of Bersham and SE of Coedpoeth; the game larder is near the southern end of the park and is reached 1km along the N drive off A425. Close to Offa's Dyke. Plas Power was completely remodelled in 1858 for Thomas Lloyd Fitzhugh by John Gibson, architect, of London and was demolished in 1946-7. The Game Larder is contemporary with this remodelling and the associated improvements to the estate and is shown on a plan of 1866.

Octagonal red brick structure with hammer dressed, long and short sandstone quoins. Unusually steep slate roof with bands of shaped slates and very wide overhanging eaves carried on arched timber brackets springing from stone corbels; timber finial to top. Rectangular windows concealed under the eaves with freestone architraves, metal bars and gauze. Panelled door. Internally the walls are diagonally tiled below the windows with blue and white band to the top.

Listed as a good example of this building type and for its special interest as a surviving building associated with Plas Power. Group value with the Dairy at Plas Power.

Dairy at Plas Power

Grade II

Ref. 1738

Designated 30/01/1992

Amended 26/10/1995

To W of and uphill from the Game Larder whcih adjoins the site ofof Plas Power house; close to the SE corner of the walled garden.

Single-storey red brick building with hipped slate roof and wide overhanging eaves. The design is distinctive for its heavily tooled sandstone dressings, similar in style to those on the game larder but more extensive, including quoins, architraves and linking bands at sill and eaves level. 3-bay symmetrical front with rectangular windows and central entrance. Taller window on left hand end with inward opening casements; gauze to other windows; similar window treatment to rear with cut down chimney stack.

Central lobby opens onto 2 large rooms; that to right is lined with blue and white glazed tiles laid diagonally and enriched by Greek fret pattern banding; tiled floor and slate slab shelves carried on brackets. Small fireplace to left hand part.

Listed for its special interest as a surviving estate building at Plas Power. Group value with the Game Larder at Plas Power.

Wall to Plas Power Park SW of Rhosberse Lodge

Grade II

Ref. 16456

Designated 26/10/1995

Forms part of the western boundary to Plas Power Park, from closeto Nant Bridge to Rhosberse Lodge on Rhosberse Road.

Plas Power was completely remodelled in 1858 for Thomas Lloyd Fitzhugh, by John Gibson, architect, of London. The reconstruction of the house formed part of an extensive programme of improvement and rebuilding on the estate, and the wall was erected c1860 as part of this programme.

Rusticated rock-faced rubble with rustic projecting castellations, varying in height.

Included as an integral part of the mid C19 landscaping of Plas Power Park, and as an excellent example of the Picturesque style adopted in various interpretations for most of the mid C19 work at Plas Power.

Wall to Plas Power Park including Park Cottage

Grade II

Ref. 16455

Designated 26/10/1995

Forms the western boundary to Plas Power Park, parallel with Rhosberse Road from its junction with the A525 at Coedpoeth to Rhosberse Lodge on Rhosberse Road.

Plas Power was completely remodelled in 1858 for Thomas Lloyd Fitzhugh, by John Gibson, architect, of London. The reconstruction of the house formed part of an extensive programme of improvement and rebuilding on the estate, and the wall was erected c1860 as part of this programme.

Rusticated rock-faced rubble with rustic projecting castellations, varying in height and incorporating two minor entrances into the park. Park Cottage pre-dates the wall and is probably early C19: coursed and squared stone with slate roof: 2 storeys, 2-unit plan with central entrance, and rear wing parallel to the road. Fenestration renewed, mainly in original openings.

The wall is included as an integral part of the mid C19 landscaping of Plas Power Park, and as an excellent example of the Picturesque style adopted in various interpretations for mostof the mid C19 work at Plas Power. Park Cottage is included for its group value with the wall.

Rhosberse Lodge at Entrance to West Drive at Plas Power

Grade II

Ref. 1740

Designated: 30/01/1992

Amended 26/10/1995

On the western boundary of the Plas Power Estate; set back from Rhosberse Road, approximately 0.75km S of A525 near Coedpoeth.

The Lodge lies on the N side of the drive beyond the iron railings and gates that close the drive entrance and is attached to the stone boundary wall of the park. Plas Power was completely remodelled

in 1858 for Thomas Lloyd Fitzhugh by John Gibson, architect, of London, and was demolished in 1946-7. Rhosberse Lodge is contemporary with this remodelling and the associated improvements to the estate, and is therefore believed to be by the same architect.

Picturesque Tudor Gothic style, single storey L-plan lodge of consciously random rubble construction with plinth. Slate roofs with fishscale bands and cresting; crenellated stone chimney stacks. Gables to each elevation with distinctive undulating bargeboards further ornamented by dentilling and pendants and finials. Fine, diamond-paned, mullioned and transomed windows, 3-light to front gable and 2-light set back to left.

Listed as a well preserved lodge to Plas Power, which is a good example of the Picturesque style favoured in the mid C19 improvements to the estate.

Railings and Gates to West Entrance Drive at Plas Power

Grade II

Ref: 16454

Designated 30/01/1992

Amended 26/10/1995

On the western boundary of the Plas Power Estate; set back from Rhosberse Road, approximately 0.75km S of A525 near Coedpoeth.

The iron railings flank the gates that close the drive entrance, and are attached to Rhos Berse Lodge on one side, and the boundary wall of the park on the other. Plas Power was completely remodelled in 1858 for Thomas Lloyd Fitzhugh by John Gibson, architect, of London, and was demolished in 1946-7. Rhosberse Lodge with the associated entrance gates and railings are contemporary with this remodelling and the associated improvements to the estate, and are therefore believed to be by the same architect.

Iron railings with spearhead finials flank central gates hung from square, openwork, piers with Gothic arches and scrolled and finialed caps.

Listed as a well preserved entrance feature to Plas Power, part of a group with Rhosberse Lodge and the boundary wall to the park, and a good example of decorative cast-iron work.

Higher Berse Farmhouse

Grade II

Ref. 16457

Designated 20/10/1995

Higher Berse Road runs to the N of and parallel to the A525 on the E side of Coedpoeth; the farm is towards the E of the community, close to New Broughton.

The house is dated on rainwater heads 1815 and appears to be entirely of this date. There had been a house here since at least the mid C15 (owned by the Puleston family, and subsequently by the Drelincourts of Berse Drelincort), but it was acquired by the Plas Power estate in 1814, and immediately rebuilt. The initials on the rainwater heads may be those of Thomas Fitzhugh.

Main front is tooled ashlar, the rest roughly coursed and squared rubble; hipped slate roof with bold overhang to eaves, brick end wall and rear stacks. 2 storeys, deep pile plan, with 3 window entrance front facing S. This has full-height recessed central arch housing doorway in reeded pedimented architrave, with interlace fanlight to 6-panelled door. Above it is a wide 12-pane sash window with cambered stone lintel. Similar windows in the outer bays have wedge lintels. Ground floor windows are 6-pane sashes. Return elevation to W has casement windows of 2 and 3-lights set towards rear of first floor; doorway and 3-light small-paned mullioned and transomed window towards rear. Rear elevation has central doorway with y-traceried window over it, in tall round-arched architrave. E return has 3-light small-paned mullioned and transomed windows.

Central entrance hall with principle rooms facing S. The hall is divided by a wide segemental archway with radial fanlight over door in moulded architrave, with the staircase set to the rear of the house. The house retains much of its contemporary detail, with plaster ceiling cornices and joinery including plain spindle stair with scrolled tread-ends, panelled doors and window shutters.

Listed due to being A fine example of an early C19 gentry farmhouse, retaining a high degree of integrity.

Tyn-y-Coed

Grade II

Ref. 1562

Designated: 07/06/1963

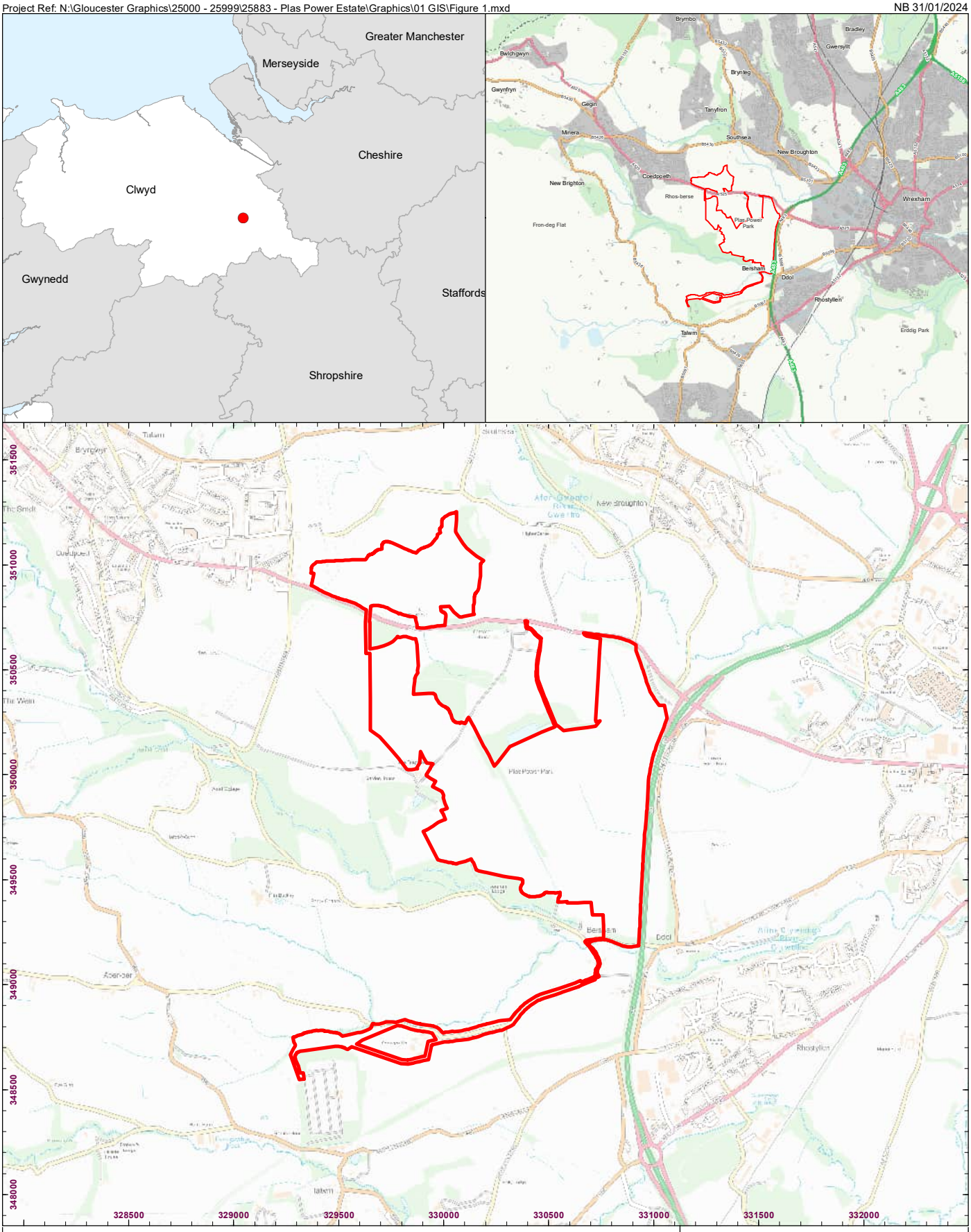
Amended: 26/10/1995

On the E side of Coedpoeth, the house is approached from the lanelane that leaves Heol Offa immediately N of its junction with New Road, 200m approx. N of the junction with the A525.The house is built on or adjacent to the line of Offa's Dyke.

The house is dated 1758 (the recorded date-stone was obscured at time of inspection, July 1995) and appears to represent a single building phase. Much of the exterior detail however, has been renewed in the C20. Inscribed datestone with the name 'Elizabeth Price'.

Brown brick with slate roof and coped gables with moulded kneelers. 3 storeys, 3-window range with central entrance. Original detail of doorcase now obscured by added timber gabled porch. Windows all renewed in original openings (but previously flush-framed casements), with steep cambered brick heads.

FIGURES



Site Boundary

N

0 260 520 780m

Scale at A4: 1:25,000

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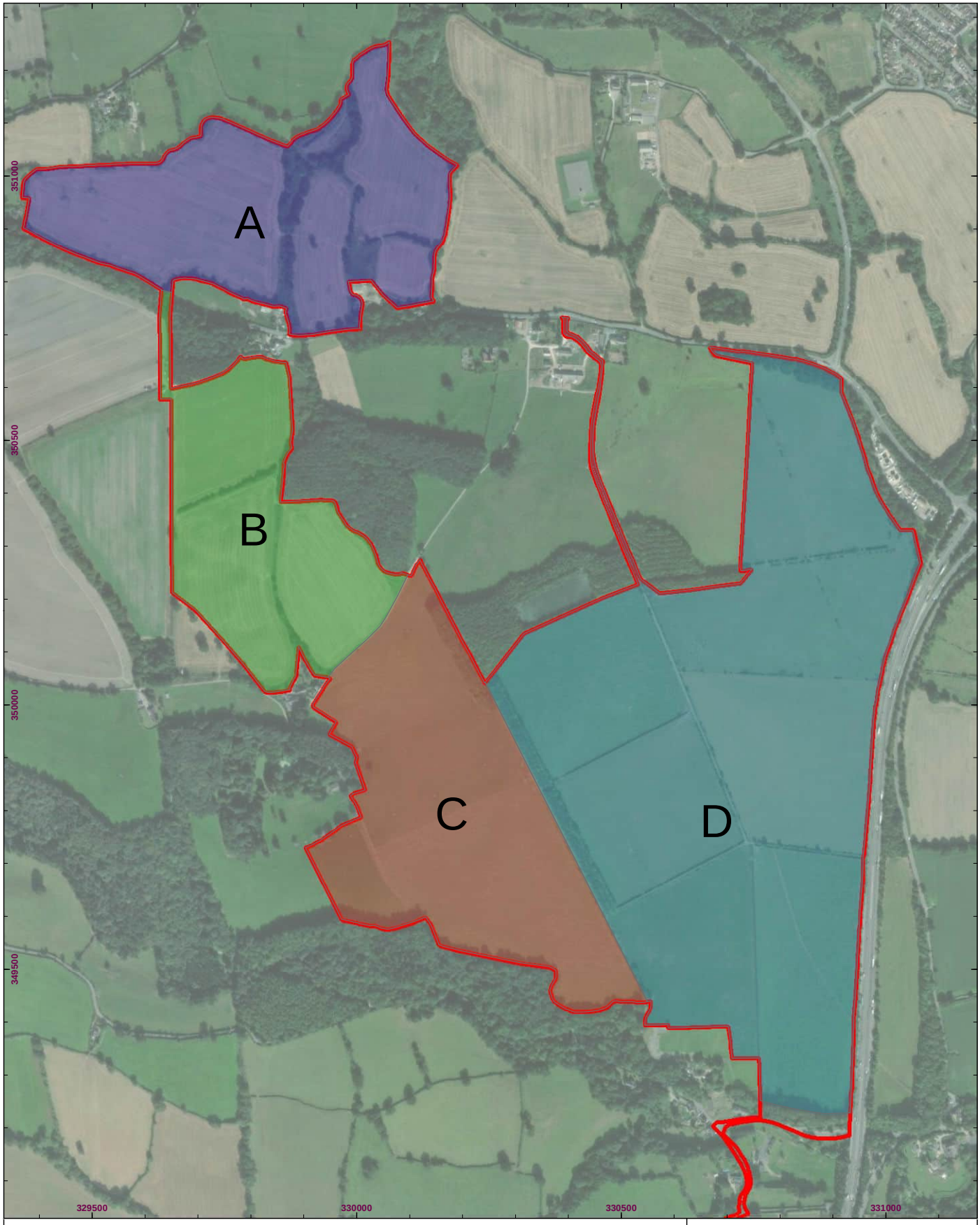
Figure 1a

Site Location



Site Boundary

N

0 100 200 300m

Scale at A4: 1:10,000

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Figure 2

Division of the Site into Zones A-D

NB 09/02/2024

Legend

- Site Boundary
- 3km search radius
- Conservation Areas
- Registered Parks and Gardens

Listed Buildings

- Grade I
- Grade II*
- Grade II

Low Visibility (up to 1 origin point)

High Visibility (up to 19 origin points)

Minera CA
9355
16457
1562
Grosvenor Road, Wrexham CA
16455
1740, 16454 & 16456
Wrexham Town CA
1762
16452
1739
16453
1738
1737
16558
16556-7
16554-5
16553
1560
1720
Salisbury Park CA
Fairy Road CA
16560
Bersham CA
16552
16561
16540-1, 16546-7 & 16549-50
PGW(C)67(WRE) Wrexham Cemetery
PGW(C)62(WRE) Erddig
1533

N

0 250 500 1,000 1,500m

Scale at A3: 1:35,000

Notes:

ZTV compiled assuming observer height as 1.7 m at eye level, and takes into account screening effects of local settlements at 9m and existing vegetation / woodland at a height of 10m.
24 origin points, from within the Application Site, have been used to illustrate the full parameters of the proposed development. Including:

- 23 origin points (in total), set at 3m above existing ground level (EGL), within the centre of each of the fields of the Application Site containing solar panels; and,
- 1 origin point, set at 3 m EGL, at the approxmate highest point within the Application Site.

OS Terrain 5 data has been used for generating the ground model.

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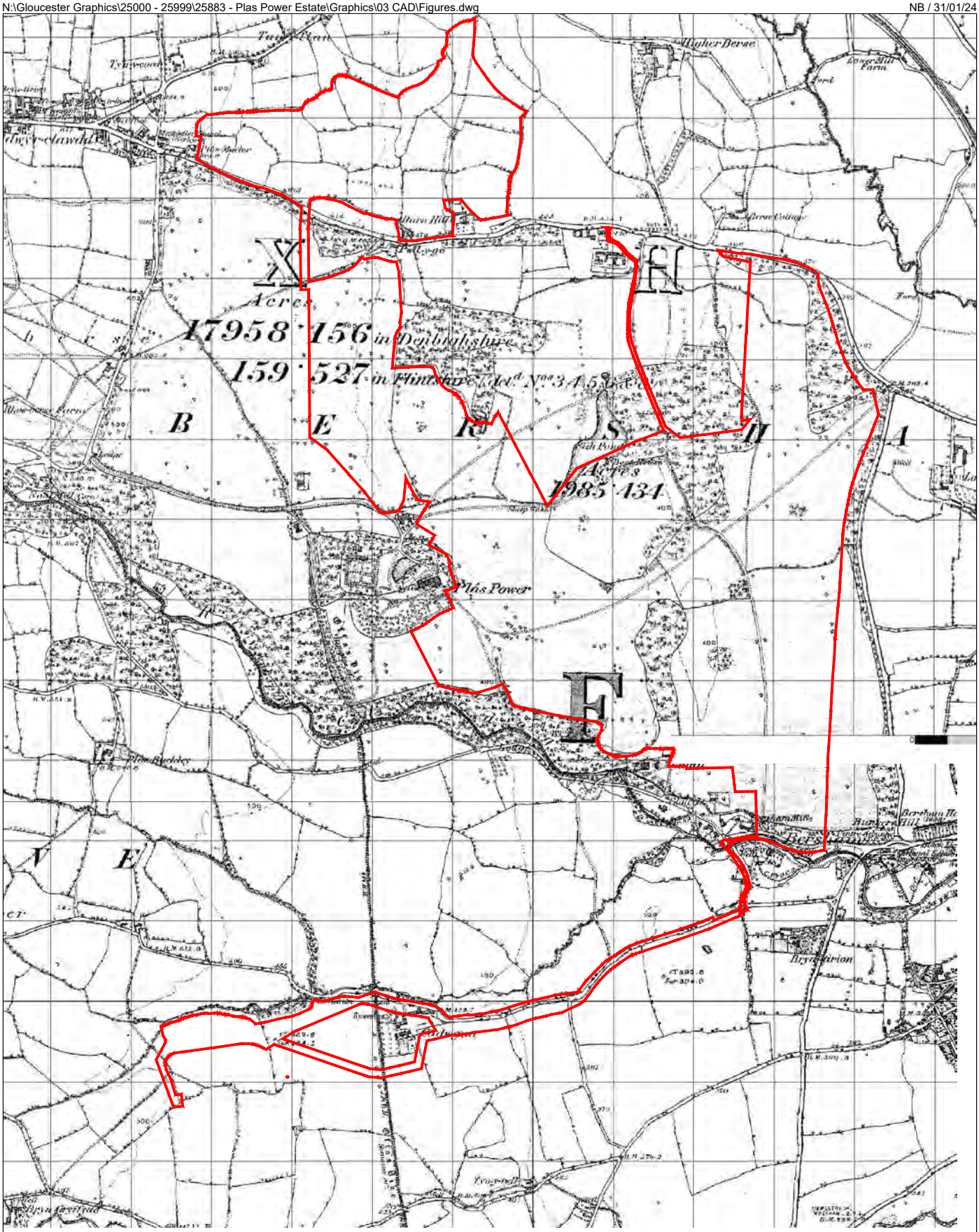
Figure 3

Designated Heritage Assets and the Zone of Theoretical Visibility

Project Ref: C:\Users\richard.conolly\OneDrive - RPS Group PLC\25883 - Plas Power Estate\Graphics\01 GIS\25833 Plas Power BHS fig 3_Feb24.mxd



Site Boundary

N

Not to Scale
Illustrative Only

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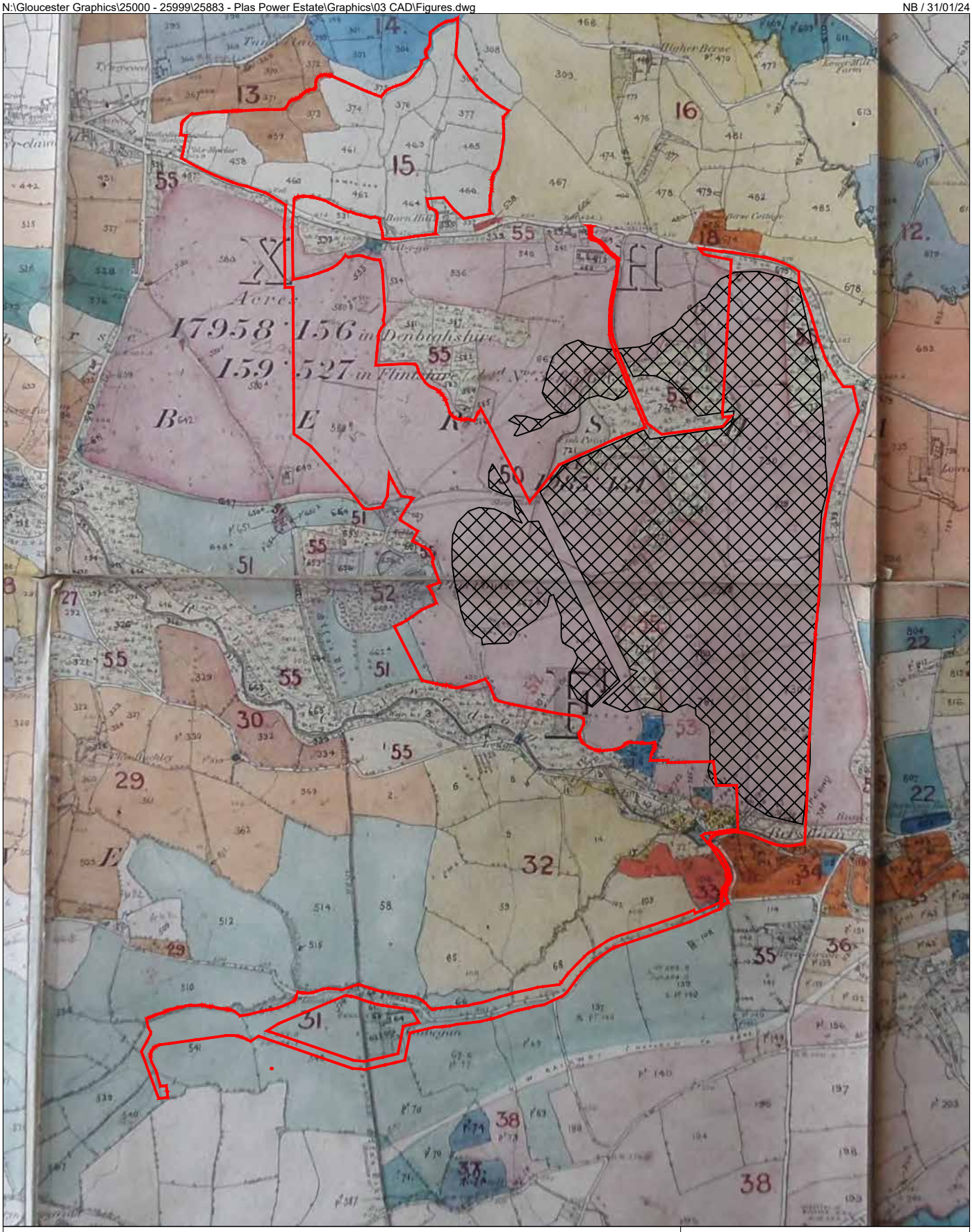
Figure 4

1879 Ordnance Survey Map



Site Boundary

N

Not to Scale
Illustrative Only

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Figure 5

1899 Plas Power Estate Map

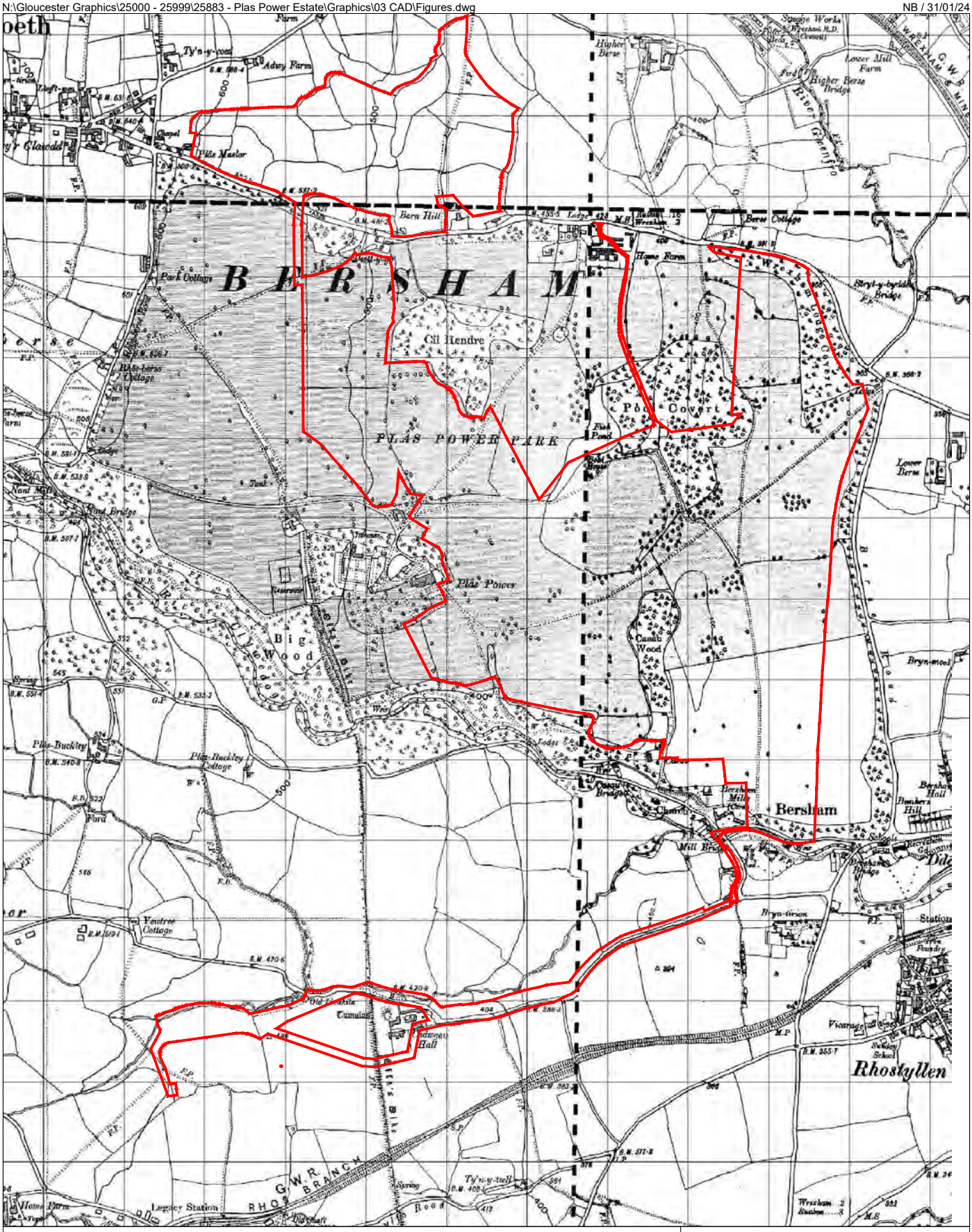

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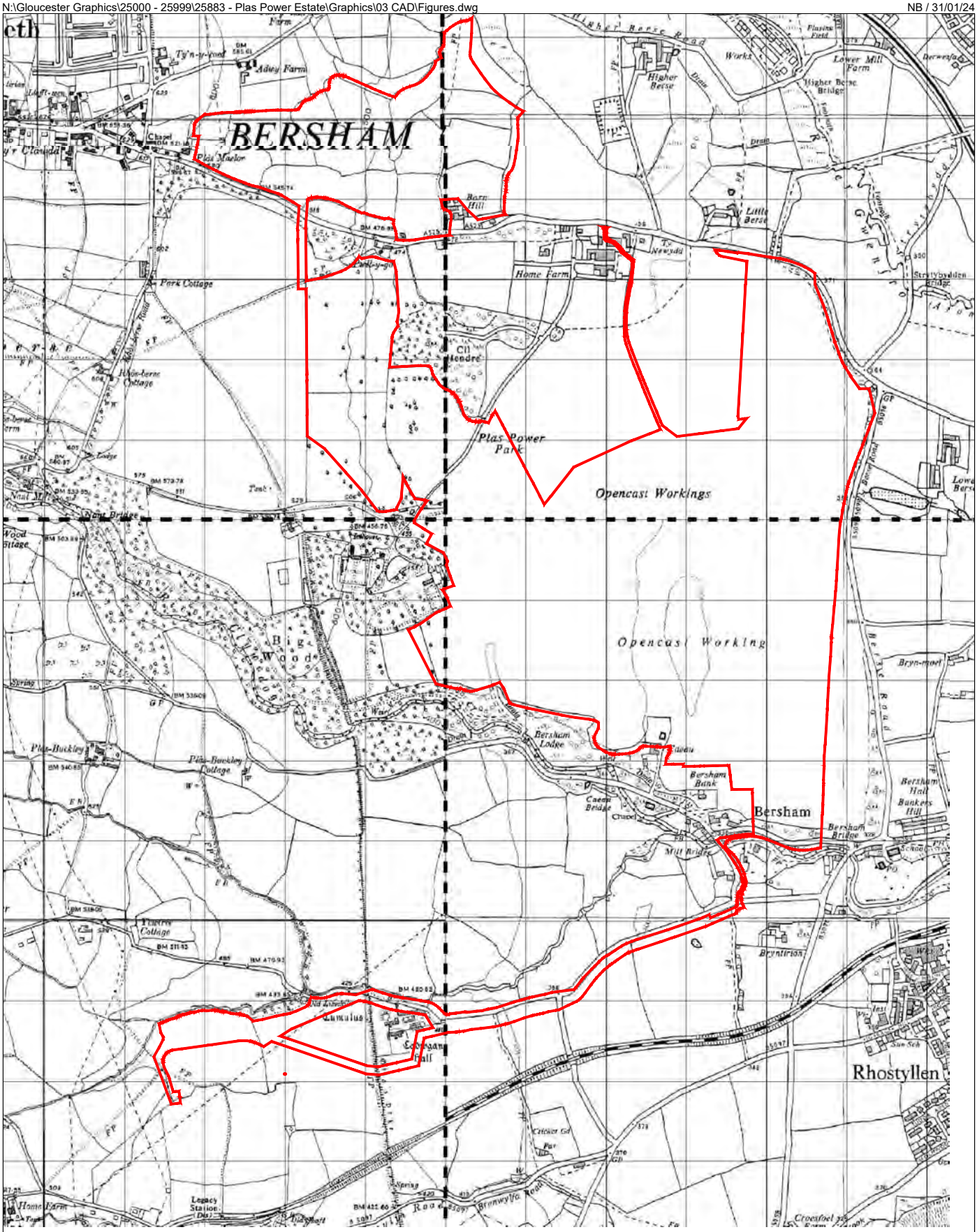
Figure 6

1938 Ordnance Survey Map



Site Boundary

N

Not to Scale
Illustrative Only

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Figure 7

1963-1964 Ordnance Survey Map

Site Boundary

N

Not to Scale
Illustrative Only

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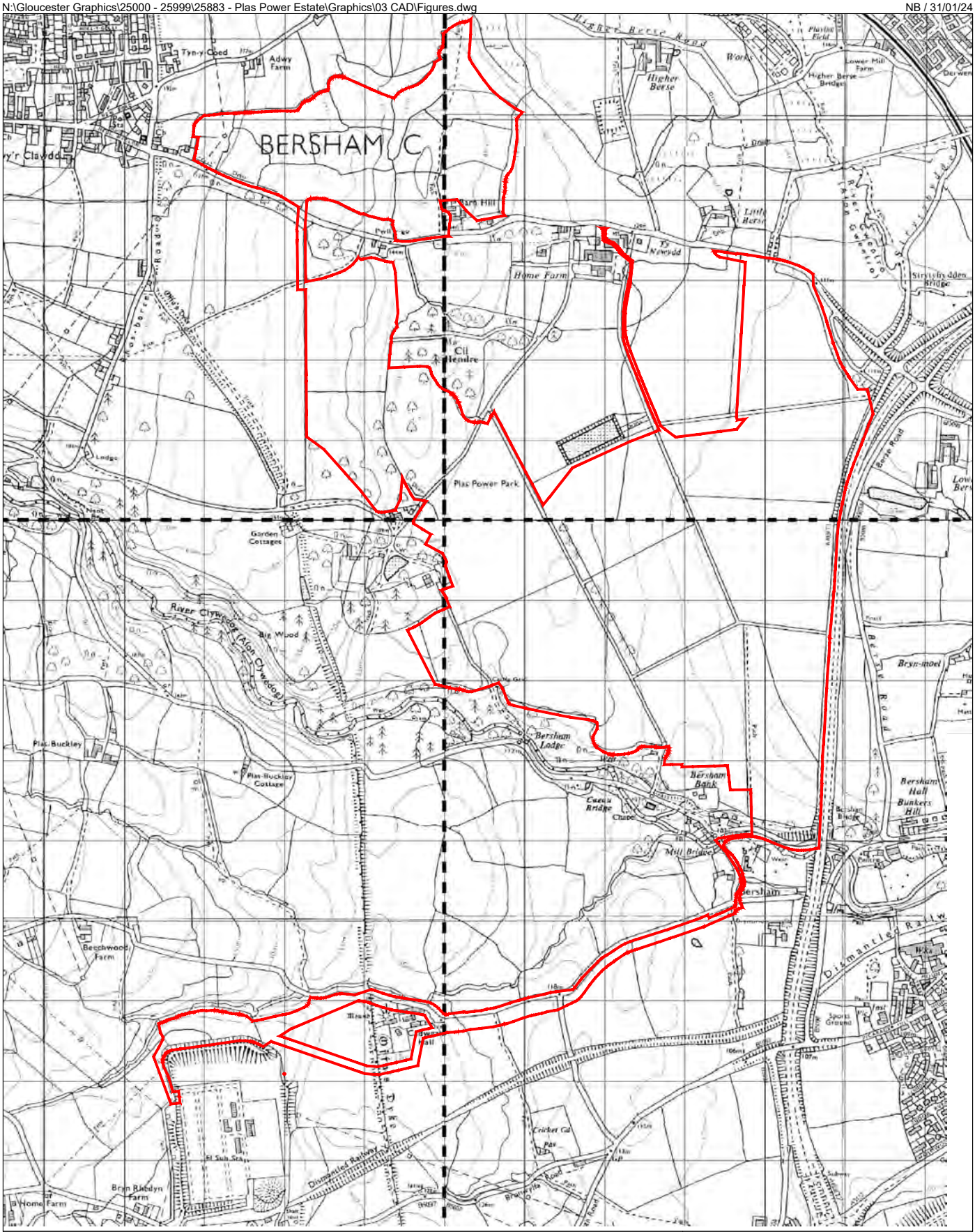
Figure 8

1966 Aerial Photograph showing extent of opencast mining



Site Boundary

N

Not to Scale
Illustrative Only

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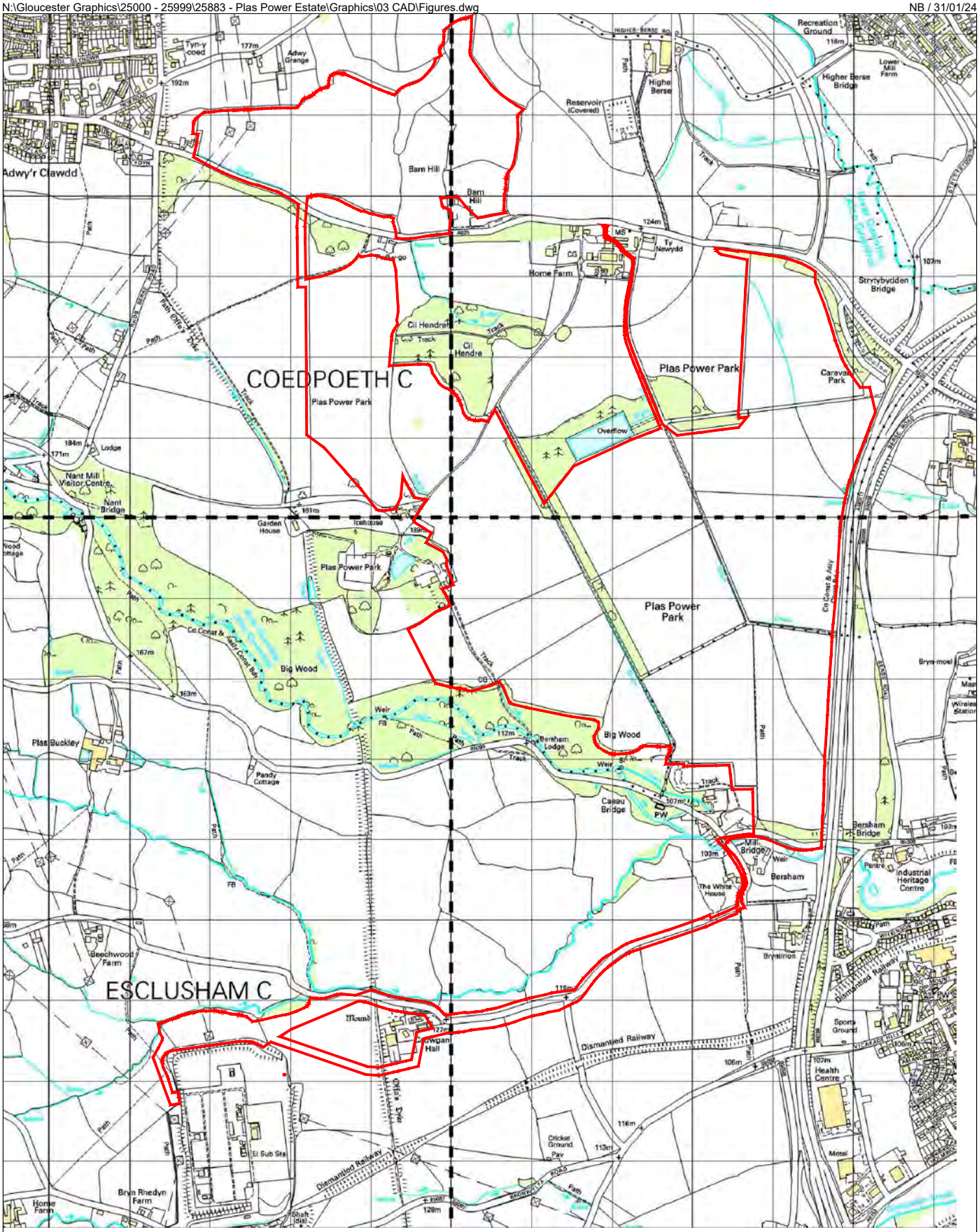
Figure 9

1974-1979 Ordnance Survey Map



Site Boundary

N

Not to Scale
Illustrative Only

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Figure 10

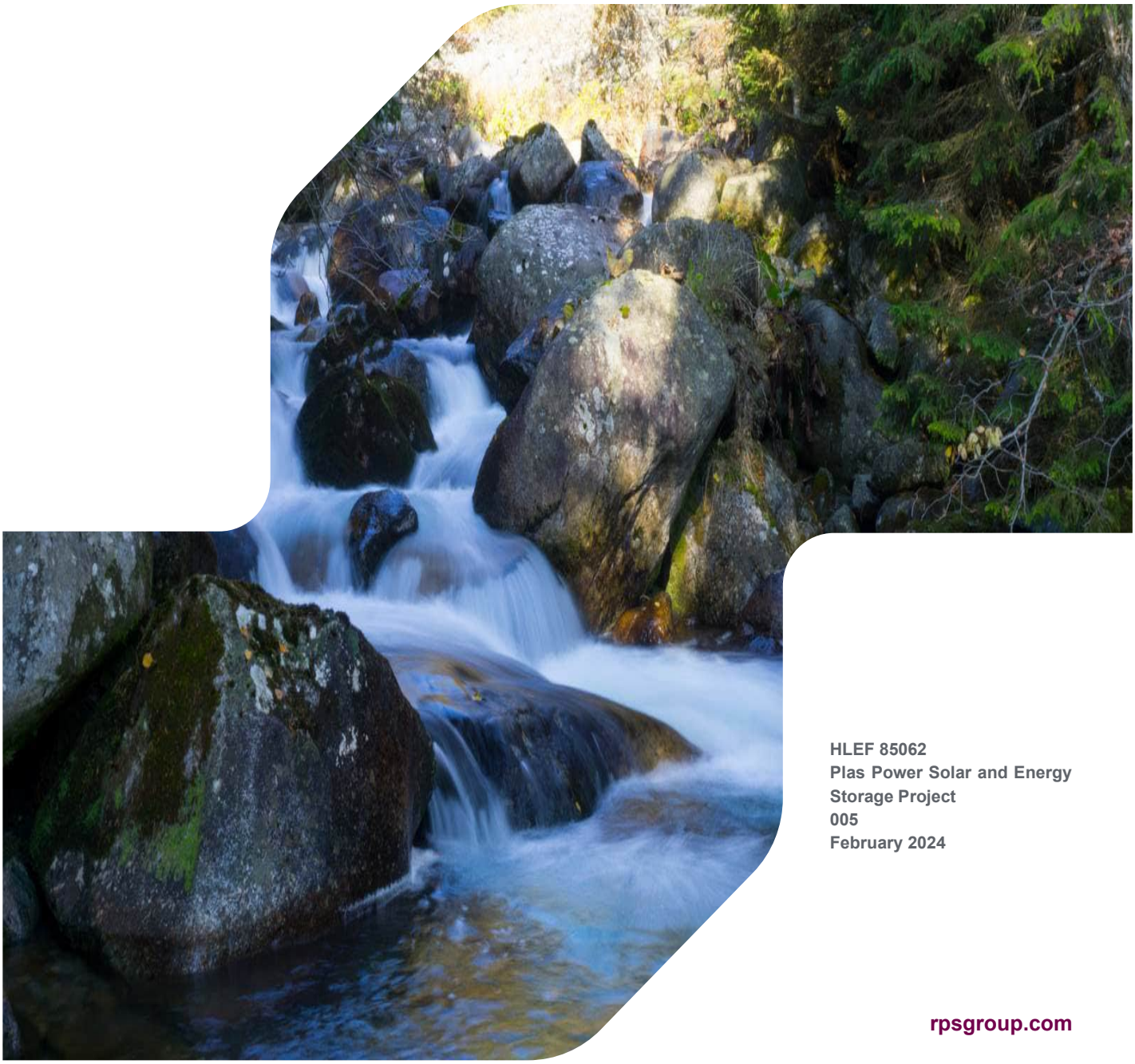
2000 Ordnance Survey Map

Appendix 8.1

Flood Consequences Assessment (FCA) & Conceptual Drainage Strategy

PLAS POWER SOLAR AND ENERGY STORAGE PROJECT

Flood Consequence Assessment and Drainage Assessment



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Plas Power Solar and Energy Storage Project
005
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Quality Management

Version	Status	Authored by	Reviewed by	Approved by	Review date
001	Draft	Rosie Jones/ Tamsin Jones	Anna-Lisa Morse	Jonathan Morley	26/09/2023
002	Updated to comments	Rosie Jones/ Tamsin Jones	Anna-Lisa Morse	Jonathan Morley	02/10/2023
003	Updated with client comments	Rosie Jones/ Tamsin Jones	Anna-Lisa Morse	Jonathan Morley	30/10/2023
004	Updated with minor client comments	Caitlin Evans	Tamsin Jones	Jonathan Morley	10/11/2023
005	Updated with new site layout	Caitlin Evans	Tamsin Jones	Jonathan Morley	02/02/2024

Approval for issue

Jonathan Morley	2 February 2024

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Contents

Tables

Figures

Appendices

1 SCOPE OF WORK

1.1 Background

1.1.1 At the request of Lightsource bp, RPS Consulting Services Ltd (RPS) has prepared a site-specific Flood Consequence Assessment (FCA) for the development of a solar and battery project at land at Plas Power Estate, Ruthin Road, Wrexham LL11 3BS. The DNS reference for the site is DNS/3253253. The key objectives of the FCA are:

- To assess the flood risk to the Proposed Development and to demonstrate the feasibility of appropriately designing the development such that any residual flood risk to the development would be acceptable;
- To assess the potential impact of the Proposed Development on flood risk elsewhere and to demonstrate the feasibility of appropriately designing the development such that the development would not increase surface water on Site or elsewhere; and
- To assess potential drainage strategies to minimise flood risk and surface water flooding due to the implementation of the Proposed Development.

1.2 Project Scope

1.2.1 The report has been produced in accordance with the guidance detailed in Planning Policy Wales and Technical Advice Note 15 (TAN15): Development and Flood Risk. Reference has also been made to local flood risk documents and provides an outline of the potential flood risk and hydrological constraints to the site.

1.3 Limitations

1.3.1 The report is based on publicly available hydrological and flood risk data extracted from the National Resources Wales website (DataMap Wales). The report, therefore, provides a desktop assessment.

2 SOURCES OF INFORMATION

2.1 Introduction

2.1.1 Information sources consulted during preparation of this report are listed in Table 2-1 below.

Table 2-1. Reports consulted during preparation of the document

Reports Consulted		
Source	**Data**	**Information consulted/provided**
Wrexham County Borough Council	Local Development Plan (2023)	The document outlines local planning policies.
Wrexham County Borough Council	Preliminary Flood Risk Assessment (2011)	The document identifies areas where there is significant flood risk from local sources, namely ordinary watercourses, surface water runoff and groundwater.

2.2 Legislation and Guidance

Planning Policy Wales Edition 12, 2024

2.2.1 Planning Policy Wales Edition 12 sets out the land use planning policies of the Welsh Government. Chapter 6 'Distinctive and Natural Places' outlines the Welsh Government's objectives in terms of addressing flood risk.

2.2.2 Paragraph 6.6.8 of Planning Policy Wales states:

> *"New development should be located and implemented with sustainable provision of water services in mind, using design approaches and techniques which improve water efficiency and minimise adverse impacts on water resources, including the ecology of rivers, wetlands and groundwater and thereby contributing towards ecological resilience."*

2.2.3 Planning Policy Wales is supplemented by a series of Technical Advice Notes (TAN). TAN15 provides technical guidance on development and flood risk.

Technical Advice Note (TAN) 15: Development and Flood Risk

2.2.4 TAN 15 provides technical guidance to supplement the policy set out within Planning Policy Wales in relation to development and flooding. The guidance relates to sustainability principles and provides a framework to allow risks arising from river flooding, coastal flooding and additional run off from developments to be assessed.

2.2.5 In relation to flood risk, TAN 15 indicates that the Assembly has a duty to ensure that development is sustainable and does not create problems for future generations. Managing flooding has an important role to ensure sustainable development by: guiding developments to locations with little or no risk from river, tidal or coastal flooding, managing consequences of flooding where developments can be justified and making provision for climate change.

2.2.6 TAN 15 confirms that each planning authority in Wales must prepare a Development Plan for its area. The development plans provide locational guidance for development, detailed site-specific policies, and identification of proposals for development. Catchment Flood Management Plans aim to take a holistic approach to flood management at a catchment scale and can provide guidance on managing risk to future developments. The information provided in local development plans and catchment flood management plans will aid with the application of the Justification Test.

Requirements of TAN 15

2.2.7 A Flood Consequence Assessment, to support a development application, should be proportionate to the risk and appropriate to the scale, nature, and location of the development. The following will need to be considered;

- The consequences of flooding on the development, the consequences of the development on flood risk elsewhere and if appropriate mitigation measures can be incorporated into the design.
- Mechanisms of flooding, including sources of floodwater, how floodwater enters and flows across a site, height, and speed of floodwaters.
- Uncertainties in estimating flood events including use of historical records and forecasting.
- Security of Proposed Developments over their lifetime and ensuring those using the development have an awareness of the potential risks from flooding.
- Description of consequences under a range of extreme events including mechanisms, sources, depths, speed, rate of rise, overland flood routes, velocity, access and egress, impacts on natural heritage, impact on flood risk in surrounding areas.
- Structural adequacy of defences to contain flows and withstand overtopping and if required the suitability of implementing a buffer zone adjacent to defences.
- Measures required to ensure flooding is managed to acceptable levels and ensure that the impact upon flood risk elsewhere in the flood plain is managed.

TAN15 updates

2.2.8 Updates to TAN15 are due to come in to force in 2024. These include updated modelling to incorporate the risk of climate change in Fluvial/Tidal Flood Zones. As well as the addition of Surface Water and Small Watercourses Flood Zones which also incorporate climate change.

2.2.9 This update takes precedent over current guidance as it provides more recent modelling, and the guidance will be in force following completion of the development. Therefore, although current guidance is referenced the updated guidance has been followed within this report.

2.3 Local Planning Policy

Wrexham Local Development Plan

2.3.1 The adopted Wrexham County Borough Council Local Development Plan (LDP) covers 2013 – 2028 and was adopted in December 2023. The LDP is a long-term land use and development strategy, focused on achieving sustainable development which:

- guides development for housing, employment, retail and other uses
- set out policies that will be used to decide planning applications
- safeguard areas of land requiring protection or enhancement

In addition, the County Council of Wrexham have prepared the following document relevant information from which was used in this assessment:

Wrexham County Borough Council Preliminary Flood Risk Assessment

2.3.2 Preliminary Flood Risk Assessment (PFRA) is a high-level screening exercise to identify areas where there is significant flood risk from local sources, namely ordinary watercourses, surface water

runoff and groundwater. It does not directly consider flooding from main rivers or from sewers. PFRAs have been produced by Lead Local Flood Authorities (LLFAs) to fulfil statutory requirements in the Flood Risk Regulations 2009. In this case the LLFA is the Wrexham County Borough Council and the PFRA1 was published in 2011.

2.3.3 The report is not currently available to review online.

Wrexham County Borough Council Local Flood Risk Management Strategy

2.3.4 The Local Flood Risk Management Strategy (LFRMS) report published in 2013 sets out the principles, objectives and measures for the management of local flood risk by Wrexham County Borough Council as the LLFA (where "local flood risk" is defined as "surface water runoff, ground water and ordinary watercourses and included any lake, pond or other body of water that feeds from an ordinary watercourse").

2.4 Climate Change

2.4.1 TAN15 states that when considering new development proposals, it is necessary to take account of the potential impact of climate change over the lifetime of development. Solar panel development is assumed to have a lifetime of 40 years. To ensure future development can provide a safe and secure living and /or working environment throughout its lifetime, national planning policy requires proposals in areas of high flood risk to be accompanied by an assessment of flooding consequences to and from the development, taking into account the impacts of climate change.

2.4.2 In line with TAN15, the climate change allowances have been informed by latest available information on climate change projections and different scenarios of carbon dioxide (CO2) emissions to the atmosphere. Allowances are provided for different epochs (periods) of time over the next century. This guidance will be reviewed when more up-to-date climate change research is available.

2.4.3 Both the central and upper end allowances should be assessed to understand the range of impact. As a minimum, proposals should be assessed against the central allowance to inform design levels. It is recommended that the 2080s changes are used when considering any time beyond 2115.

2.4.4 Table 2-2 presents the peak river flow allowances for the Dee River Basin catchment. Table 2-3 presents the expected change to Extreme Rainfall Intensity. The climate change allowances are based on UKCP09 and emerging UKCP18 research data.

Table 2-2. Peak River Flow Allowances by River Basin District (use 1961 to 1990 baseline)

River Basin District	Allowance Category	Total potential change anticipated for '2020s' 2015-2039)	Total potential change anticipated for '2050s' (2040-2069)	Total potential change anticipated for the '2080s' (2070-2115)
Dee	Upper Estimate	20%	30%	45%
	Central Estimate	10%	15%	20%

Table 2-3. Change to Extreme Rainfall Intensity Compared to a 1961-90 Baseline

Change to Extreme Rainfall Intensity			
Applies across all of Wales	Total potential change anticipated for '2020s' 2015- 2039)	Total potential change anticipated for '2050s' (2040- 2069)	Total potential change anticipated for the '2080s' (2070-2115)

Upper Estimate	10%	20%	40%
Central Estimate	5%	10%	20%

2.4.5 The Guidance recommends that the central estimate, or change factor, for the 2080s for the relevant river basin district and peak rainfall intensity should be used to assess the potential impact of climate change as part of a flood consequence assessment. As such the 20% allowance should be used.

2.4.6 The allowances are consistent with the A1B (medium) emissions scenario derived from latest research projects and converted into regionalised data of climate change on flood flows for the 2020s, 2050s and 2080s time-horizon, and for the B1 (low) and A1F1 (high) emissions scenarios for the 2080s time-horizon.

2.4.7 Runoff and attenuation calculation for any development design would have to take into account the above change in climate change policy.

3 SITE SETTING

3.1 Site Location

3.1.1 The Site is located on land at Plas Power Estate, Ruthin Road, Wrexham with the nearest postcode LL11 3BS. The Site is centred on grid reference is SJ 305 500 and encompasses an area of approximately 136ha. The site is split across two parcels of land north and south of Ruthin Road, connected by a proposed cable route corridor. The land parcels are connected to Legacy power station via a cable route corridor within the southern extent of the site. Figure 1 below demonstrates approximate Site boundaries.

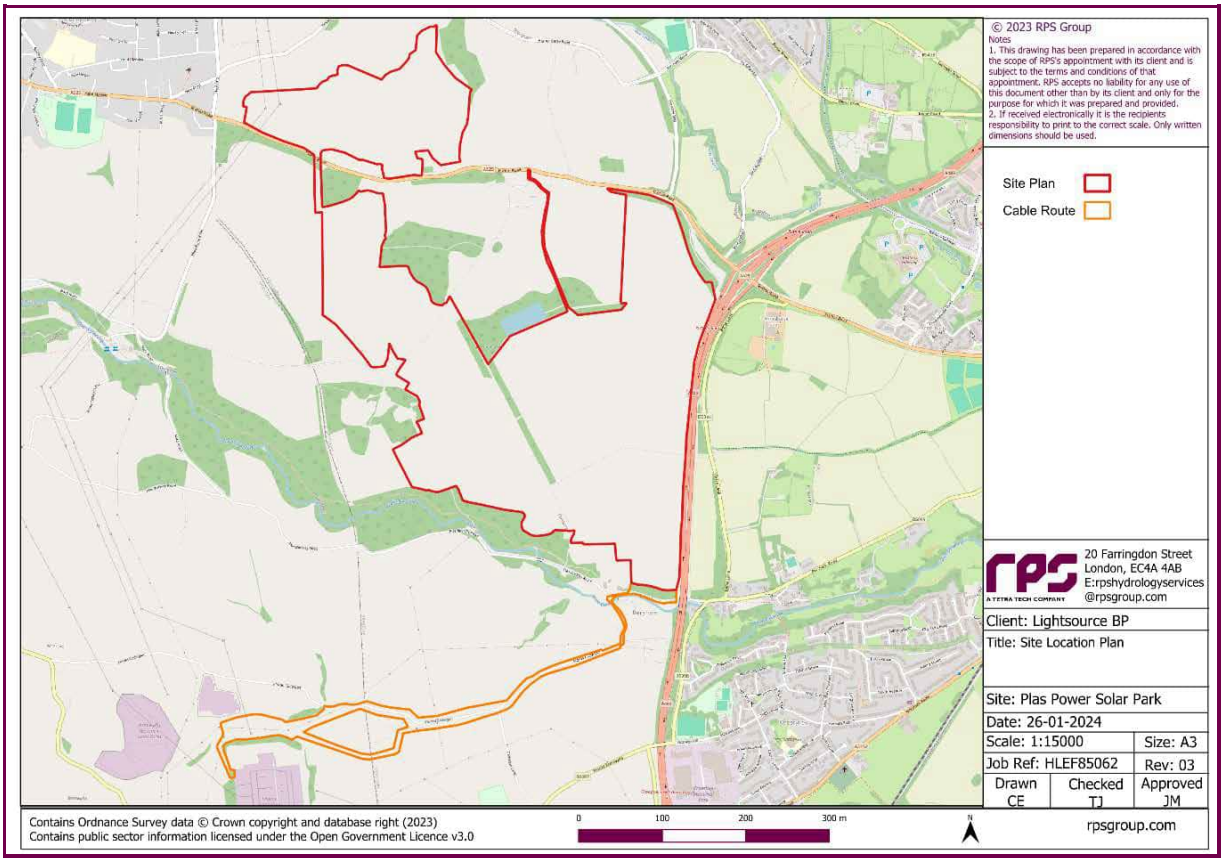


Figure 1. Site Location

3.2 Existing Land Use

3.2.1 The Site occupies approximately 136 ha of pastural and arable agricultural land with field boundaries delineated by hedgerows and trees. Ruthin Road (A525) and Plas Buckley Road bisect the site area from east to west, and a farm track bisects the north of the southern site plan, as well as a footpath in the south.

3.3 Surrounding Land Uses

3.3.1 The south the site is bordered by agricultural land and woodland, with residential and agricultural buildings located in close proximity. Plas Buckley Road is located 35m south with the River Clywedog is located approximately 45 m south. The west of the site is bordered by further agricultural land, with areas of woodland and agricultural and residential buildings located adjacent. The north of the site is bordered by Tanllan Lane, as well as agricultural land. The east of the site is bordered by further agricultural land, woodland, and the A483 road. Wrexham City Centre is located

in the wider area approximately 2.5km to the east. The centre of the site is bisected by agricultural land, woodland, residential properties and farmyards, and Ruthin Road (A525).

3.3.2 There are no designated sensitive areas (e.g. Special Area of Conservation (SAC), Special Protection Area (SPA) or Site of Special Scientific Interest (SSSI)) on site or within close proximity to the site.

3.4 Topography

3.4.1 From contour lines presented within the Proposed Development Layout, presented within **Appendix A**, site levels fall from a high point of 180mAOD (meter above ordnance datum) within the north-western extent of the northern parcel of the site to approximately 102mAOD within the south-eastern extent of the southern land parcel.

3.4.2 Field drains can be identified from the topography in the east of the southern parcel, there are two drains identified as being 0.3-0.5m below the surrounding topography.

4 PROPOSED DEVELOPMENT

4.1.1 The Proposed Development will consist of the construction of solar panels mounted on metal frames, new access tracks, underground cabling, perimeter fencing with CCTV cameras, switchgear substations, inverters, transformer stations, auxiliary transformers, permanent storage containers, monitoring houses, Battery Energy Storage at the Site (BESS) and all ancillary grid infrastructure and associated works. It will also include landscaping and ecological enhancement areas.

4.1.2 The main components of the Proposed Development are:

- Solar arrays comprising solar panels and frames;
- Inverters;
- Transformers;
- Cabling;
- Substations;
- BESS;
- Internal access tracks; and
- Landscaping and ecological enhancement areas.

4.1.3 Proposed Development is classified as 'Less Vulnerable' within TAN15.

4.1.4 The solar farm and battery site will connect to the National Grid via an underground cable to the Legacy Substation located approximately 600m to the south-west of the site. Five cable routes are currently being assessed as part of this connection.

4.1.5 The Proposed Development is temporary and fully reversible; the land can be restored to its present state at the end of the facilities planned life.

4.1.6 The potential to provide surface water attenuation, including the use of Sustainable Drainage Systems (SuDS), has been considered as part of the preliminary design process (see Section 10 – Surface Water Management).

4.2 Solar Panels

4.2.1 Solar panels, also known as photovoltaics (PV), are made up of cells, which convert the light energy from daylight into electrical energy.

4.2.2 The solar will be constructed across the northern and southern parcels of land. There is anticipated to be 2-2.5m between each row of panels, this will help to avoid inter-panel shading.

4.2.3 The solar panels will be attached to metal frames or mounting structures which together form PV tables (or modules). The PV tables will be typically fixed to pile driven galvanised steel posts. When the site is decommissioned, the frame piles are simply pulled out from the ground causing minimal ground disturbance.

4.2.4 The frames will allow the panels to be positioned at an angle of between 12-18 degrees from the horizontal axis and orientated to the south, typically the height of a panel will be 3.055m to the top of the panel frame on level ground, including 1m of ground clearance to enable maintenance access and continued sheep grazing below the PV modules. However, subject to the topography, the height of the panel could be up to 3.20m high. The plans for a typical solar panel is included in **Appendix B.** The solar panels will be arranged over module tables; either in columns of 30 x rows of 2, or 15 columns x 2 rows.

4.2.5 The solar panels will be set back from the site boundaries to allow for landscaping and screen planting, perimeter security fencing, CCTV coverage, access tracks and maintenance access.

4.3 Cable Route

4.3.1 All of the cabling within the northern and southern areas of the site will be laid underground via surface dug trenches of approximately 1m deep and 50cm wide and backfilled. These will utilise existing access tracks and road options wherever possible, particularly where sensitive habitats or archaeology are potentially present.

4.3.2 A cable route between the northern and southern parcels will be installed using Horizontal Directional Drilling (HDD) under the road and trees into the site and via an existing Public Right of Way (PRoW).

4.3.3 The 33kV cable route to connect to the existing Legacy Substation will pass to the east of Bersham Ironworks Museum, under the River Clywedog and Clywedog Trail via HDD, and follow the unnamed road south-west for approximately 800m. From here it will either pass to the north of Cadwgyn hall or to the south where it crosses Offas Dyke, before connecting to Legacy Substation from the west side.

4.4 Ancillary Features

Inverters, Transformers and Switchgear Substations

4.4.1 Lightsource bp are currently considering two inverter options:

- String inverters; or
- Central inverters.

4.4.2 The inverters are required to convert the Direct Current (DC) electricity generated by the panels, to Alternating Current (AC) which is compatible with the wider UK grid network. From the inverters, the electricity flows to a transformer which ‘steps-up’ the voltage of the electricity from low voltage (LV) to medium voltage (MV) before it reaches the switchgear substations. The switchgear substations include a ‘switch’ mechanism to shut parts or all of the solar farm off from the wider network in the event of a fault (similar to a household fuse box).

4.4.3 String inverters would be mounted onto support frames whilst central inverters would be situated in pairs at regular intervals throughout the site. Central inverters are larger and comprise containerised units, as shown in grey on the site layout and will measure up to approximately 8.2m long (L), 2.3m wide (W) and 2.8m high (H) (including the base). 26no inverters are required. For the purpose of the drainage design, central inverters are assumed to be included representing a worst-case both in terms of scale.

4.4.4 The proposed transformers will be up to approximately 5.5m (L), 4.5m (W) and 3.2m (H). These are an ‘open air’ design, surrounded by a fence and accompanied by a switchgear substation. The switchgear substations will be up to 4.2m (L), 2.6m (W) and 3.15m (H) (including the base). 26no. Transformers and 13no. Switchgear Substations are proposed.

4.4.5 The inverters, transformers and switchgear substations will be sited on a hardcore base.

Auxiliary Transformer

4.4.6 There will be one auxiliary transformer located within the site adjacent to the customer substation in the south-west of the site. This will be up to approximately 3.8m (L) x 3.8m (W) 3.2m (H). The auxiliary transformer will provide low voltage electricity supply to ensure the safe and secure operation of the site.

Substations

4.4.7 All electricity from across the solar PV arrays will collect at a substation (referred to as the 'PV Intake Substation') which will be installed to the south-west of the site. The PV Intake Substation will be up to approximately 10.5m (L) x 2.5m (W) 3.1m (H) (including the base).

4.4.8 A further BESS Intake Substation will be located in the BESS compound as described below. Both the PV Intake and BESS Substations connect into the Customer Substation which will be owned, operated and maintained by the operator. From here, a high voltage (HV) cable buried underground, will connect the solar farm to the existing grid network. The customer substation will be up to approximately 10.3m (L) x 5.0m (W) 3.9m (H) (including the base).

4.4.9 A GRP cabinet supplies low-voltage power to the Battery Storage systems, facilitating ventilation and refrigeration for the battery units. Its GRP structure offers a more compact footprint compared to the brick building option and will be 3.00m (L) x 3.00m (W) x 2.55m (H).

Spares Container

4.4.10 It is proposed that one permanent spares container will be located within the site to store miscellaneous spare parts. This unit will measure approximately 12.4m (L) x 2.6m (W) x 2.9m (H).

Monitoring House

4.4.11 A monitoring house is required to enable remote monitoring of the solar PV site. This building is typically up to approximately 3.9m (L) x 3.2m (W) and 3.3m (H) (including the base). This building will provide daily information/data in relation to the operation of the solar farm. During a solar farm's operation, data communication is vital to facilitate information flow from equipment such as inverters to a central control centre and alert Lightsource bp to any potential operational issues with the solar farm and or battery storage compound. In addition to this an up to approximately 5.05m (above ground level) weather station attached to the outside of the building is proposed to monitor wind speed, direction, and temperature.

4.5 BESS Components

4.5.1 The BESS allows for surplus energy generated at times of high production to be stored and dispatched to the grid at times when the energy is needed. The BESS therefore contributes to balancing the intermittent energy production and maximises the site's efficiency to allow a greater output of clean energy.

4.5.2 The BESS will be located to the south of the site, close to the infrastructure associated with the solar farm, and away from residential properties and sensitive viewpoints.

4.5.3 The BESS will include 14no. BESS enclosures, 14no. BICs, 7no. twin MV Skid, a BESS backup generator, a BESS spares container, a BESS intake substation and a BESS Monitoring House.

The BESS Components are summarised in Table 4-1 below.

Table 4-1. BESS Components

BESS Component	Dimensions
14 x 4 BESS Enclosures	16.62m (L) x 3.88m (W) x 3.0m (H) (each)
14 x BIC (Battery Interface Cabinet)	2.2m (L) x 1.1m (w) x 2.3m (H) (each)
7 x Twin MV Skid	10.8 (L) x 6.8m (W) x 3.96m (H)

BESS Component	Dimensions
1 x BESS Backup Generator	6.3m (L) x 2.64m (W) x 2.89m (H)
1 x BESS Spares Container	6.3m (L) x 2.64m (W) x 2.9m (H)
1x BESS Intake Substation	15.70m (L) x 3.00m (W) x 3.60m (H)
1x BESS Monitoring House	3.86m (L) x 3.2m (W) x 3.3m (H)

4.6 Access

4.6.1 The main site access will be via the A525. The northern land parcel will connect to this road from the south with the southern land parcel connecting to this road to the north. Three access points to the site are situated on the A525, two for the Southern parcel and one for the Northern parcel.

4.6.2 Existing farm tracks will be used for internal access within the site wherever possible. New access tracks, where required, will be formed, normally using a layer of permeable crushed stone. Geosynthetic reinforcement or soil stabilisation may be used to reduce the depth of track construction. The surface will be a compacted granular material (crushed rock) up to an approximate thickness of 0.3m, dependent on the ground conditions. Width will increase at bends and at the entrance point. The tracks will measure between 3.5m and 4.5m wide.

5 HYDROLOGICAL SETTING

5.1 Nearby Watercourses

5.1.1 The watercourses in proximity to the site are shown in **Figure 2**.

5.1.2 The River Gwenfro, a main river, is located approximately 350m northeast of the site. A tributary of this river is located 180m northeast of the site which joins the River Gwenfro approximately 500m east. The River Gwenfro flows through Wrexham City Centre, before joining the River Clywedog east of the City Centre and 3.8km east of the site.

5.1.3 The River Clywedog is also a main river located within the southern extent of the southern land parcel and bisects the northern extent of the cable route corridor.

5.1.4 An unnamed watercourse flows eastwards approximately 100m to the north of the cable route corridor route. The watercourse discharges to the River Clywedog approximately 75m to the west of the cable route corridor.

5.1.5 There are three drains located in the southern land parcel, located along the boundaries of the agricultural fields. The southern drain appears to drain into the River Clywedog. Two ponds are also present; one within the centre of the site (however not located within the site boundary) and a second located beyond the south-western boundary of the southern land parcel. Drains and ponds appear to be associated with agricultural land use.

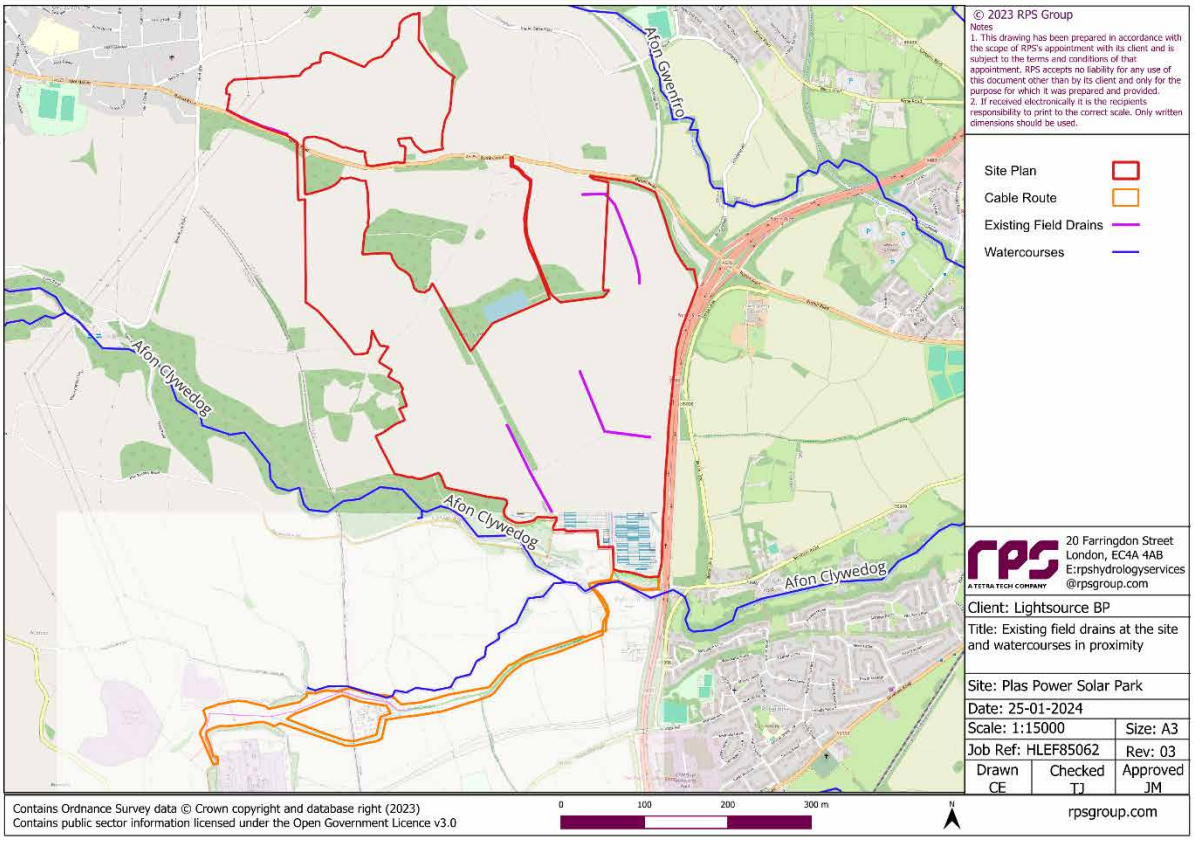


Figure 2. Location of watercourses at and in proximity of the site

5.2 Fluvial Flood Risk Classification

Development Advice Mapping

5.2.1 The Welsh Assembly Government produces Development Advice Maps (DAM) to accompany TAN 15. These maps show the degree of flood risk which is to be applied to the Site for the planning process and thus establish the suitability of the Site for development. These maps are based upon the Natural Resource Wales flood maps and similarly they can be modified through the presentation of data (i.e. hydraulic modelling) to illustrate that a Site is within a different flood zone. The development advice zones are listed below, alongside their attributed planning actions:

5.2.2 The development advice zones are listed below, alongside their attributed planning actions:

- Zone A: Areas considered to be at little or no risk of fluvial or tidal/coastal flooding. Flood risk within this zone does not need to be considered further.
- Zone B: Areas known to have been flooded in the past evidenced by sedimentary deposits. Areas within this zone are further checked against the 0.1% flood level.
- Zone C1: Based on Environment Agency 0.1% flood outline and are areas of the floodplain developed served by significant flood defence infrastructure.
- Zone C2: Based on the Environment Agency 0.1% flood outline and areas of the floodplain without significant flood defence infrastructure.

The Development Advice Map for the site is presented for the site in **Figure 3**.

5.2.3 The northern and southern land parcels are situated wholly within Zone A. There are areas of Zone C1 and C2 located in close proximity to the northern and southern land parcels. These areas are near to the southern boundary owing to the River Clywedog and in proximity to the north eastern boundary owing to the River Gwenfro located in the wider area to the north.

5.2.4 The associated cable route corridor is predominantly located within Zone A. There are limited areas of Zone C2 and Zone B within the northern and central extent of the cable route corridor, associated with fluvial flooding from the River Clywedog and its unnamed tributary.

5.2.5 The associated access roads are situated within Zone A.

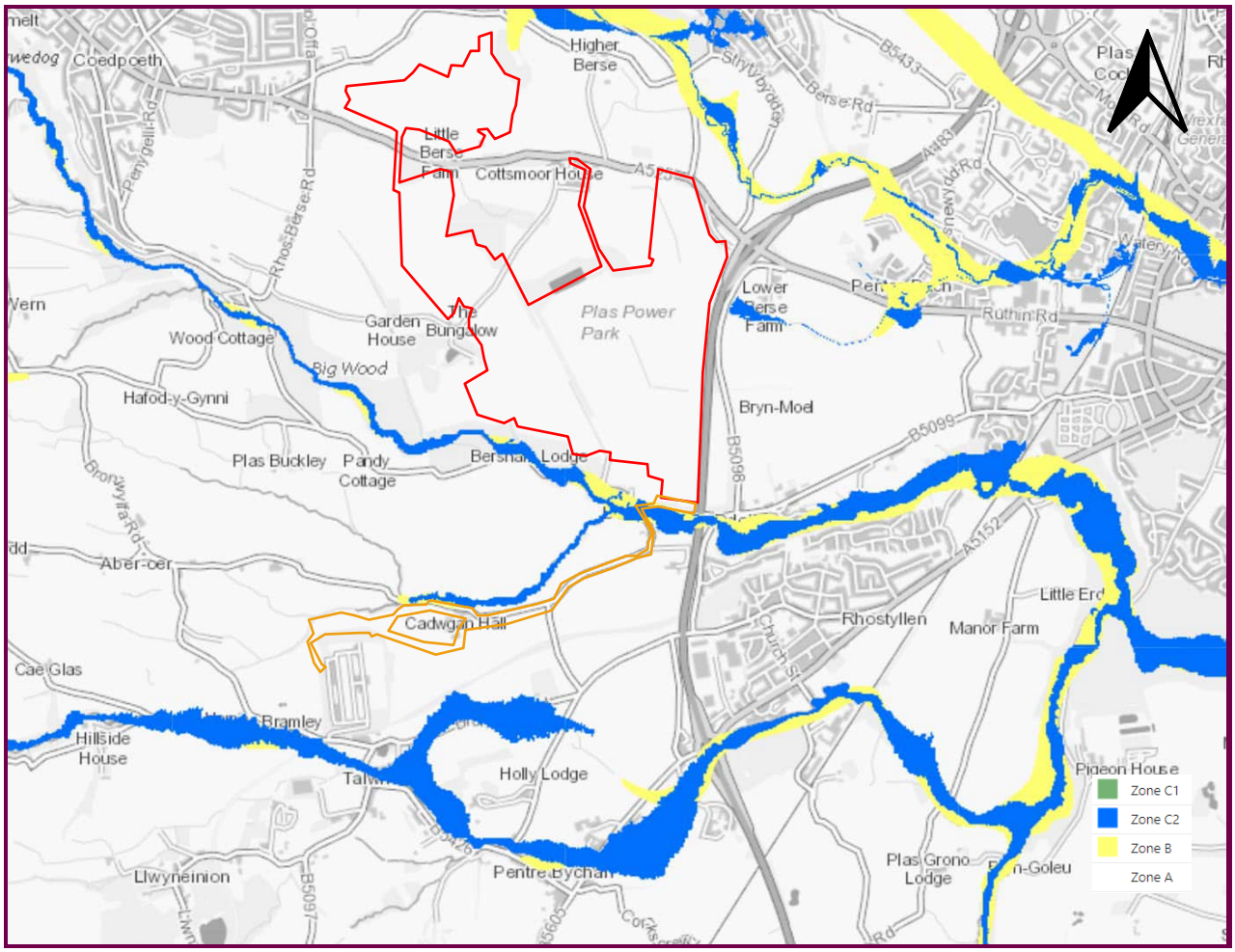


Figure 3. NRW Development Advice Map

TAN15 Updates

5.2.6 RPS notes a revised TAN15 is due to be implemented in 2024. This will be supported by the new Flood Map for Planning, which includes climate change information to show how this will affect flood risk extents over the next century. It shows the potential extent of flooding assuming no defences are in place.

5.2.7 The Flood Map for Planning has no official status for planning purposes until the revised TAN 15 is implemented. However, given the completion of the development is likely to extend beyond this date and it provides more up to date assessment of the risk it takes precedent over current guidance. As such mitigation has been referenced in line with the findings of this data.

5.2.8 The climate change data is taken from the 'central estimate' epochs and as such is considered an appropriate assessment of future risk for 'essential infrastructure' developments in line with TAN15 guidance.

5.2.9 The Flood Zones are divided into the following categories:

- Flood Zone 1 (Rivers) are areas with a less than 0.1% (1 in 1000) chance of flooding from rivers each year, including the effects of climate change.
- Flood Zone 2 (Rivers) are areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers each year, including the effects of climate change.
- Flood Zone 3 (Rivers) are areas with more than 1% (1 in 100) chance of flooding from rivers each year, including the effects of climate change.

5.2.10 Flood Zones are presented within **Figure 4** The northern and southern land parcels are situated wholly within Zone 1. There are areas of Flood Zone 2 and 3 located in close proximity to the northern and southern land parcels. These areas are near to the southern boundary owing to the River Clywedog and in proximity to the north eastern boundary owing to the River Gwenfro located in the wider area to the north.

5.2.11 The associated cable route corridor is predominantly located within Flood Zone 1 with limited areas of Flood Zone 3 within the northern and central extent of the cable route corridor, associated with fluvial flooding from the River Clywedog and its unknown tributary.

5.2.12 The associated access roads are situated within Flood Zone 1.

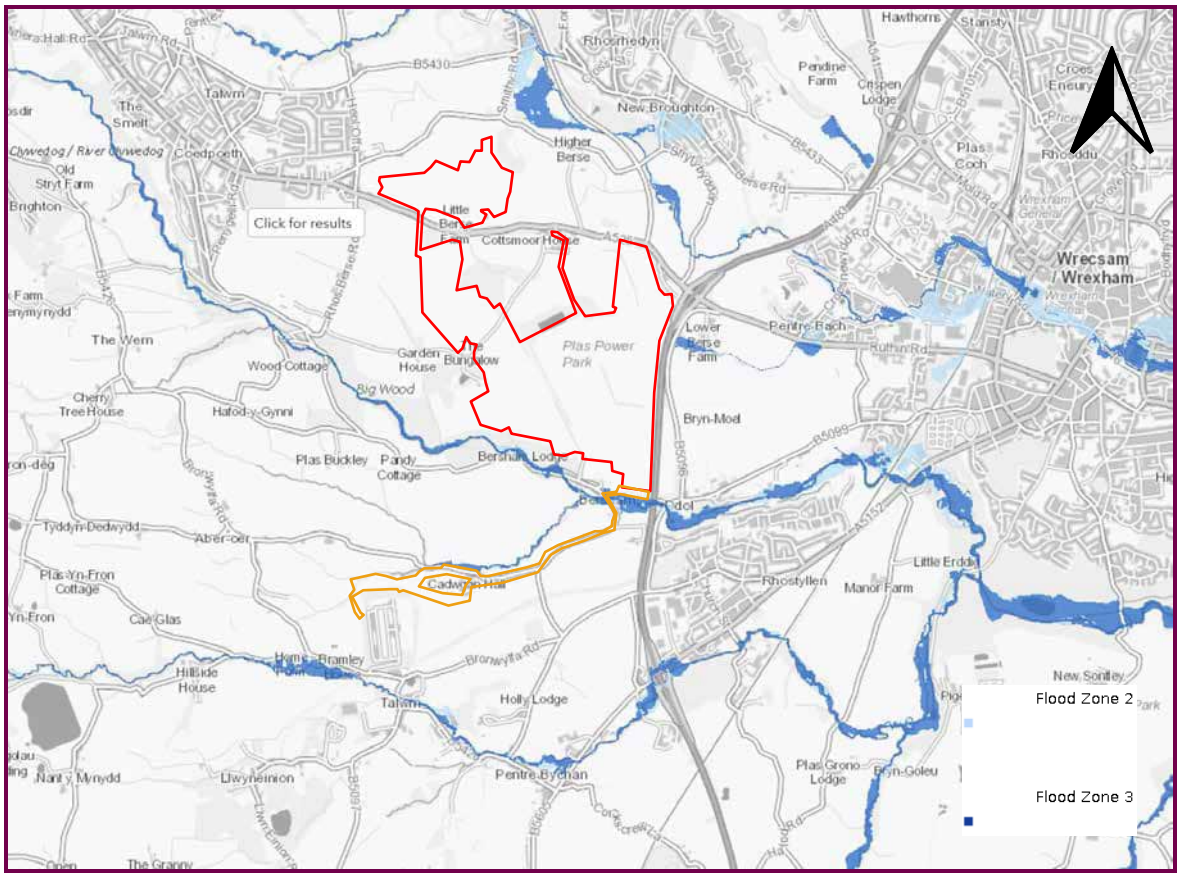


Figure 4. NRW Flood Map for Planning (Rivers and Sea)

5.2.13 NRW National Flood Maps - Flood Risk from Rivers mapping is further used to assess flood risk to the Site with risk of flooding divided into the following categories:

- High risk: The area has a chance of flooding of greater than 1 in 30 (3.3%) each year.
- Medium risk: The area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) each year.
- Low risk: The area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) each year.
- Very low risk: The area has a chance of flooding of less than 1 in 1000 (0.1%) each year.

5.2.14 The current NRW Flood Risk from Rivers map, presented within in **Figure 5**. The northern and southern land parcels are located outside the mapped extent of risk of flooding from this source. The associated cable route corridor has a 'low - high' risk of flooding from this source, associated with fluvial flooding from the River Clywedog and its unnamed tributary.

5.2.15 Flood depth information relating to the low risk (worst-case) scenario shows flood depths of less than 0.15m within the central extent of the cable route corridor inundated by flooding associated with the tributary of the River Clywedog. The northern extent of the cable route corridor inundated by flooding associated with the River Clywedog experiences out of bank flooding of up to 0.90m.

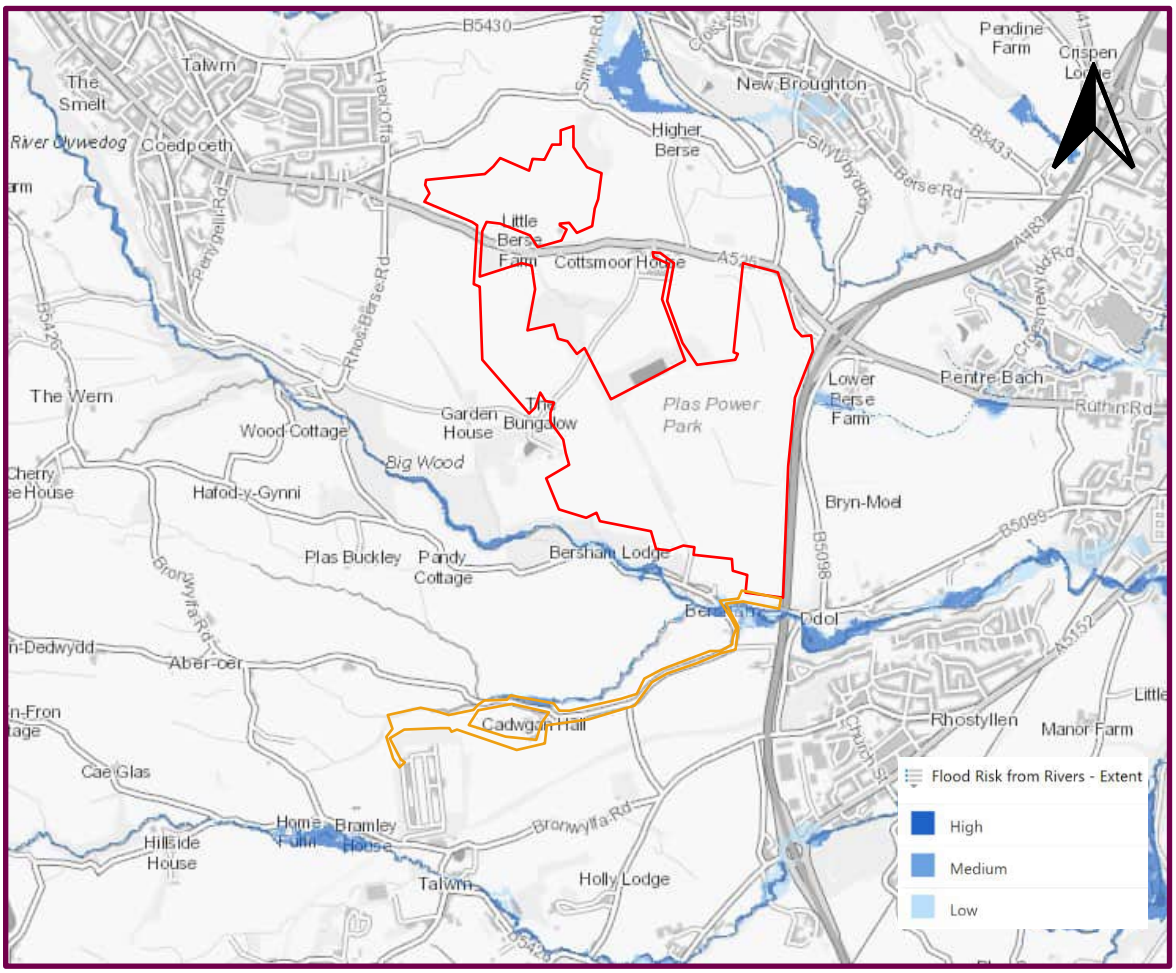


Figure 5. Natural Resources Wales Flood Risk from Rivers Map

Flood Warnings

5.2.16 Areas of Zone C2 which inundate the central extent of the cable route corridor are covered by the Flood Watch area around the River Dee from Llangollen to Trevalyn Meadows.

Flood Defences

5.2.17 The NRW Flood Risk from River's map indicates no flood defences present in close proximity of the site.

Historical Flood Events

5.2.18 NRW Recorded flood extents mapping does not show any recorded flood events within the Site or to its immediate proximity.

5.2.19 The Wrexham County Council Flood Risk Management Plan (FRMP) was published in 2016 and aims to quantify the scale of the risk of local flooding across the County Borough and identifies locally relevant actions and measures to reduce flood risk into the future. FRMP highlights the areas most at risk from surface water and ordinary watercourse flooding in Wrexham CBC, draws conclusions from these risks and sets out the measures we will take over the next 6 years to mitigate these risks and make our communities more resilient. No polices directly relevant to the location of the site are listed.

5.3 Sea/Tidal Flood Risk Classification

5.3.1 The Development Advice Map indicates the site is outside of the risk of sea/tidal flooding.

5.4 Surface Water Flood Risk Classification

NRW Flood Risk

5.4.1 The NRW Flood Risk from Surface Water Map is presented within Figure 6 and demonstrates the Site has a predominantly 'very low' risk of flooding from surface water. This means that each year this area has a chance of flooding of less than 0.1%.

5.4.2 The risk classifications correspond to the following return periods:

- High risk – areas which have a chance of flooding greater than 1 in 30 year (3.3%);
- Medium risk – areas which have a chance of flooding between 1 in 100 year (1%) and 1 in 30 (3.3%);
- Low risk – areas which have a chance of flooding between 1 in 1000 year (0.1%) and 1 in 100 year (1%); and,
- Very low risk – areas which have a chance of flooding less than 1 in 1000 year (0.1%).

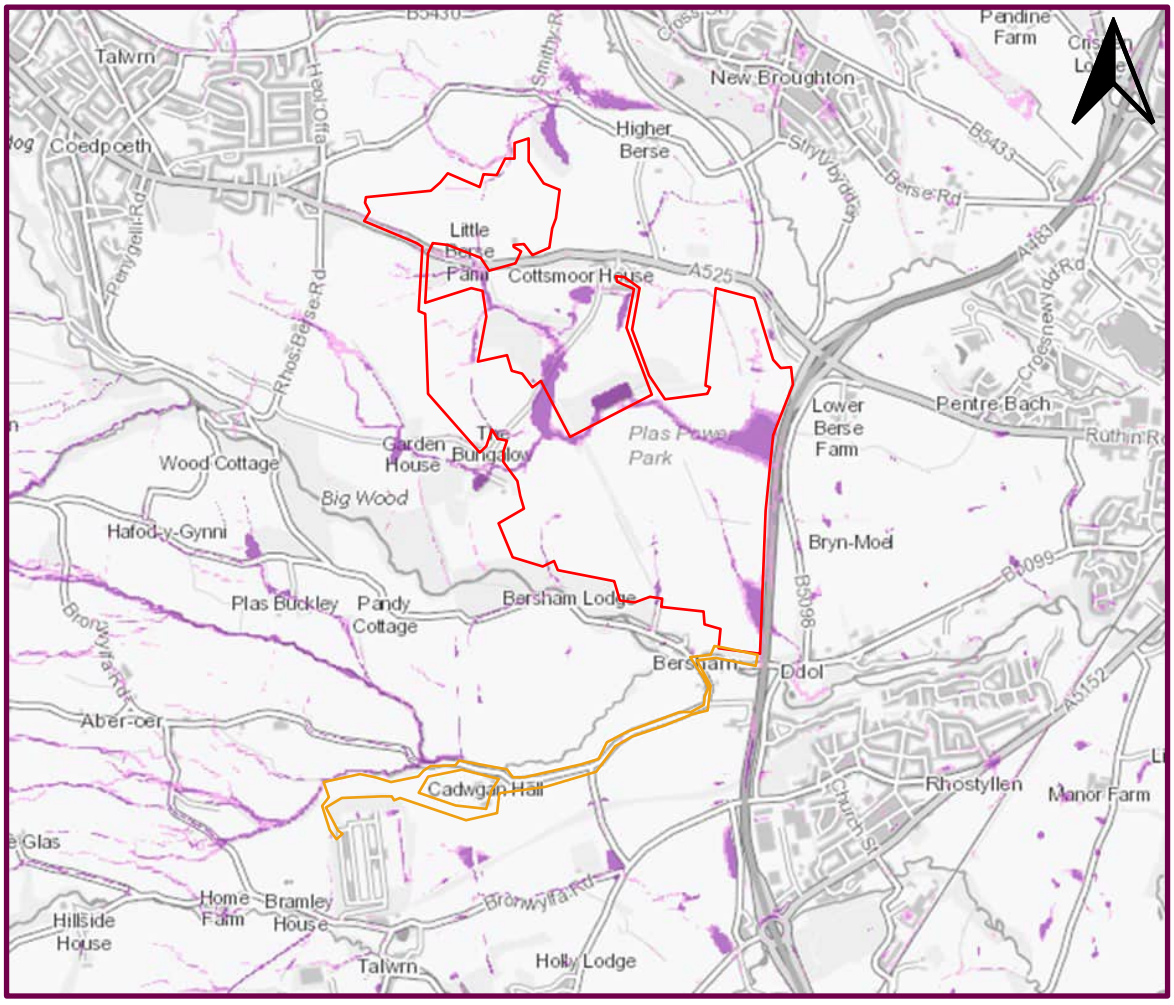


Figure 6. NRW Surface Water Flood Risk Map

5.4.3 Areas where there is an identified risk has been discussed in more detail in the relevant section below. Depth and velocity maps for the entire site for a high risk and medium risk scenario are included in **Appendix C.**

Northern Land Parcel

5.4.4 There are minor areas of risk along field boundaries in the centre of the site. The areas of flood risk are defined as 'low', 'medium' and 'high' risk. Depths of areas at risk are generally lower than 0.9m, there are minor areas in the centre where depths may exceed 0.9m during a high risk scenario. Velocities are generally under 1m/s during a high risk scenario, with a small area in the north at risk of velocities between 1m/s and 2m/s.

5.4.5 There are no significant surface water pathways, and the risk appears to be associated with minor isolated topographical depressions along the field boundaries. The depths and velocities are presented in Figure 7 and Figure 8 below for the northern land parcel.

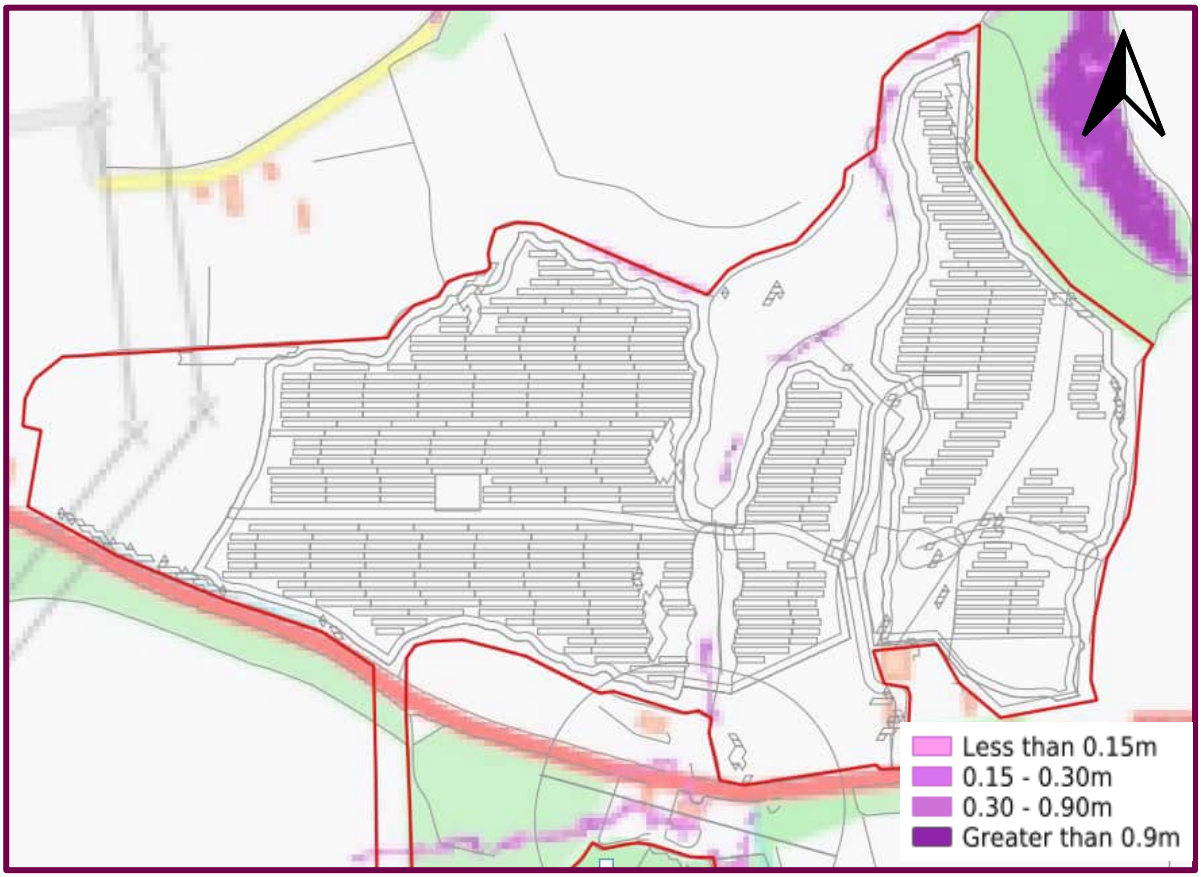


Figure 7. Surface water depths during a high risk scenario (Northern Land Parcel)

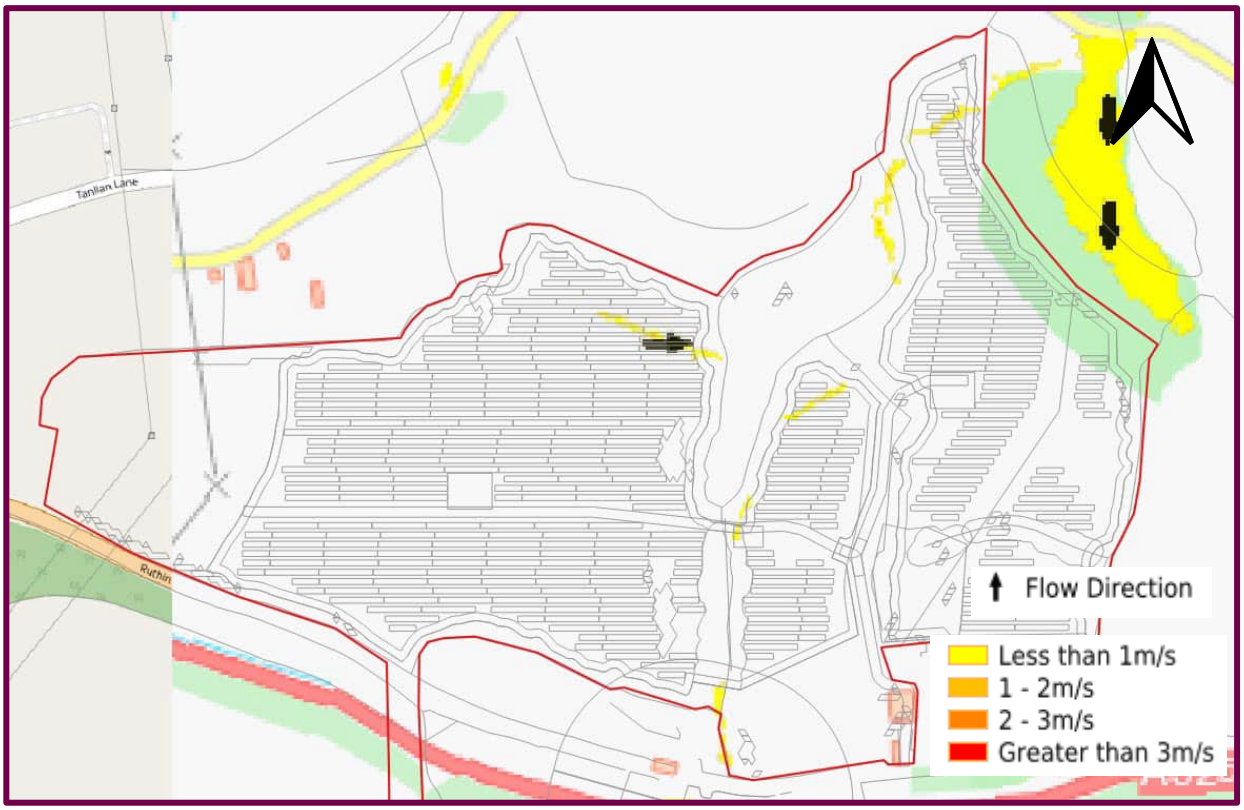


Figure 8. Surface water velocities during a high risk scenario (Northern Land Parcel)

Southern Land Parcel

5.4.6 There is a defined flow path which runs from the centre of the site flowing west to east and forms areas of 'low', 'medium', and 'high' risk of flooding. Adjacent north of the site is a pond where water collects with any exceeding water heading south east. The water then pools in area of risk adjacent to the eastern site boundary. The depths along the flow path are less than 0.15m during a high risk scenario, with the eastern boundary where water pools seeing depths exceeding 0.9m. In a medium risk the extents are greater.

5.4.7 Velocities are largely restricted to below 1m/s in a high risk scenario, with a small area of the flow path reaching between 1m/s and 2m/s. Where water pools the velocity remains below 1m/s. In a medium risk scenario there is a greater section of the flow pathway with velocities between 1m/s and 2m/s.

5.4.8 No ordinary watercourses or drainage ditches are located at this area of the site. The risk appears to be associated with the topography which slopes to the east, where there is a low lying dip where water pools.

5.4.9 In the north of this area of the site there is a further area of water pooling associated with a topographical depression. Water flows into the area from the south west and south east along overland flow pathways. The risk ranges from 'low', 'medium', and 'high' risk of surface water flooding.

5.4.10 The depths along the flow path are generally less than 0.3m, with a small area at 0.3m to 0.9m during a high risk scenario, with the area of pooling reaching depths exceeding 0.9m.

5.4.11 Velocities are less than 1m/s in a high risk scenario along the flow pathway. Where water pools the velocity remains below 1m/s. In a medium risk scenario, the overland flow pathways velocity may reach between 1m/s and 2m/s.

5.4.12 Flows are assumed to comprise of surface water runoff following high intensity rainfall events and following the elevation and local depressions of the land.

5.4.13 The depths and velocities are presented in Figure 9 and Figure 10 below for the southern land parcel.

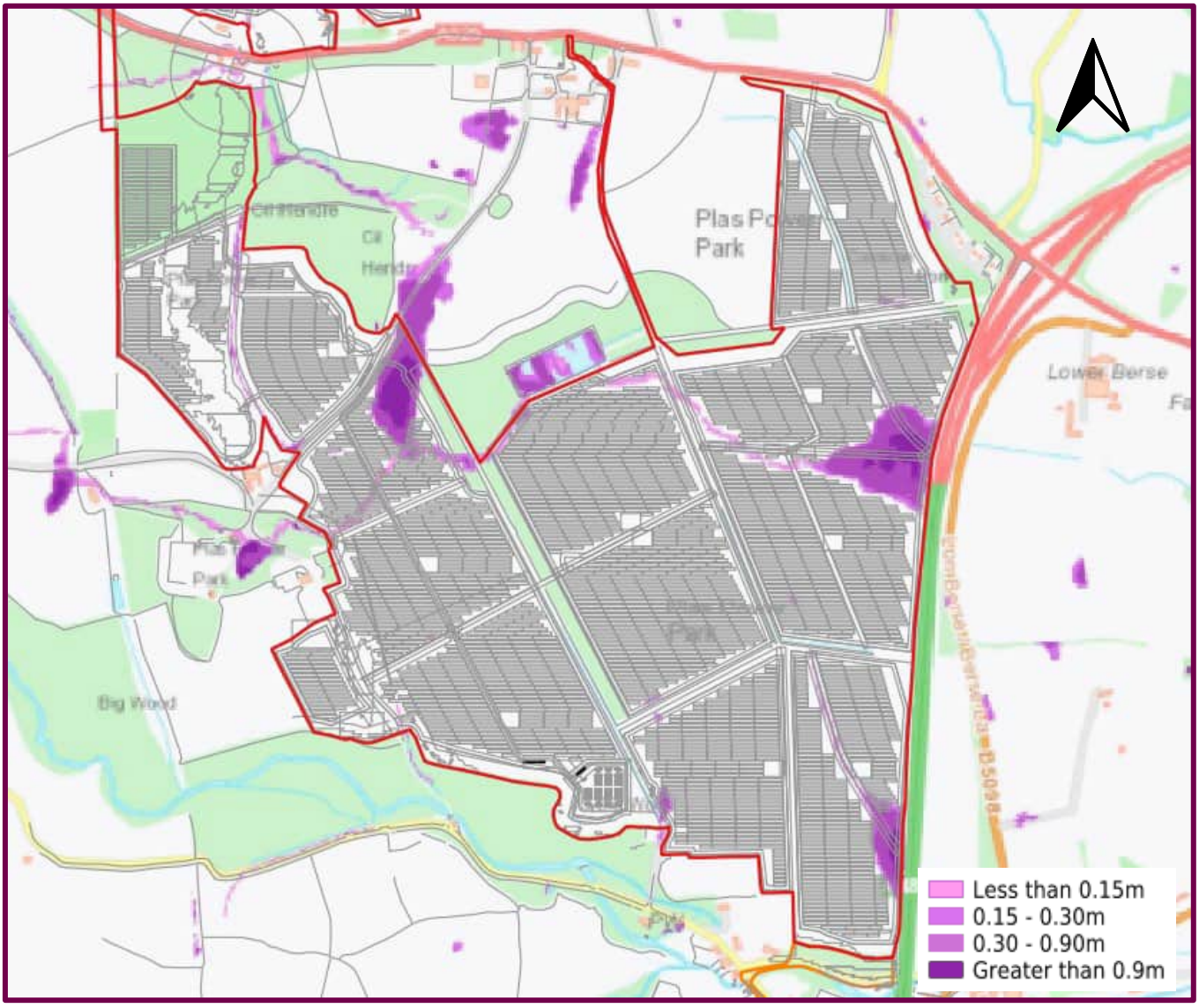


Figure 9. Surface water depths during a high risk scenario (Southern Land Parcel)

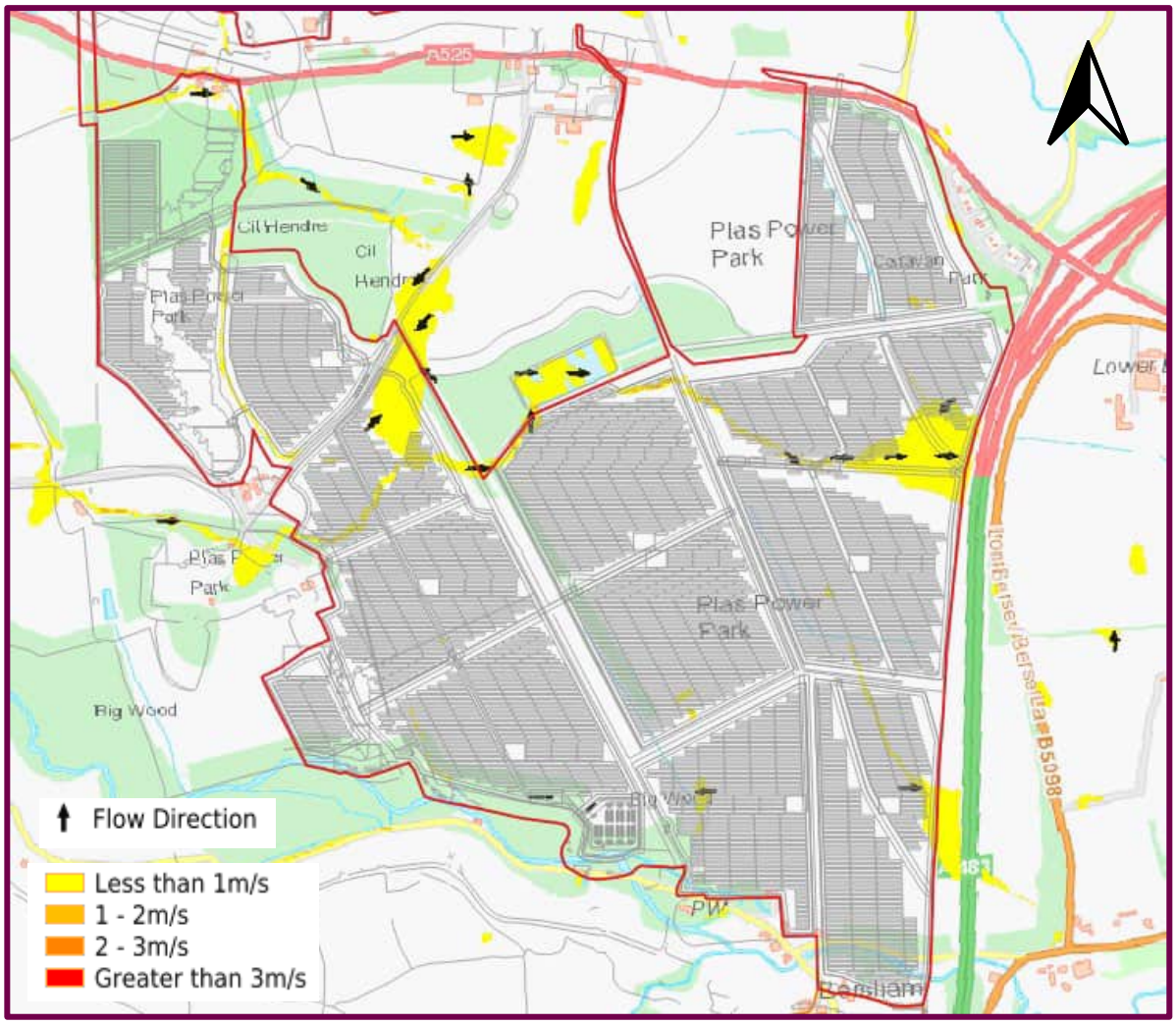


Figure 10. Surface water velocities during a high risk scenario (Southern Land Parcel)

Cable Corridor

5.4.14 The cable route corridor is predominantly located outside the extent of land at risk of flooding from this source. There are isolated areas at 'low' – 'high' risk of surface water flooding, associated with pond of surface water within topographical low points. Flood depths are up to 900mm and flow velocities are predominantly below 1m/s. Additionally, there is a surface water flow pathway which clips the central extent of the cable route corridor which presents a 'high' risk of surface water flooding, with flood depths up to 300mm and flow velocities are above 3m/s. Flooding appears to be associated with the conveyance of surface water flows along topography towards the unnamed tributary of the River Clywedog.

TAN15 Future Risk

5.4.15 The NRW's new Flood Map for Planning includes Flood Zones for surface water and small watercourses with consideration for climate change and how it will affect flood risk extents over the next century. As stated, the Flood Map for Planning has no official status for planning purposes until 2024.

5.4.16 However, the risk has been displayed in Figure 11 to show how the new modelling work undertaken and how climate change risk may impact the site in the future. The extent of the risk shows that risk

generally matches that of the present day, with small areas of the site in Flood Zone 2 and 3. The access tracks and cable route corridor cross Flood Zone 2 and 3.

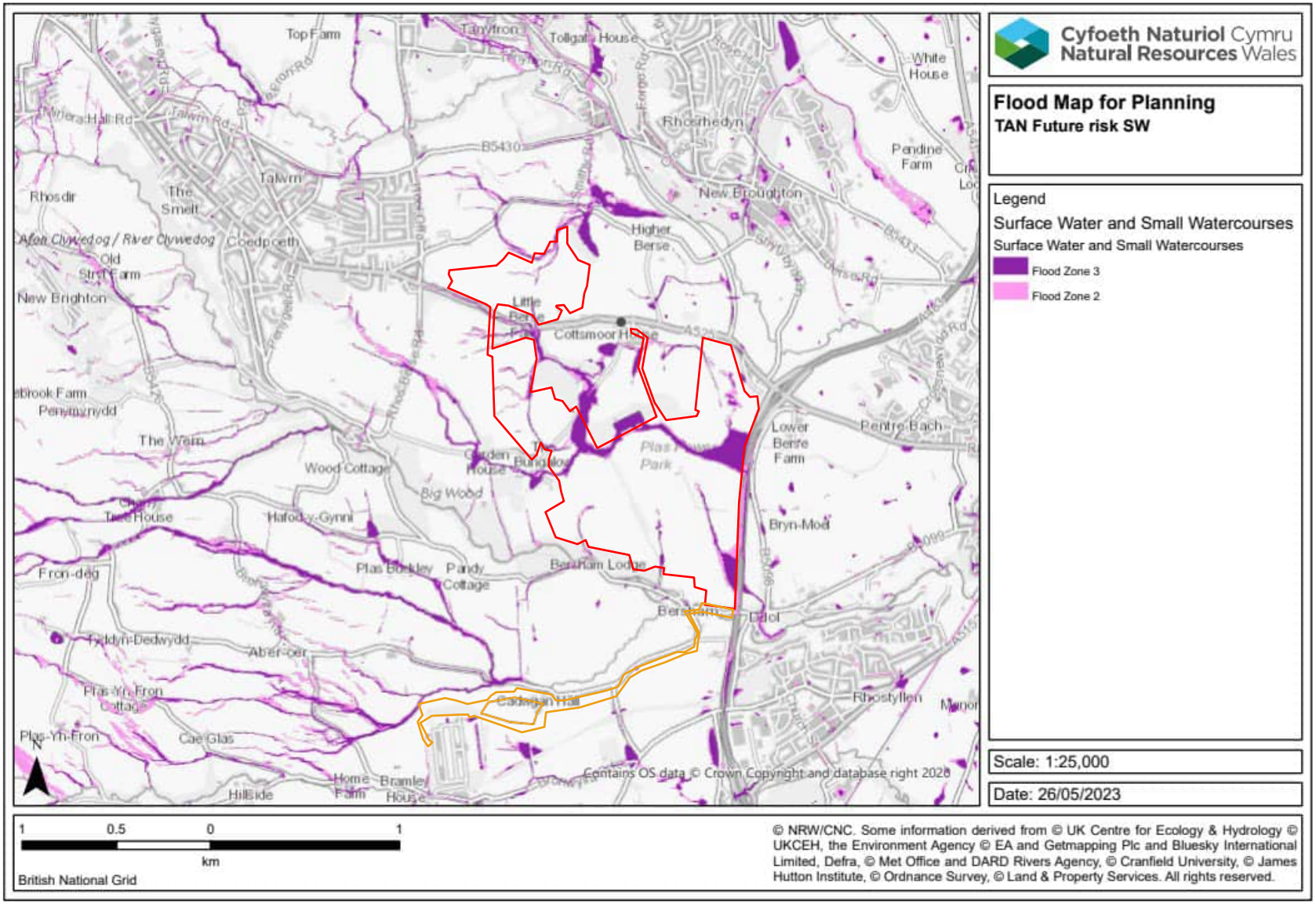


Figure 11. Flood Map for Planning Surface Water and Small Watercourses (Updated TAN15 mapping)

5.5 Reservoir Flooding

5.5.1 Reference to the NRW's Reservoir Flood Map indicates that the Ty Mawr Reservoir is located approximately 2.5 km south-west of the site. The northern and southern land parcels are located outside the mapped extent at risk of flooding from this source. Flooding from reservoirs however inundates the far eastern extent of the cable route corridor.

5.5.2 The NRW stipulates that a reservoir dam failure is an unlikely event. All large reservoirs are inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoir Act 1972 in England, the NRW ensure that reservoirs are inspected regularly, and essential safety work is carried out where required. Taking into account the above, it is considered the Site is at low risk of reservoir flooding.

5.6 Wrexham LFRMS and SFRA

5.6.1 Wrexham LFRMS has split the area into community areas, the site is situated within Coedpoeth community area. Of the 2029 properties in the area none are at fluvial risk from a 1 in 100 year or 1 in 1000 year event. 13 properties are at risk of surface water flooding from either/and a 1 in 30 year, 1 in 100 year and 1 in 1,000 year surface water event. The site is not currently developed so not incorporated in these property statistics.

6 HYDROGEOLOGICAL SETTING

6.1 Bedrock Geology

6.1.1 BGS Geology Viewer (1:50,000 scale) indicates that the bedrock geology varies across the site.

6.1.2 The northern extent of the site is comprised of Cefn Rock (sandstone) and Pennine Lower Coal Measures and Pennine Middle Coal Measures Formation (sandstone). The latter also underlays the southern extent of the site.

6.1.3 Numerous borehole records are noted on site. In the northern land parcel, borehole reference SJ25SE42 indicates that clay is present below soil; between 0.1 and 6m below ground level (bgl), below this is gravel up to 8.5m bgl, with sandstone until the base of the record at 9m bgl. No groundwater was struck during these records.

6.1.4 Borehole reference SJ35SW46 was recorded to reach a depth of approximately 59m bgl and comprised of sandstone, mudstone, and siltstone. No groundwater was struck during this record,

6.1.5 Therefore, this indicates that groundwater levels are not anticipated to be at or near the surface for the site area.

6.2 Superficial Deposits

6.2.1 The superficial geology deposits at the site are comprised of Till Devensian and Glaciofluvial Sheet Deposits, Devensian (sand and gravel).

6.2.2 Devensian Till is present across the majority of the site, including the majority of the southern parcel, and the south and northwest of the northern parcel of the site. Small outcrops of Glaciofluvial Sheet Deposits are noted across the site, largely in the south eastern corner of the southern parcel, as well as a small area in the west and the centre. The north eastern corner of the northern parcel of the site notes Glaciofluvial Sheet Deposits.

6.3 Hydrogeology

6.3.1 BGS Geology of Britain mapping shows multiple borehole records on site however, most of these were not available to view. Borehole reference SJ25SE42 indicates that water was struck at 151.2m bgl. No water was encountered within the borehole record SJ35SW46.

6.4 Aquifer Designation

6.4.1 BGS Aquifer Designation mapping shows bedrock deposits are categorised as Secondary A Aquifers which generally support water supply and base river flow on a more local scale. The underlying superficial geology deposits are classified as Secondary A Aquifers and Secondary Undifferentiated. Secondary Undifferentiated Aquifers have varying characteristics in different locations.

6.5 Surface Protection Zones

6.5.1 The NRW natural environment mapping shows the Site is located within an area of medium – high, medium – low, and low groundwater vulnerability and is not located within a Source Protection Zone.

6.6 Soils Classification

6.6.1 The National Soils Research Institute Soilscapes viewer classifies soils underlying the majority of the southern site boundary as loamy (restored soils mostly from quarry and opencast spoil). The

soils in the northwest of the southern boundary and northern boundary of site are classified as loamy and clayey (slowly permeable seasonally wet acid loamy and clayey soils).

7 FLOOD RISK VULNERABILITY CLASSIFICATION AND JUSTIFICATION TEST

7.1.1 In accordance with TAN15, solar farm and battery developments are classified as “Less Vulnerable”. Flood risk vulnerability and flood zone compatibility is presented below in Table 7-1.

Table 7-1. Flood Risk Vulnerability and Zone Compatibility

Flood Zone	Vulnerability Calassification		
	Emergency Services	Highly Vulnerable	Less Vulnerable
Zone A	Permitted	Permitted	Permitted
Zone B	If site levels are greater then flood levels, no need to consider risk further	If site levels are greater then flood levels, no need to consider risk further	If site levels are greater then flood levels, no need to consider risk further
Zone C1	Yes – if justification test applied	Yes - if justification test applied	Yes - if justification test applied
Zone C2	Not permitted	Not permitted	Yes - if justification test applied

7.2 Justification Test

7.2.1 TAN 15 technical guidance states a requirement for any Proposed Development within Zone C1 and Zone C2 to be subject to the Justification Test, including acceptability of consequences. The following must be demonstrated in order to justify development within Zone C:

i. “Development within zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; or,

ii. Development within zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

And

iii. Development concurs with the aims of PPW and meets the definition of previously developed land; and,

iv. The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.”

7.2.2 The Proposed Development will contribute towards meeting the UK Government’s targets for generating energy from a renewable energy source; it will generate local employment during its construction and operation. Part ii of the justification test is therefore considered to be satisfied.

7.2.3 The Proposed Development located within Zone C is the cable corridor only. This is classified as ‘Less Vulnerable’. The percentage within Zone C2 is less than 1%.

7.2.4 Solar PV modules are to be installed within the northern and southern land parcels and will connect to the existing National Grid substation via the cable route corridor. Therefore, is unable to be routed without crossing areas within Zones C2. Part iii of the justification test is therefore considered to be satisfied.

7.2.5 In regard to part iv of the justification test, potential consequences of a flood event have been undertaken regarding development taking place within C2 in line with Appendix 1 of TAN 15.

7.2.6 The majority of the cable route corridor within Zone C2 is covered by the Flood Watch Area around the River Dee from Llangollen to Trevalyn Meadows. The cable route corridor within Zone C2 do not benefit from flood defences.

7.2.7 During the construction phase the site manager will sign up to the Flood Warning Service and will be alerted by a phone call or text when a Flood Warning becomes active. The flood warning will enable site personnel to be evacuated from the site in a timely manner prior to a flood event occurring.

7.2.8 The installation of below ground cables will be temporary in nature with no permeant above ground structures proposed. The majority of the construction works are not within previously developed land however, there will be no changes to existing land use. The cable route corridor does not increase flood risk to the surrounding area and has negligible risk of flooding to and from the development.

7.2.9 Any buildings to be located within Zone C2 during construction are expected to be limited to temporary office units and welfare facilities. Given the temporary nature of the buildings, flood resistant design is not considered to be appropriate.

7.2.10 Any alterations in the existing surface water drainage regime associated with the installation of the below ground cables are expected to be only during the construction stage and thus temporary in nature. Any increase in run-off during construction will be managed through the CoCP which will be submitted to the LLFA for approval with consultation with NRW prior to the commencement of works.

7.2.11 On this basis, the Justification Test is determined to be passed.

8 FLOOD RISK AND MITIGATION

8.1.1 The key sources of flooding that could potentially impact the site are discussed below:

8.2 Fluvial and Sea Flooding

8.2.1 In accordance with the Development Vulnerability Categories in Figure 15 of TAN15, solar farm and battery developments are classified as 'Less Vulnerable'.

8.2.2 The northern and southern land parcels and associated access roads are located entirely within Zone A. The cable route corridor has a small area within Zones B and C2.

8.2.3 The Flood Map for Planning shows the northern and southern land parcels, associated access roads and the majority of the cable route corridor to be located within Flood Zone 1. Limited areas of the cable route corridor located within Flood Zone 3.

8.2.4 All types of development are considered acceptable within Zone A and B. The justification test is considered to be passed for development located within Zone C2.

8.2.5 With the inclusion of the below mitigation measures, the Site is therefore assessed to have a low risk of flooding from this source.

Flood Mitigation Measures

8.2.6 During construction, site workers will be made aware of areas that are located within Flood Zone 3 / Zone C2 and of the evacuation protocol in the event of a flood. Stockpiled material and construction compounds will be located outside of the floodplain, minimising loss of floodplain storage area and reducing possibility of silt laden runoff into surrounding watercourses.

8.2.7 In accordance with Land Drainage (Wales) Byelaws, no persons shall without the consent of the authority, deposit or store objects or matters within 8m of the edge of drainage, watercourse and flood risk management features. No work will be carried out within 8 m of non-tidal water bodies unless agreed with the relevant drainage authority, NRW or LLFA.

8.2.8 Cable route crossing methods have yet to be determined. Mitigation measures to minimise any potential adverse effects on surrounding watercourses, increase in flood risk, degradation of agricultural land/ during construction will be ascertained in detailed design. Consent from NRW for any works within 8m of non-tidal waterbodies will also need to be obtained prior to any construction activities.

8.3 Surface Water Flooding and Ordinary Watercourses

8.3.1 The NRW Flood Risk from Surface Water map indicates the majority of the Site is located at very low risk of flooding. However, mapping does identify a low to high risk of flooding from surface water flow pathways across the site, predominantly across the centre of the site to the east, and in the south eastern corner of the site.

8.3.2 The extents of risk are similar in the Flood Map for Planning with Flood Zones 2 and 3 from surface water and small watercourses present across the site, associated with surface water flow pathways.

8.3.2 With the inclusion of the below mitigation measures, the Site is therefore assessed to have a very low risk of flooding from this source.

Flood Mitigation Measures

8.3.1 According to detailed mapping where these flow pathways are situated, the velocities are considered to be less than 2 m/s. Depths are largely below 900mm, which will be below the minimum height of solar panels which is to be at least 1m.

8.3.2 Development has been avoided in isolated areas where depths exceeds 900mm during a high or medium risk scenario. In addition, the proposed Conceptual Surface Water Drainage strategy has been designed to slow flow and intercept runoff to allow for a betterment in pre-existing conditions, see section 10.

8.3.3 No land raising activities are proposed with development and as such the levels at which solar panels will be set will reflect undulating Site topography. As no land raising is proposed, the Proposed Development will not interfere with the existing surface water runoff and flows paths currently present within the undeveloped Site and will remain unaltered with Proposed Development.

8.3.3 Solar PV modules are mounted on the array framework, often but not always stacked in a portrait or landscape layout. The panels themselves are waterproof with a minimum IP64 rating and meant to be exposed to the elements. The photovoltaic energy generation process is passive and does not require moving parts. The only element of a solar panel that could be impacted by water is the “junction box” in the middle (on the rear of) each panel. These allow each panel to connect to the other in ‘strings’. Junction boxes are rated to either IP67 or IP68 meaning they would be able to withstand immersion in up to 1m of water. Even if this occurs, the panels themselves would remain operational, however, junction boxes would potentially be compromised and could require minor electrical works to replace once flood waters had subsided. As such, solar arrays themselves should not be considered vulnerable to flood risk.

8.3.4 The only elements vulnerable to flooding are ancillary buildings with electrical equipment. None of the buildings are proposed in areas where there is a surface water flood risk. These buildings are primarily prefabricated container units. They can be raised off the ground so there is a void between the ground and floor level of the unit, with internal electrical equipment therein also not situated directly on the floor of the unit.

8.3.1 There will be some cut and filling as part of the BESS storage, but a slight gradient will remain to allow water to flow towards the pond. In addition, the BESS is placed outside of any surface water risk and therefore, is not anticipated to impact any surface water flows. The attenuation pond allows for a betterment to pre-conditions.

8.3.5 Access tracks cross areas where depths are largely below 300mm. The access tracks are to be primarily formed of permeable material’ loose gravel. Where a risk is identified, it is recommended to camber the roads to prevent water pooling to ensure access can be maintained. The residual effect of the Proposed Development on flood risk is therefore considered to be negligible. The solar farm and battery site will be safe for its lifetime, taking account of the limited number of users of the Site with no increase in flood risk elsewhere.

8.4 Other Sources

8.4.1 Drains are situated in the south and east of the southern land parcel, these are generally shallow in nature. These are associated with the agricultural nature of the site and flow in an easterly direction away from the site. It is anticipated these drains will remain as is, and therefore should be regularly inspected to ensure they remain blockage free.

8.4.2 Where access tracks are proposed these do not cross on-site drains and therefore, no further mitigation is proposed.

8.4.3 We have been informed from consultation that there is a highway drain located on Ruthin Road to the south of the northern land parcel. This cannot be identified from street view imagery. However, from reviewing the catchment of the northern parcel water flows easterly away from the highway to the river tributaries. As such runoff from the site to the road is not anticipated. However, we have placed a swale along the edge of this field boundary to capture exceedance runoff. This is also designed to slow runoff from the fields, to reduce the risk to the properties adjacent south of the northern land parcel. This design enables a betterment to pre-existing drainage conditions.

8.4.4 Due to the type of development proposed, the Site is assessed to have a very low risk of flooding from groundwater and sewer flooding and a negligible risk of flooding from reservoirs. No mitigation measures are proposed.

9 POTENTIAL IMPACTS

9.1 Impermeable areas

Solar Arrays

9.1.1 The majority of the Plas Power Solar and Energy Storage Project will be occupied by solar arrays. Although arrays have a large land take, the actual ground impact is negligible. The only intrusion will be from the pile-driven posts. There will be one post for about 6-7 panels, so likely to be 6-7m between each post. Posts are made of galvanized steel and are not solid poles. Traditional fixed solar arrays have surface area ground impact in the range of 0.0012 m^2 - 0.0014 m^2. The number of the modules in this solar farm would be approximately 149,100 with a panel width of 1.3 m. Assuming that there will be posts every 6 m the total number of posts would be 32,305.

9.1.2 Based on this, if the 0.0014 m2 per post is assumed, the total solar farm ground impact would be 45.2 m^2 on a 136ha (1,355,397m^2) Site. This means that what covers the majority of the land as “development” will have a ground impact of approximately 0.00% of the Site.

Ancillary Features

Inverters, Transformers and Switchgear Substations.

9.1.3 A conservative assumption notes that a total of 26 Central Inverters will be placed across the site. The Central Inverters are 8.2m (L) and 2m (W). Per Central Inverters the area is 16.4m^2. As such the total conservative impermeable area from Central Inverters is 426.4m^2.

9.1.4 A total of 26 Transformers will be placed across the site. The Transformers are 5.5m (L) and 4.5m (W). Per transformer the area is 24.8m^2. As such the total conservative impermeable area from transformers is 643.5m^2.

9.1.5 A total of 13 Switchgear Substations will be placed across the site. The Switchgear Substations are 4.2m (L) and 2.6m (W). Per Switchgear Substation the area is 10.9m^2. As such the total conservative impermeable area from Switchgear Substations is 142m^2.

9.1.6 Therefore, the above will create a total of 1211.9m^2 of new impermeable areas within the site which equates to a ground impact of 0.09% across the site.

Auxiliary Transformer

9.1.7 1no. Auxiliary Transformer is proposed. The Transformer is proposed to have 3.8m (L) and 3.8m (W). Per transformer the area is 14.4m^2.

9.1.8 Therefore, the Auxiliary Transformer will create a total of 14.4m^2 of new impermeable areas within the site which equates to a ground impact of 0.001% across the site.

Substations

9.1.9 1no. Customer Substation is proposed. The Substation is proposed to have 10.3m (L) and 5m (W). Per Substation the area is 51.5m^2.

9.1.10 1no. PV intake substation is proposed. This is anticipated to be up to approximately 10.5m (L) x 2.5m (W), a total area of approximately 26.3m^2.

9.1.11 1no. GRP Substation is proposed. This is anticipated to be approximately 3.0m (L) x 3.0m (W), a total area of approximately 9.0m^2.

9.1.12 Therefore, substations will create a total of 86.8m^2 of new impermeable areas within the site which equates to a ground impact of 0.006% across the site.

Spares Container

9.1.13 1no. Spares Container will be located at the site. This is anticipated to be approximately 12.4m (L) x 2.6m (W), a total area of 32.2m^2. Therefore, the spares container will create a total of 32.2m^2 of new impermeable areas within the site which equates to a ground impact of 0.002% across the site.

Monitoring House

9.1.14 1no. Monitoring House will be located at the site. This is anticipated to be approximately 3.9m (L) x 3.2m (W), a total area of 12.5m^2.

9.1.15 Therefore, the Monitoring House will create a total of 12.5m^2 of new impermeable areas within the site which equates to a ground impact of 0.001% across the site.

BESS Components

9.1.16 14no. BESS Enclosures will be located within the BESS area. These are anticipated to be approximately 16.6m (L) x 3.9m (W). Per BESS Enclosure the area is 64.5m^2.

9.1.17 14no. BIC will be located within the BESS area. These are anticipated to be approximately 2.2m (L) x 1.1m (W). Per BIC the area is 2.4m^2.

9.1.18 7no. MV Skid will be located within the BESS area. These are anticipated to be approximately 10.8m (L) x 6.8m (W). Per MV Skid the area is 73.4m^2.

9.1.19 1no. Backup Generator, and 1no. BESS Spares Container will be located within the BESS area. These are anticipated to be approximately 6.3m (L) x 2.6m (W). Per feature the area is 16.6m^2.

9.1.20 1no. BESS Intake Substation will be located within the BESS area. This is anticipated to be approximately 15.7m (L) x 3m (W), the area is 47.1m^2.

9.1.21 1no. BESS Monitoring House will be located within the BESS area. This is anticipated to be approximately 3.9m (L) x 3.2m (W), the area is 12.4m^2.

9.1.22 Therefore, a conservative BESS Area will create a total of 3,746m^2 of new impermeable areas within the site which equates to a ground impact of 0.3% across the site.

Access Tracks

9.1.1 It is proposed that the internal access tracks will be comprised of gravel and fully permeable with no tarmac or other hardstanding type surface. Most will follow existing farm tracks so would not even be new access routes. As such they will have no impact with respect to surface water drainage. Geotextile membrane layers will help to secure the aggregate to prevent it sinking into the soil and this will help prevent ground compaction.

9.1.2 After the construction of the solar farm and battery the heaviest vehicles likely to use the tracks are occasional van or 4x4 type vehicles. There will be less intensive traffic around the Site compared to existing farm use. This means there is low risk of over-use causing compaction that could compromise permeability. Despite this, it will be reasonable to include monitoring and maintenance of the internal accesses over the lifetime of the solar farm and battery site.

9.1.3 In construction there will be no HGVs using the internal access tracks around the Site except from the highway into the Site. All HGVs making deliveries to the Site for construction will drop off in temporary construction compounds at the access point, to be shown on design and layout drawings. Materials will then be delivered around the Site by tractor-trailer type vehicles which are the same as vehicles that currently use these routes around the working farm. This means there is low risk of traffic/vehicles causing excess soil compaction either in construction or during operation which could limit the efficacy of the tracks' permeability.

9.2 Summary

9.2.1 The proposed impermeable surface areas within the 154.5 ha (1,355,397m^2) site is presented within Table 9-1 below. In total, the new impermeable areas create a ground impact across 2,946m^2/0.21% of the site.

Table 9-1. Impermeable areas

Development	Area (m^2)
Solar PV module posts	45.2
Inverters, Transformers and Switchgear Substations	657.94
Substations	86.8
Spares ContainerS	32.2
Monitoring house	12.5
BESS	3,746
Total	**5,149**

10 SURFACE WATER MANAGEMENT

10.1 Introduction

10.1.1 New potential impermeable areas within the site are equivalent to 5,149m^2/0.3% of the whole Site area.

10.1.2 The sustainable management of surface water is an essential element of reducing future flood risk to the site and its surroundings. Legislation and guidance relating to sustainable drainage systems are presented within Section 2, legislation and guidance.

10.1.3 Undeveloped sites generally rely on natural drainage to convey or absorb rainfall, with water infiltrating into the ground or coalescing across the surface towards watercourses.

10.1.4 Modelling work (Cook and McCuen 2013) shows that solar panels themselves do not have a significant effect on runoff volumes, peak flows or times to peak. However, where design decisions or lack of maintenance lead to bare ground then the peak discharge may increase requiring storm water management.

10.1.5 Ancillary features are expected to increase hardstanding within each site. Reducing the permeability of at least part of the site will however lead to marked changes in each site's response to rainfall. Without specific measures to manage surface water the volume of water and peak flow rate are likely to increase. Inadequate surface water drainage arrangements can threaten the Project itself and increase the risk of flooding to others.

10.1.6 Surface water arising from a developed site should as far as is practicable be managed in a sustainable manner to mimic the natural hydrology of the site while reducing the risk of flooding and elsewhere, taking climate change into account.

10.1.7 Generally, this type of development is considered to have a design life of 40 years. Therefore, for the purposes of this assessment, taking into account Wales climate change allowances a 20 % increase in peak rainfall intensity has been included as climate change allowance, which caters up to the year 2115. No climate change guidance is available beyond 2115.

10.2 Existing Surface Water Runoff Rates

Greenfield Runoff Rate

10.2.1 The existing runoff rate has been calculated using the Interim Code of Practice for Sustainable Drainage Systems (ICP SuDS) Method. Existing greenfield runoff rates are presented in Table 10-1. Existing surface water run-off rates per hectare are listed below. ICP SuDS calculations are included as **Appendix D.**

- Area: 1ha
- Standard-period Average Annual Rainfall: 967 mm/yr
- Soil (global soils index): 0.3
- Region number: 9 (catchment based on Flood Studies Report Figure I.2.4.).

Table 10-1. Existing surface water run-off rates

Return period (years)	Runoff rate (l/s/ha)*
1 in 1	2.3
QBAR**	2.7
1 in 30	4.7
1 in 100	5.8

**l/s = litres per second*
***Mean Annual Flood*

10.2 The presence of solar panels and associated ancillary buildings will result in total potential new impermeable surfaces 5,149m^2/0.3% of the whole site area. If a conservative approach is adopted, it is assumed that the ancillary buildings will entail new hardstanding within the site.

10.3 Proposed Development Conceptual Drainage Strategy

10.3.1 A conceptual drainage strategy is based on the Proposed Development Layout as presented within **Appendix E**. The discharge location and method of surface water flows is to be determined at detailed design stage, following soakaway testing.

Solar Panels

10.3.2 It is expected precipitation would be intercepted by between 25% to 40% of the surface of the site typically over-sailed by solar PV modules. A known concern is the risk of water “sheeting” off a solar array façade. As a result of the construction of the solar panels, some rainfall will be intercepted by the surface of the arrays before reaching ground level. Intercepted rainfall will either run down the face of the panels and drip onto the ground below or will be lost due to evaporation from the face of the panels. Without mitigation there is a risk of erosion of the ground on which rainwater drips. This could then result in the formation of rivulets which could increase the speed at which runoff discharges from the site.

10.3.3 However, the potential for erosion to occur as a result of the ‘drip effect’ is appropriately mitigated by features of the solar arrays themselves, typical solar arrays are constructed with gaps between each panel on an array which allows surface water to fall to the vegetated ground beneath.

10.3.4 As presented within Figure 12 and **Appendix B.3**, the solar PV modules for Plas Power are to have a 25 degree pitch on the horizontal plane. This will reduce the flow velocity of run-off landing on the solar PV modules, resulting in run-off to drip down through gaps between individual panels and thus reducing the risk of water sheeting and run-off from the lower edge of the modules. Figure 13 is from the underside of a typical array providing a helpful visual aid to show what the gaps are like. These images are provided for context and comparison only.

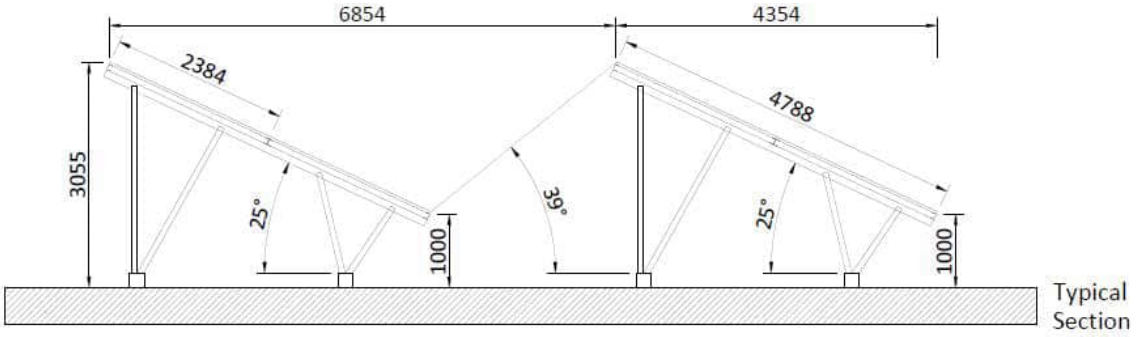


Figure 12. Solar Panel Elevation

Figure 13 Typical underside of a solar panel

Filter strips

10.3.5 Filter strip SuDS comprising of appropriate seeded vegetation will be provided below and between rows of the solar PV modules to dissipate energy of surface water and promote low erosivity sheet flow during operation of the Project. The vegetation will be managed organically and will either be mowed or used for light grazing. The grassland will not only grow between array gaps.

10.3.6 It is expected grassed areas will be managed through quarterly mowing, especially in the early years while the newly operational solar farm is “bedding in”. Year-round ground coverage is an improvement with respect to surface water infiltration compared to existing arable use where the ground is regularly bare following crop harvest. Filter strips are presented within **Appendix E** the Conceptual Drainage Layout.

Swales

10.3.7 Swales (interceptor channels) comprising of appropriately seeded vegetation will be provided along the downstream perimeter of solar PV module parcels to capture and attenuate any exceedance flows from solar PV modules following high intensity rainfall events. Swales are presented within **Appendix E** the Conceptual Drainage Layout. The sizing and discharge location of swales are subject to detailed drainage design and soakaway testing.

BESS Components

10.3.8 The report takes a conservative approach and suggests that the BESS components on site will entail new hardstanding. However, this is not entirely accurate. The ancillary features comprise of prefabricated containers. They are not intended as permanent buildings as the site will require full reinstatement of the land to agricultural use at the end of the site's operational life. Therefore, there is no interest in creating any kind of permanent foundation for the temporary ancillary features. No poured concrete or other non-permeable foundation will be used.

10.3.9 The containers must have a floor level that is off the ground by at least 100mm and they are typically located on plinths or blocks 100-500mm off the ground. Within the Proposed Development, the containers will sit atop a 300mm deep gravel base with a 500mm void between the floor level of the unit and the permeable foundation beneath. Therefore, the only impermeable surface would be the area of blocks that stabilise the invertors on the gravel base.

Attenuation basin

10.3.10 Taking forward a conservative approach to surface water attenuation, the impermeable area of the BESS components has been taken forward within drainage calculations. Based on a conservative assumption of an impermeable area of 3,746m^2, approximately 233m^3 of attenuation will be required to accommodate flows from the 1 in 100 critical storm event, with an uplift to account for climate change. Calculations are presented within **Appendix E**.

10.3.11 This is proposed to be attenuated within a 1.2m deep attenuation basin with 300mm easement strip and discharge to an ordinary watercourse directly adjacent to the basin. It is proposed to restrict this to 2l/s. The greenfield runoff rate is 0.86 l/s but, to allow for self-cleansing 2 l/s is deemed acceptable. The attenuation basin is presented within **Appendix E** the Conceptual Drainage Layout.

Ancillary Features

10.3.12 The report takes a conservative approach and suggests that the ancillary buildings on site will entail new hardstanding. However, this is not entirely accurate. The ancillary features comprise of prefabricated containers. They are not intended as permanent buildings as the site will require full reinstatement of the land to agricultural use at the end of the site's operational life. Therefore, there is no interest in creating any kind of permanent foundation for the temporary ancillary features. No poured concrete or other non-permeable foundation will be used.

10.3.13 The containers must have a floor level that is off the ground by at least 100mm and they are typically located on plinths or blocks 100-500mm off the ground. Within the Proposed Development, the containers will sit atop a 300mm deep gravel base with a 500mm void between the floor level of the unit and the permeable foundation beneath. Therefore, the only impermeable surface would be the area of blocks that stabilise the invertors on the gravel base.

Gravel bases

10.3.14 Each ancillary feature unit is to be placed upon a permeable gravel-filled infiltration blanket filled with a 30% void ratio to provide surface water attenuation. The gravel base will not alter the underlying condition beyond the topsoil; what would otherwise be topsoil will be replaced by gravel, which has 30% more porosity and storage capacity than the existing topsoil would have.

10.3.15 Conceptual drainage calculations have been undertaken using the industry standard MicroDrainage software to assess indicative dimensions of the gravel bases to accommodate attenuation requirements for the 1 in 100-year critical storm event plus a 20% climate change uplift. A summary of the results are presented in Table 10-2 and Calculations are presented within **Appendix F**. Due to the modelling resolution of the software, impermeable areas have been modelled at 10m^2 increments.

Table 10-2 Attenuation requirements and volumes

Impermeable area	Area of each unit (m^2)	Attenuation required (m^3)	Indicative required dimensions of gravel base(m^3)
Inverters	16.4	3.0	8.2 * 2 * 0.3
Transformers	24.8	3.0	5.5 * 4.5 * 0.3
Switchgear Substation	10.9	1.5	4.2 * 2.6 * 0.3
Auxiliary Transformer	14.4	3.0	3.8 * 3.8 * 0.3
PV Substation	26.3	3.0	10.5 * 2.5 * 0.3
Customer Substation	51.5	7.5	10.3 * 5 * 0.3
GRP Cabinet	9.0	1.5	3 * 3 * 0.3
Spares Container	32.2	4.5	12.4 * 2.6 * 0.3
Monitoring House	12.5	3.0	3.9 * 3.2 * 0.3

Access Tracks

10.3.16 It is proposed that the internal access tracks will be fully permeable with no tarmac or other hardstanding type surface. Most will follow existing farm tracks so would not even be new access routes. As such they will have no impact with respect to surface water drainage. Geotextile membrane layers will help to secure the aggregate to prevent it sinking into the soil and this will help prevent ground compaction.

10.3.17 After the construction of the solar farm and battery the heaviest vehicles likely to use the tracks are occasional van or 4x4 type vehicles. There will be less intensive traffic around the site compared to existing farm use. This means there is low risk of over-use causing compaction that could compromise permeability. Despite this, it will be reasonable to include monitoring and maintenance of the internal accesses over the lifetime of the solar farm and battery.

10.3.18 In construction there will be no HGVs using the internal access tracks around the Site except from the highway into the Site. All HGVs making deliveries to the site for construction will drop off in temporary construction compounds at the access point. Materials will then be delivered around the site by tractor-trailer type vehicles which are the same as vehicles that currently use these routes around the working farm. This means there is low risk of traffic/vehicles causing excess soil compaction either in construction or during operation which could limit the efficacy of the tracks' permeability. Based on the above no attenuation is required.

10.4 SuDS Maintenance

10.4.1 Table 10-3 below shows the typical drainage maintenance plan suitable for gravel bases (extracted from SuDS Manual C753).

Table 10-3 Gravel base maintenance

Maintenance schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly, or as required
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect gravel for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from gravel	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the gravel (if applicable), using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required

10.4.2 Table 10-4 below shows a typical drainage maintenance plan suitable for filter strips (extracted from SuDS Manual C753).

Table 10-4 Filter Strip maintenance

Maintenance schedule	Required Action	Typical Frequency
Regular maintenance	Mow amenity grass access paths	Monthly, or as required
	Mow filter strips	Monthly, or as required
	Where marsh or wetland develops due to wet conditions then cut annually, or as required, at 100mm cuttings to wildlife piles on site	Annually or as required
Occasional maintenance	Where there is a build-up of silt on the filter strip, remove and spread on site	As required
Remedial factors	All damage to be made good to design profile unless there is a design flaw.	As required

10.4.3 Table 10-5 below shows a typical drainage maintenance plan suitable for attenuation basin (extracted from SuDS Manual C753).

Table 10-5 Basin maintenance

Maintenance schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly

	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial factors	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required

10.5 Water Quality

10.5.1 Compared to agricultural (arable and livestock) use, the solar aspects are likely to create an overall betterment in surface water drainage than a continuation of the existing use.

10.5.2 The primary reason for this is the significant advantage from full year-round organically managed vegetated ground cover on within solar PV module areas compared with intensive arable or livestock grazing uses. Research undertaken by Cook and McCuen (2013) found that provided full vegetation cover beneath the solar modules is maintained, the change in run-off characteristics from solar PV module areas is likely to be insignificant and that ground cover has a much more important control over runoff.

10.5.3 A second environmental benefit of solar PV modules are soil quality improvement from cessation of intensive arable use and organic management of the land. It is expected that soil health will be improved through increase in soil organic matter, increase in the diversity of soil flora, fauna and microbes, and improved soil structure. The ceasing of intensive agricultural practices during operation of the solar farm will likely result in an improvement in the quality of surface water runoff generated within the site as a result of reduced sediment loadings, phosphorous and nutrients.

10.5.4 When the operational phase ends, the Project will be decommissioned. The anticipated period of operation and decommissioning is 40 years. Solar PV modules, mounting structures, cabling, inverters and transformers will be removed from the site and recycled or disposed of in accordance with good practice and market conditions at that time. All of the elements of solar PV modules can be removed with minimal topsoil disturbance which should leave the improved and enriched soil as a benefit for the return to arable use.

10.5.5 As the land will be returned to full agricultural after the expiration of the solar farm and battery consent, Sustainable drainage system features that require a straightforward restoration to existing agricultural use with minimal ground disturbance or disruption to new and improved ecological features.

10.6 Event Exceedance

10.6.1 The proposed surface water drainage strategy caters for the 1 in 100 year plus 20% climate change event. In the event the attenuation measures reach capacity excess water will overtop and be conveyed by gravity across the fields mimicking the existing Site runoff characteristics. This

approach will aid in managing flood flows, whilst at the same time ensuring that the vegetated ground cover and existing and new boundary vegetation receive suitable hydration.

10.6.2 Solar farm components are not vulnerable in the event of exceedances. There is no need to mitigate a risk that does not exist, or for infiltration testing when there is no reason to expect a negative impact on the current baseline and every reason to expect at least modest betterment from gravel storage vs. topsoil storage.

10.6.3 Without introducing new unnatural SuDS within the majority of the Site, there will be betterment from full year-round vegetated ground cover compared existing intensive arable use. Aforementioned Cook and McCuen (2013) research advises that vegetated ground should be provided under and around arrays and maintained to avoid bare earth, but as long as this is done a solar farm has no impact on runoff characteristics.

10.6.4 The SuDS scheme for the project will therefore prioritise nature-based solutions for flood risk mitigation as opposed to unnatural elements that might compromise the multifunctional benefits of the cessation of arable farming and green infrastructure enhancement. Beyond attenuation for the ancillary units the remainder of the SuDS will be the natural filter strips between rows, the vegetated ground under arrays and the existing plus new landscape planting boundary treatments.

10.6.5 In support of this strategy overland flow, a pre-development and post-development exceedance flow plan drawing has been produced and is presented within **Appendix G**, the Exceedance Flow Plan drawing.

11 SUMMARY AND CONCLUSIONS

11.1.1 A site-specific Flood Consequence Assessment following the guidance of the Planning Policy Wales and TAN 15 has been prepared for the Proposed Development on land at Plas Power, Wrexham.

11.2 Flood Risk Appraisal

11.2.1 The northern and southern land parcels in which solar PV modules and associated ancillary features will be situated is located entirely within Flood Zone 1 / Zone A. Permeant and temporary site access is also located within this zone.

11.2.2 The cable route corridor is predominantly located within Flood Zone 1 / Zone A. Limited areas are located within Flood Zone 3 / Zone C2.

11.2.3 The Proposed Development is classified to be 'Less Vulnerable'. The Justification Test has been applied to Proposed Development (cable route) located within Zone C2 and is considered to be passed.

11.2.4 There are several surface water flow pathways within the site where the risk is moderate or above. The placement of development features has avoided these areas.

11.3 Surface Water and Soil Management Measures

11.3.1 The Proposed Development is expected to increase impermeable areas within the site by 4,888.25m^2/1.1% of the total site area. A SuDS strategy has been produced to incorporate appropriate management techniques that will mitigate potential increase in runoff from the Proposed Development.

11.3.2 SuDS techniques include filter strips, swales and attenuation for ancillary features is proposed via gravel basis in which infrastructure will be located upon. Access tracks will be constructed out of permeable materials.

11.3.3 Solar PV arrays are designed in such a way to prevent surface water sheeting off panels and potentially causing erosion. Panels are designed to allow surface water to drip off, landing onto filter strips below.

11.3.4 The surface water and soil management measures incorporated within the Proposed Development will ensure that there is negligible alteration to local drainage patterns, flow directions and will manage suspended sediments from entering the drainage channels.

11.3.5 Where construction has resulted in soil compaction, the areas between panel rows would be tilled / scarified to an appropriate depth and then re-seeded with an appropriate vegetation cover. Any existing field or tile drainage system will be restored, where affected by construction will be maintained by the client for the life of the development. Furthermore, all areas of the application area, where appropriate, will have vegetation cover at all times.

11.3.6 All ancillary features will be placed on a gravel subbase sized to accommodate the 100 year + 20% CC critical storm event. An attenuation pond is to accommodate any additional runoff from the BESS if it is to be included within the final plans.

11.4 Conclusion

11.4.1 The FCA demonstrates that the site has been appropriately mitigated against all sources of flooding. The following conclusions can be made:

- Development will be restricted to areas at a very low and low risk of flooding.

- The Proposed Development will neither exacerbate existing flooding problems nor increase the risk of flooding on Site or elsewhere.
- Surface water runoff will be mitigated by maintenance of a vegetation cover and SuDS features; and
- With appropriate surface water and soil management measures there is negligible alteration to local drainage patterns direction within the Site.

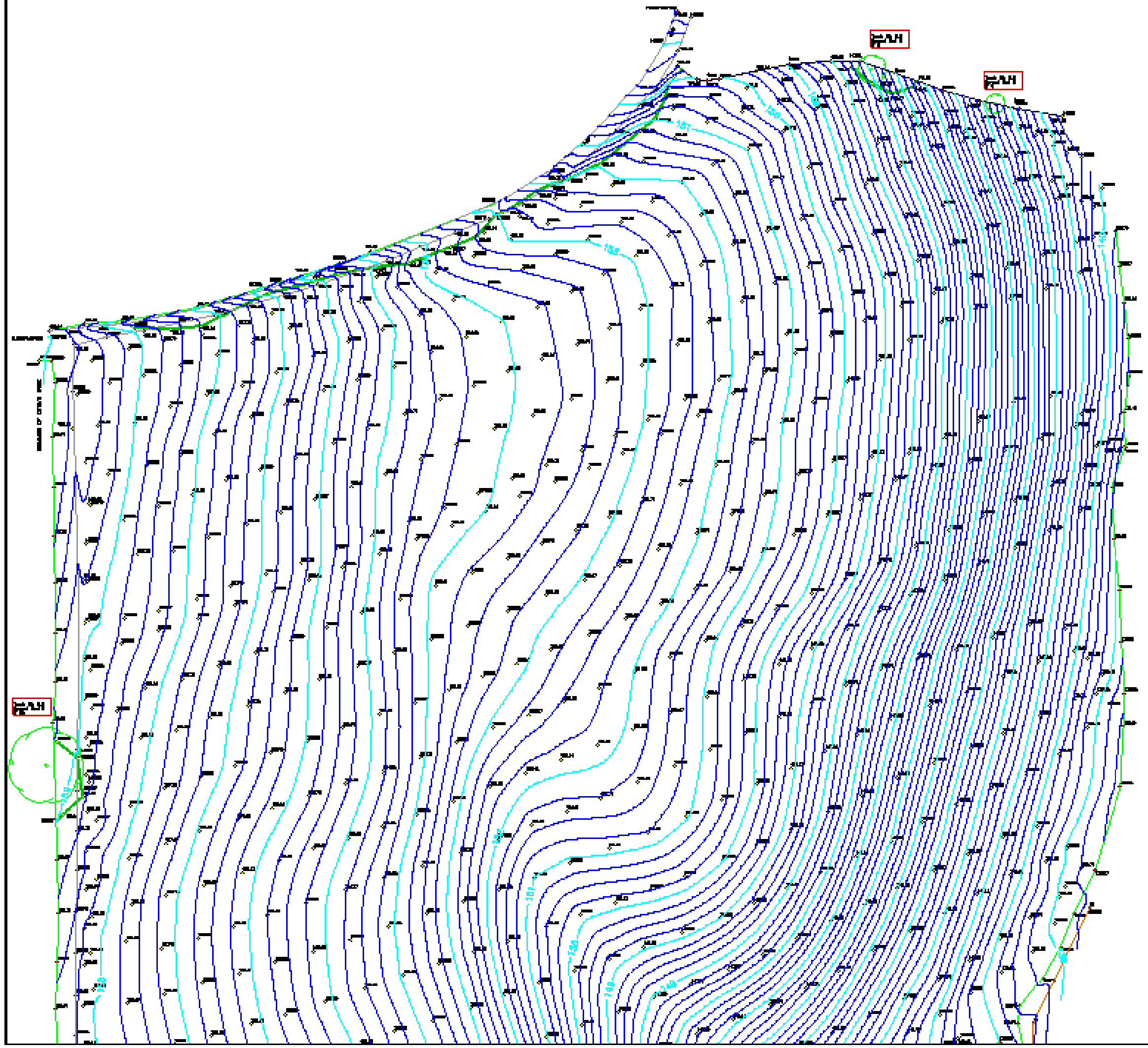
11.4.2 The residual effect of the development on flood risk is therefore considered to be negligible. The solar farm and battery project will be safe for its lifetime, taking account of the limited number of users of the Site with no increase in flood risk elsewhere.

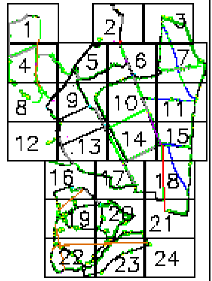
11.4.3 Additionally, the Proposed Development provides significant sustainability benefits including the significant generation of renewable electricity for the National Grid, biodiversity net gain and additional planting benefits.

APPENDICES

Appendix A

Topographic Survey





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bk.tg	[illegible]	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity [illegible]	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	top pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

1. This survey has been computed and drawn about the Ordnance Survey grid and datum and the appropriate scalefactor needs to be applied to use true ground distances.

2. All heights are to OS Newlyn and are derived from OS active network smartnet files.

3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

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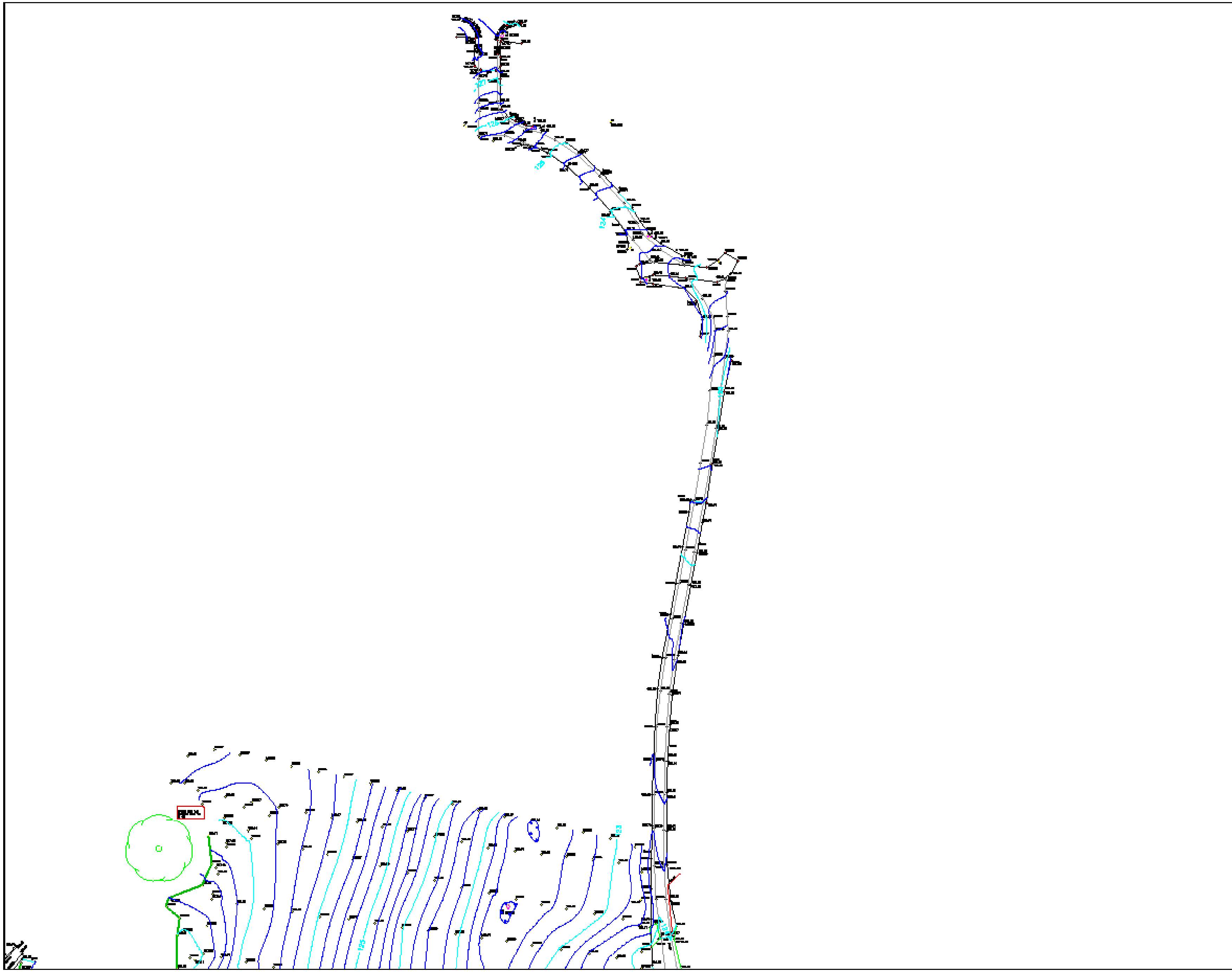
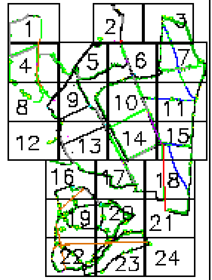
Drawing No. 3233/500/1

Revision





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ABBREVIATIONS

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bb	belisha beacon	mp	marker post
bk.g	back kerb gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable TV cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	tap pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

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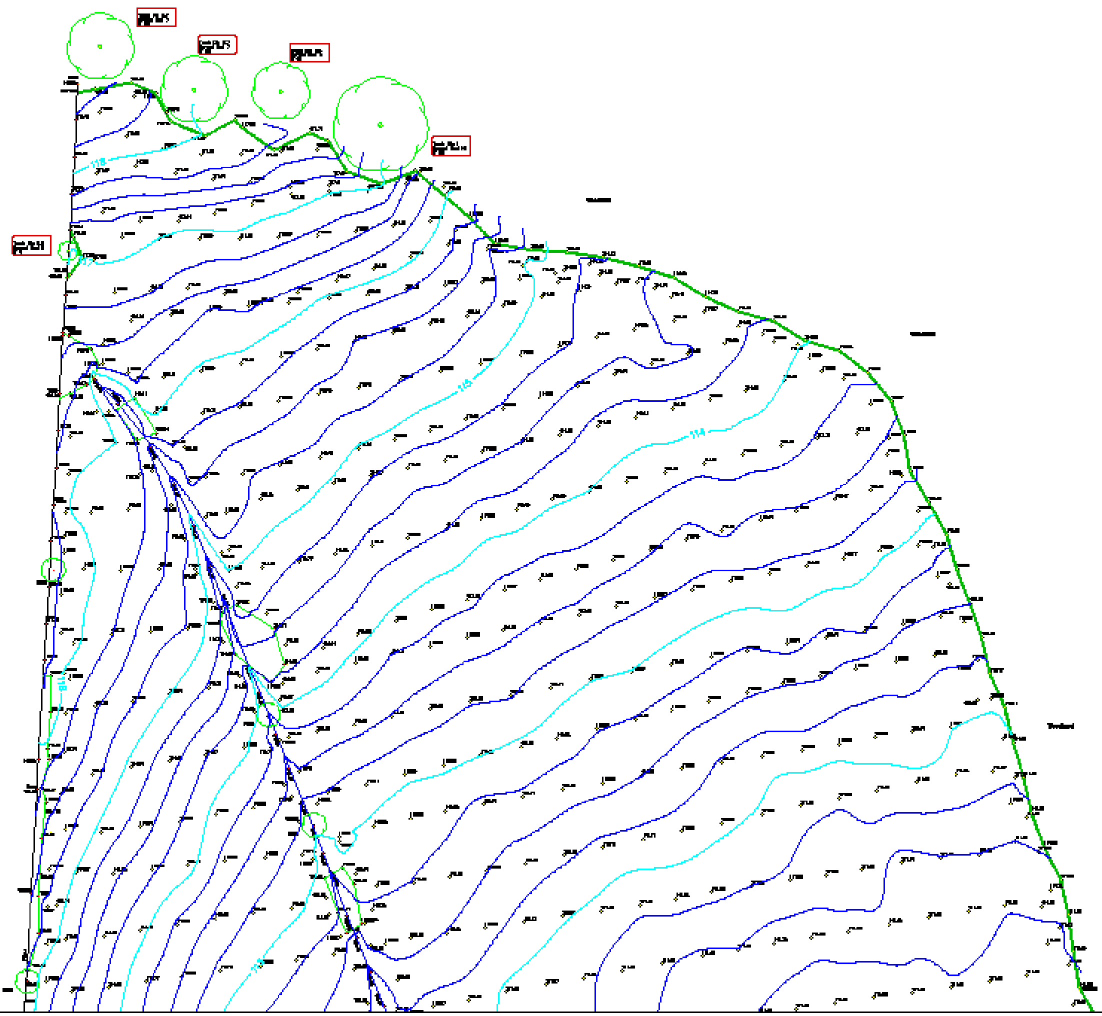

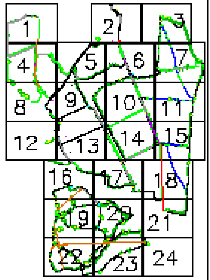

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ABBREVIATIONS

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bb	belisha beacon	mp	marker post
bk.g.	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity ?	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	tap pipe
flag	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door head height
lb	letter box		

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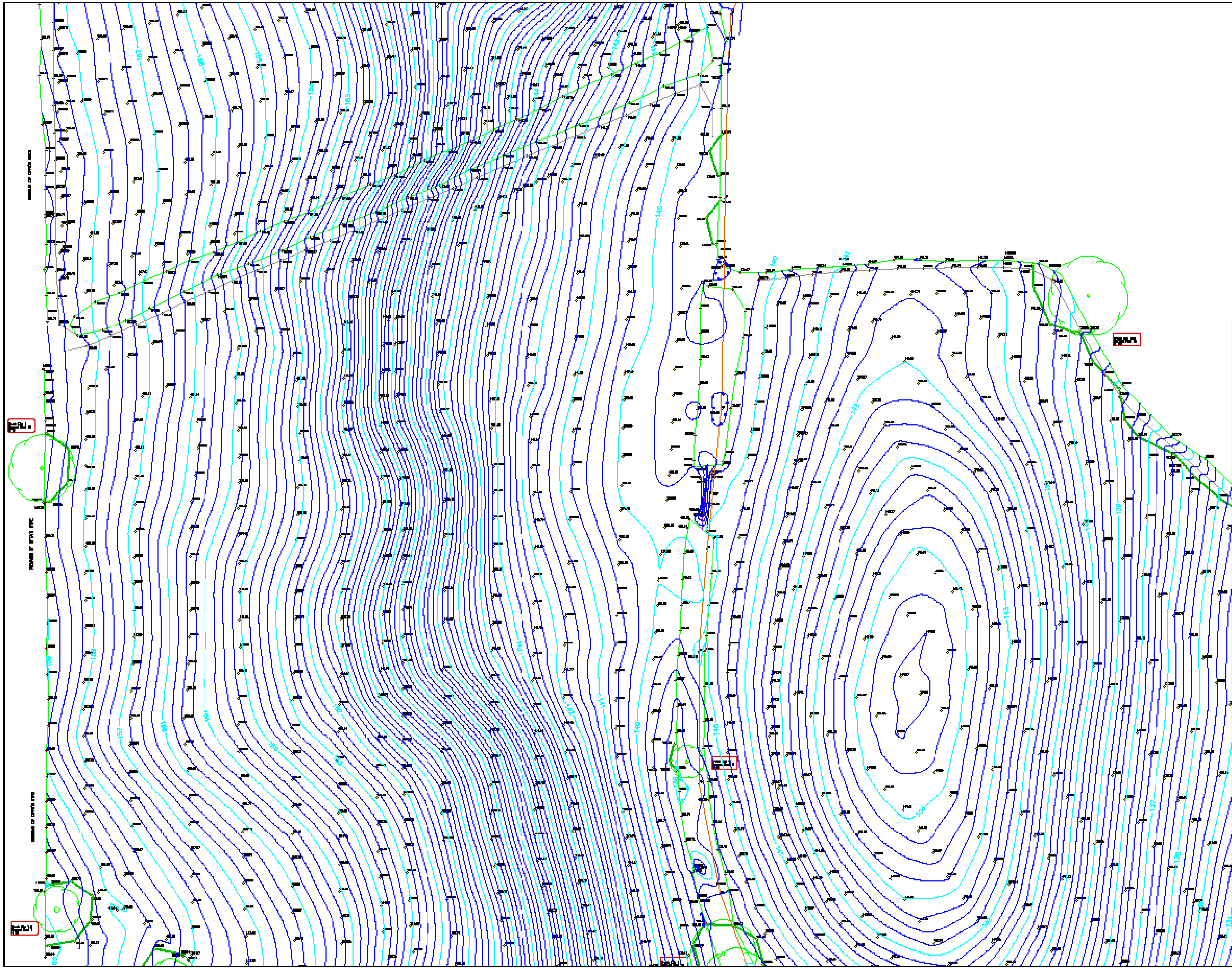

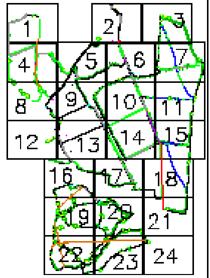

ABBREVIATIONS

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bb	belisha beacon	mp	marker post
bkg	bank kerb gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity [illegible]	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	step top
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	top pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

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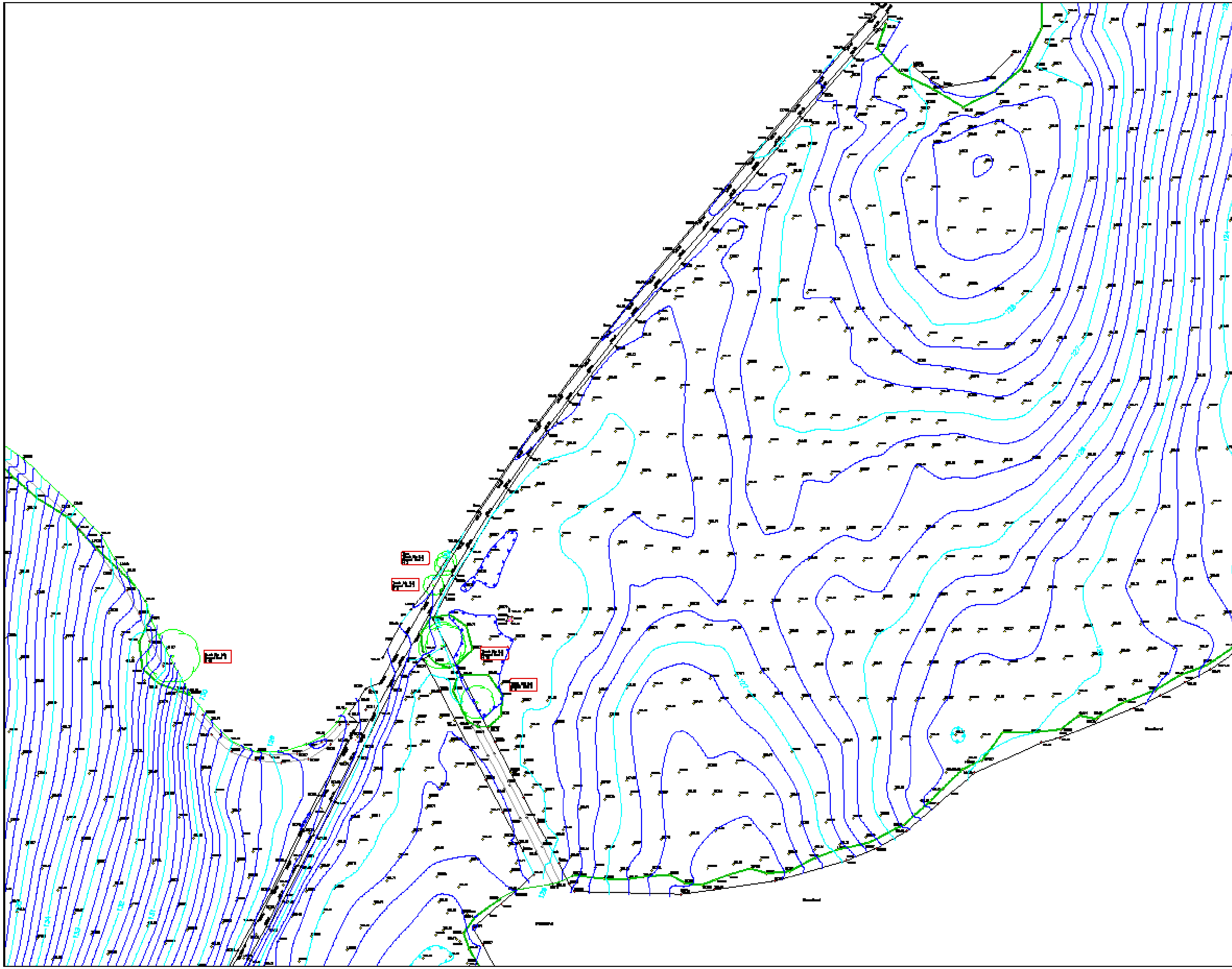

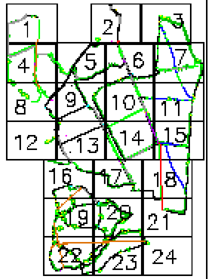

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ABBREVIATIONS

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bb	belisha beacon	mp	marker post
b.t.g.	[illegible]	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity [illegible]	rs	road sign
esb	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tw	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
g	gully	ul	unable to locate
gv	gas valve	ur	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
[illegible]	[illegible]	DHH	door height [illegible]
lb	letter box		

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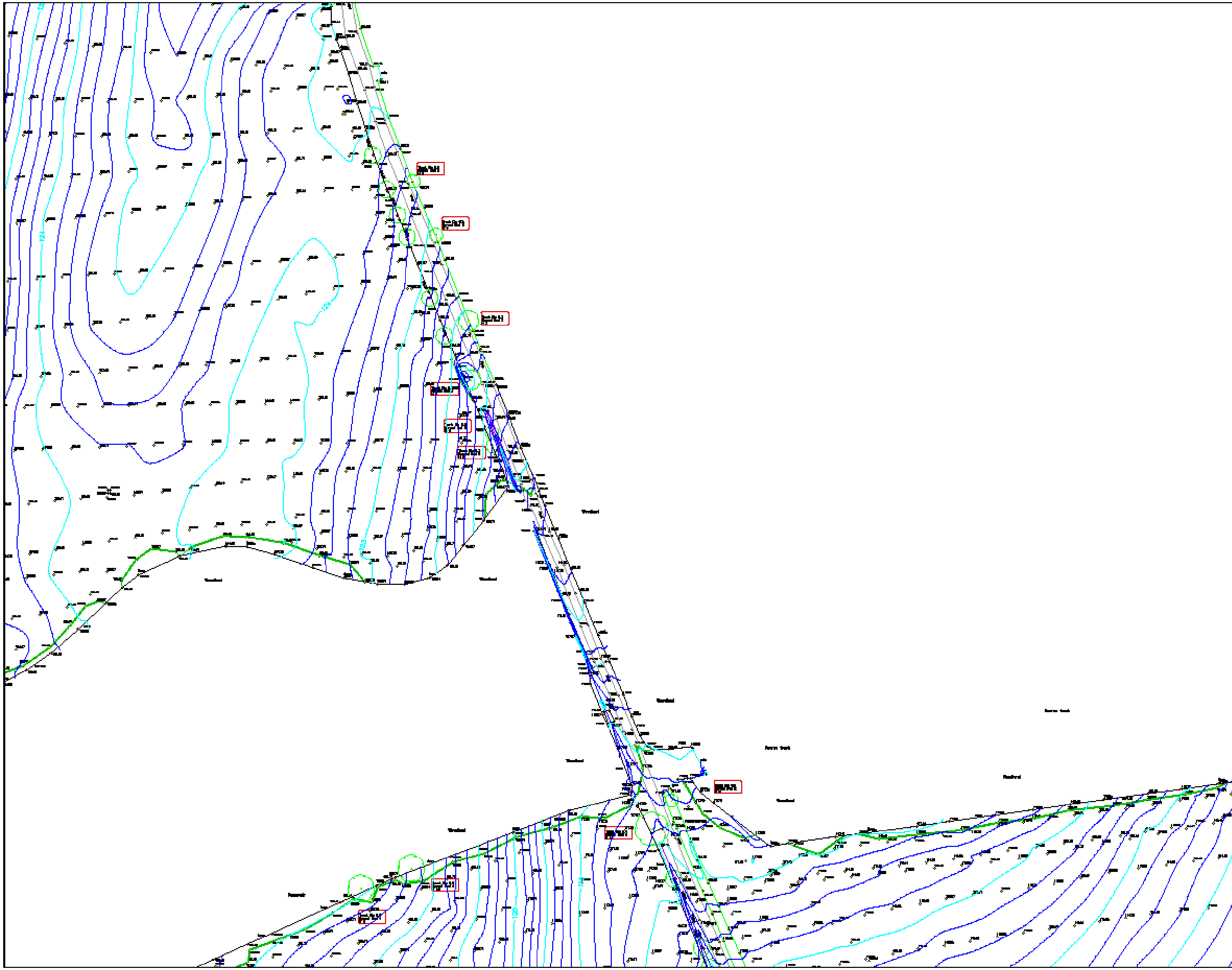

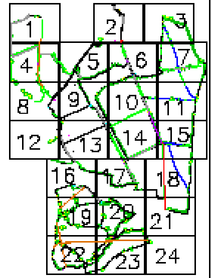

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ABBREVIATIONS

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bb	belisha beacon	mp	marker post
bk/g	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
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fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
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flg	flagpole	ts	traffic signal
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il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

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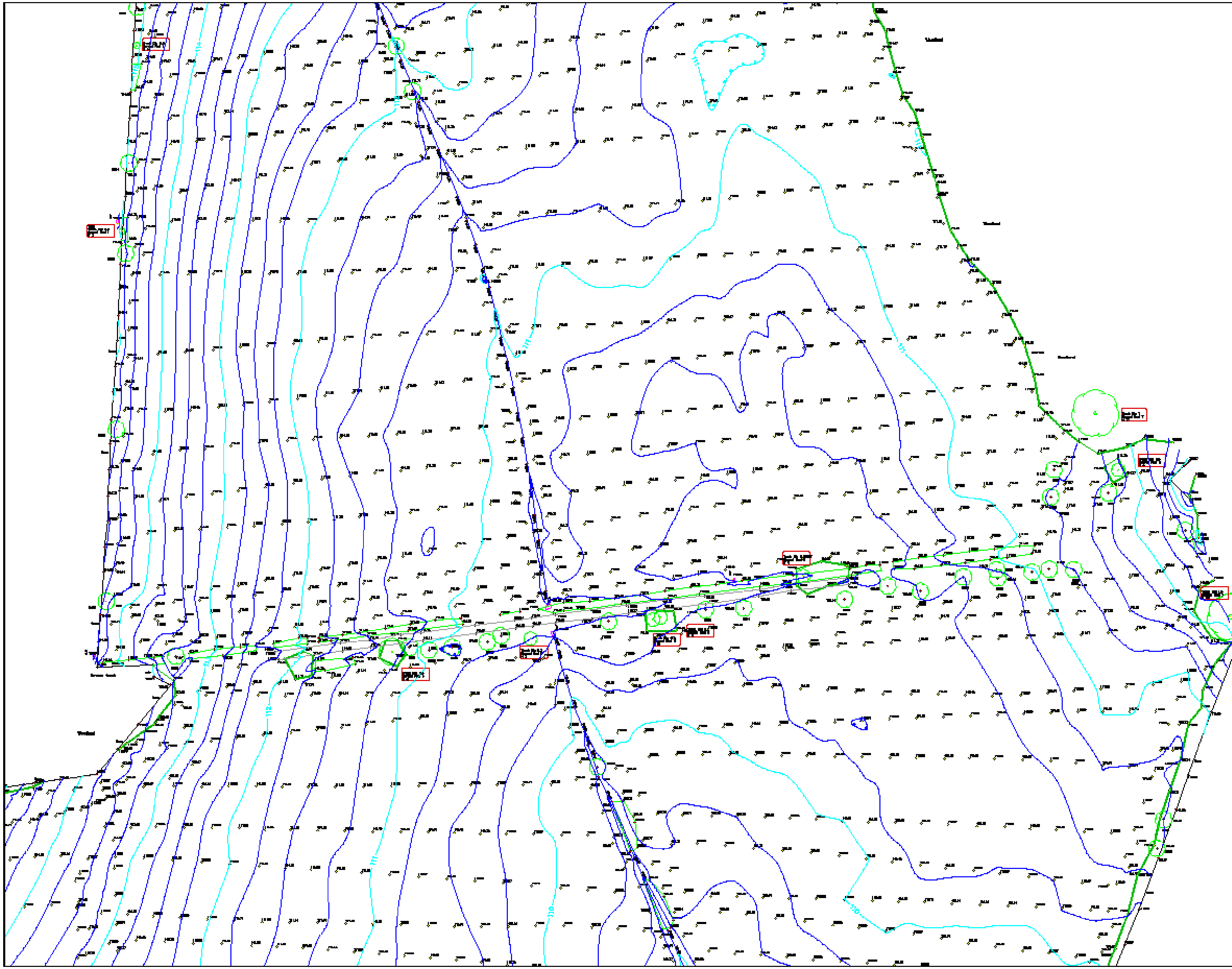

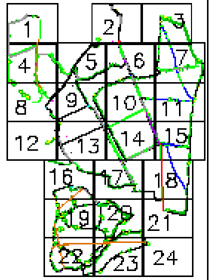

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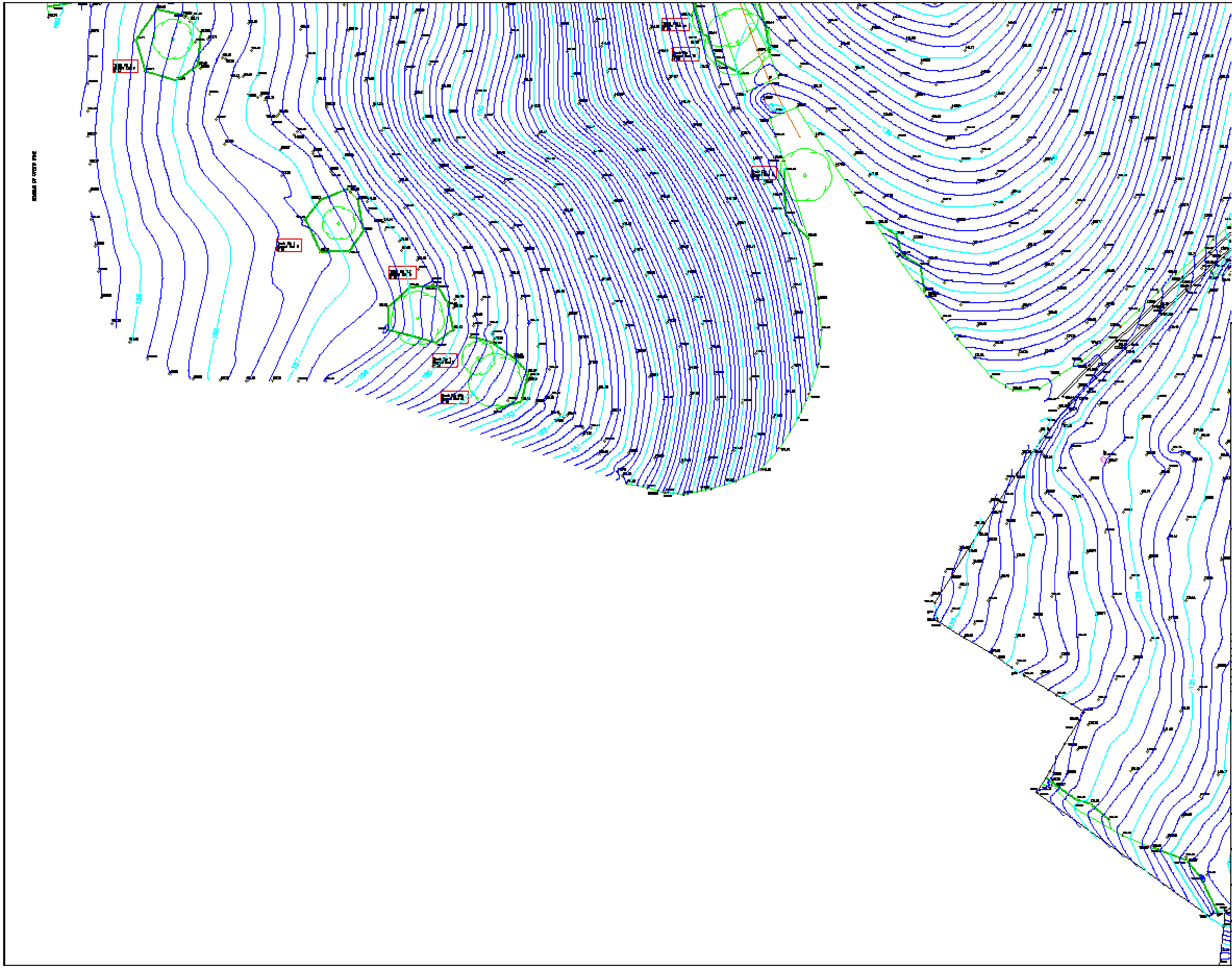

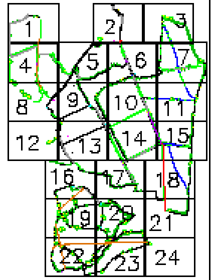

ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	m p	marker post
b.t.g.	back inlet gully	m h	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity fc	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	top pipe
f.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
to	tank outlet	DHH	door height height
lb	letter box		

Notes

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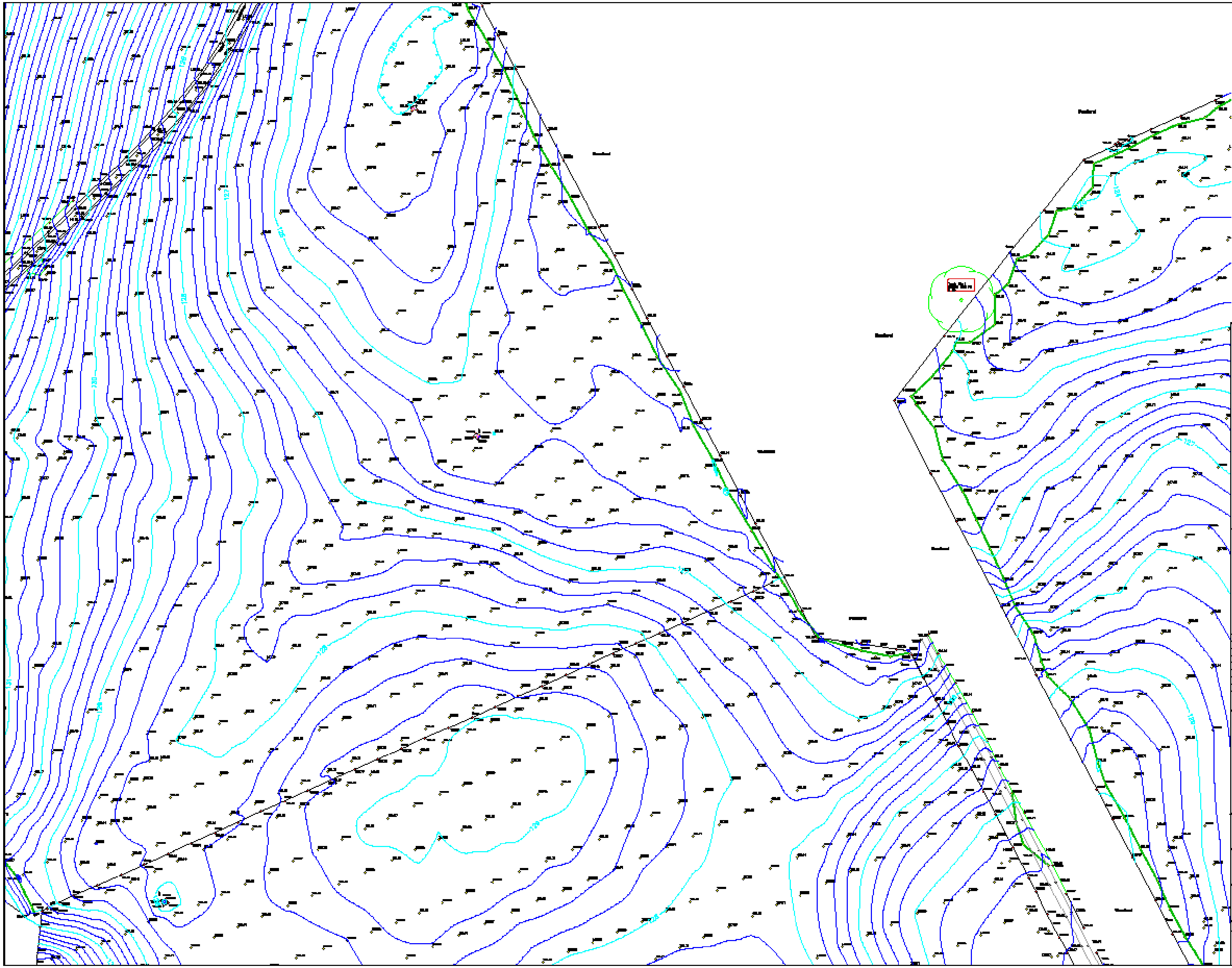

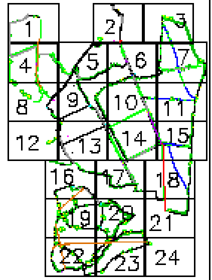

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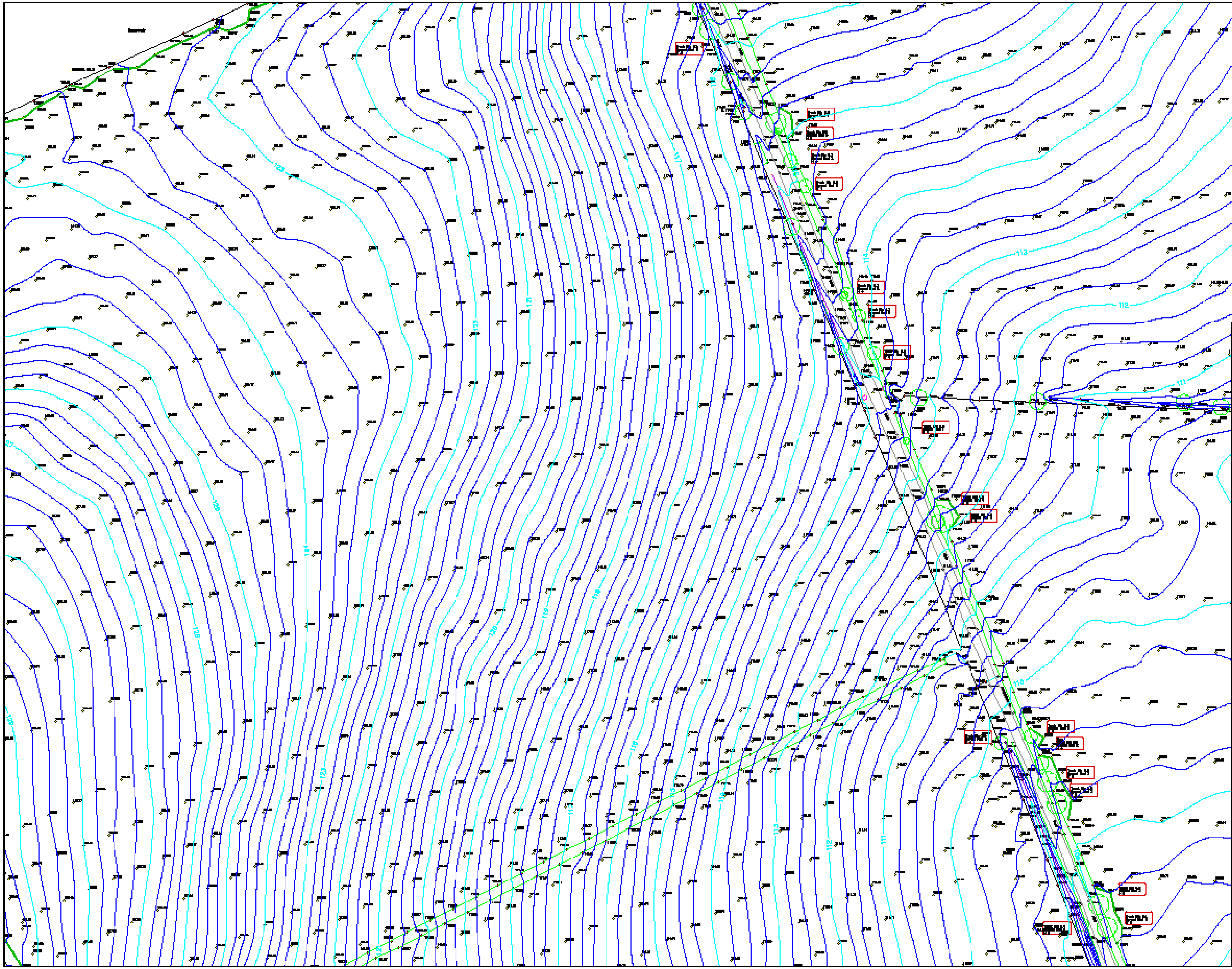
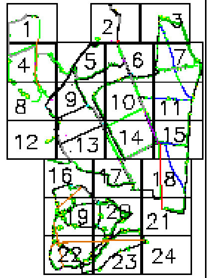
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1
Drawing No. 3233/500/9	Revision 0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bkg	back kerb gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
cabtv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity fc	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tw	top of wall
fp	footpath	tp	top pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
bc	bank cutoff	DHH	door head height
lb	letter box		

Notes

1. This survey has been computed and drawn about the Ordnance Survey grid and datum and the appropriate scalefactor needs to be applied to use true ground distances.
2. All heights are to OS Newlyn and are derived from OS active network smartnet files.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

Revision No.	Description	Date	Issued By
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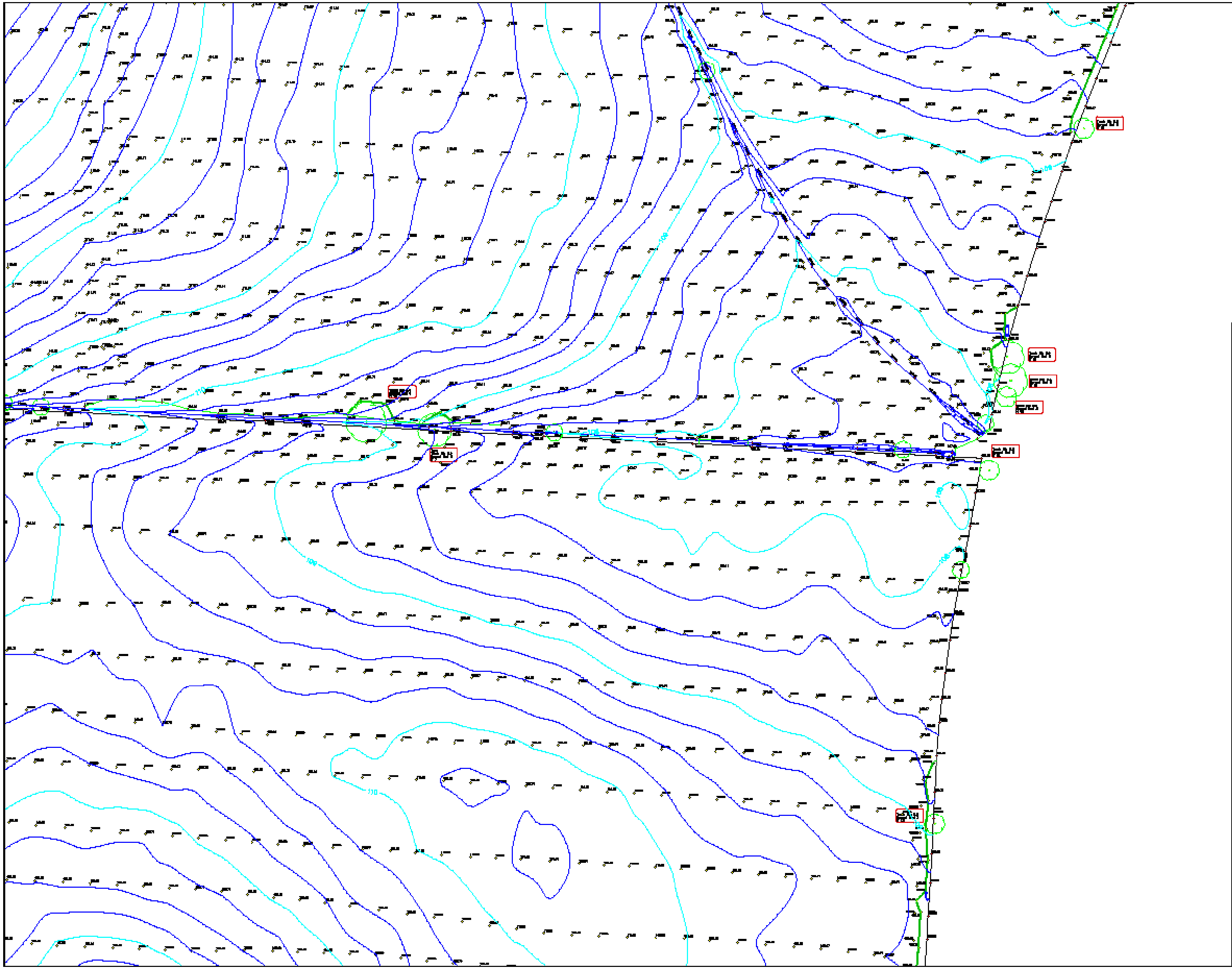
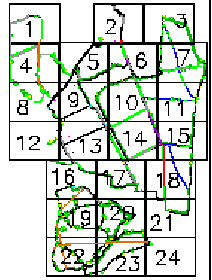
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1

Drawing No. 3233/500/10

Revision 0





N

ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bkg	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
ctv	cable TV cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity fc	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	tap pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
lo	lamb outlet	DHH	door height height
lb	letter box		

Notes

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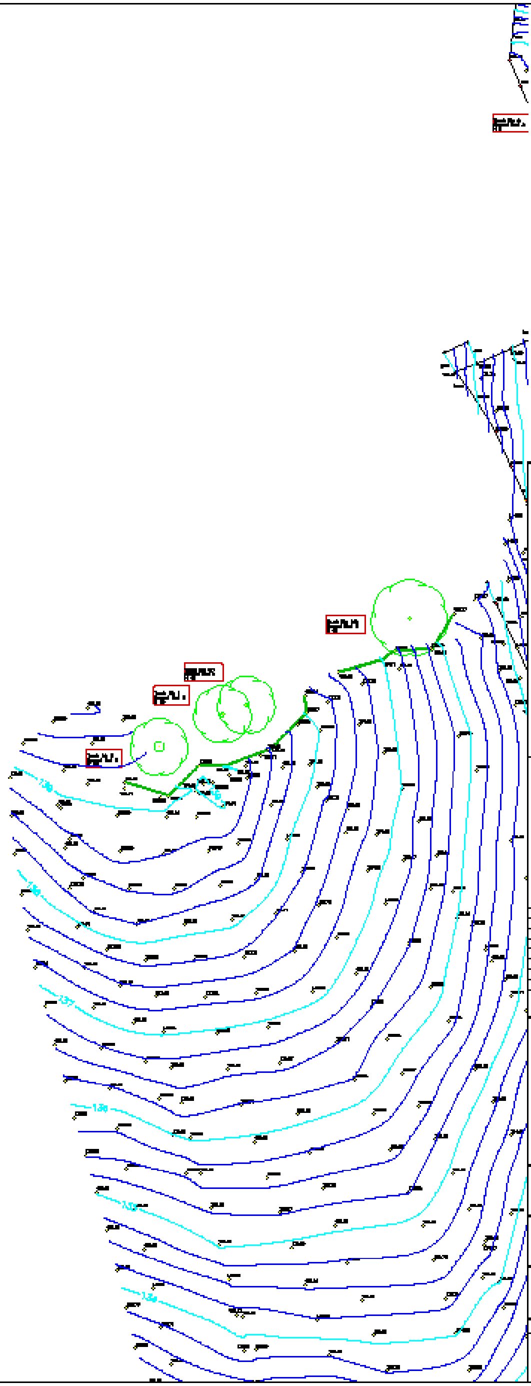
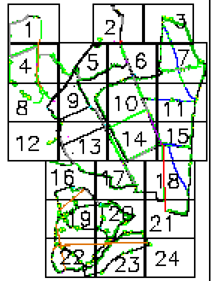
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1

Drawing No. 3233/500/11

Revision 0





ABBREVIATIONS

Notes

Revision No.	Description	Date	Issued By
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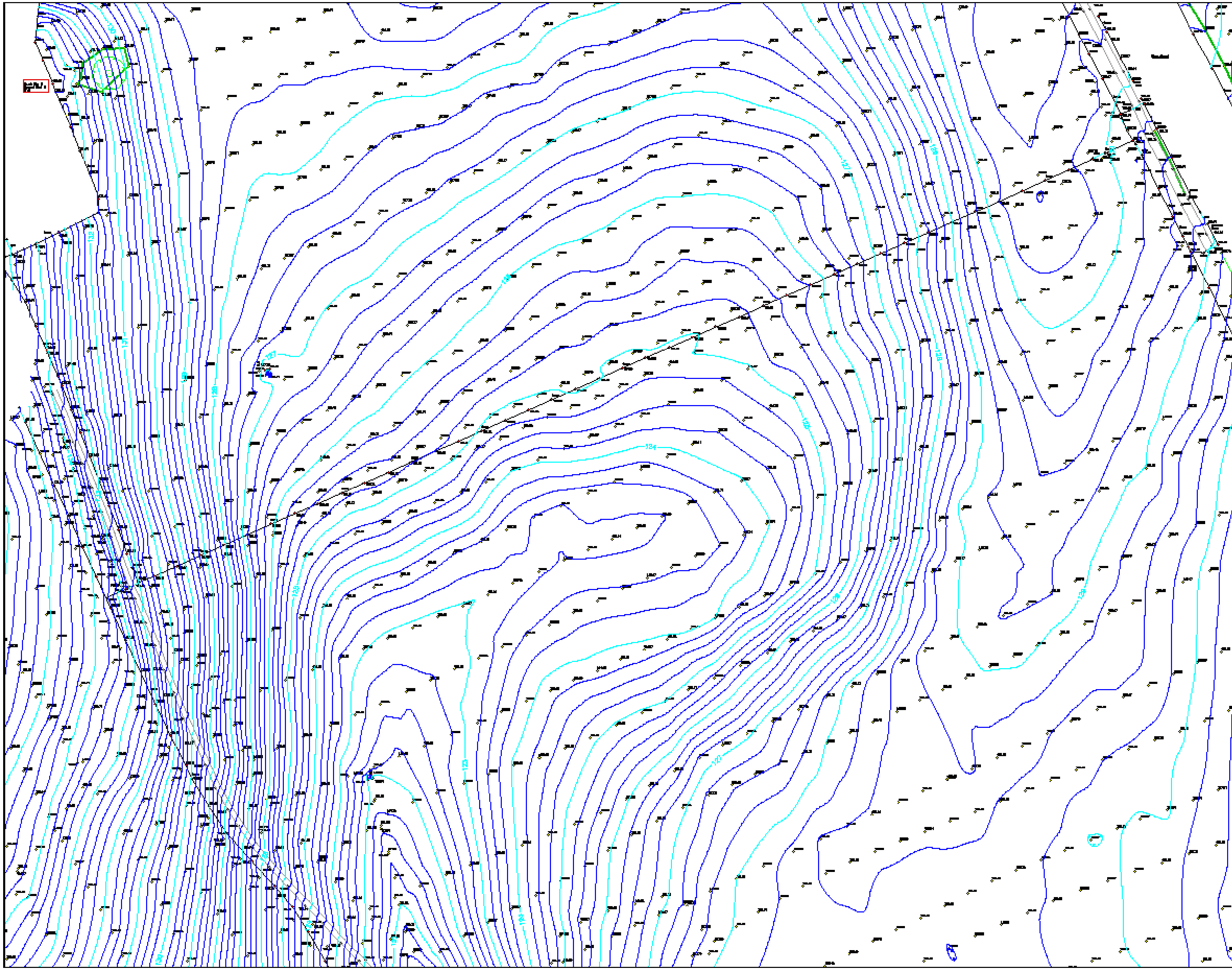
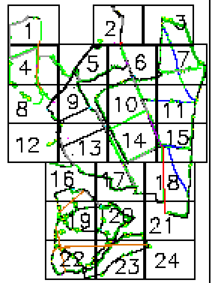
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey

Scale 1:500 | Sheet Size A1

Drawing No. 3233/500/12

Revision 0





N

ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bk.t.g	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity ??	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tw	top of wall
fp	footpath	tp	top pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door head height
lb	letter box		

Notes

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Revision No.	Description	Date	Issued By
0	First Issue	28.02.2020	AG

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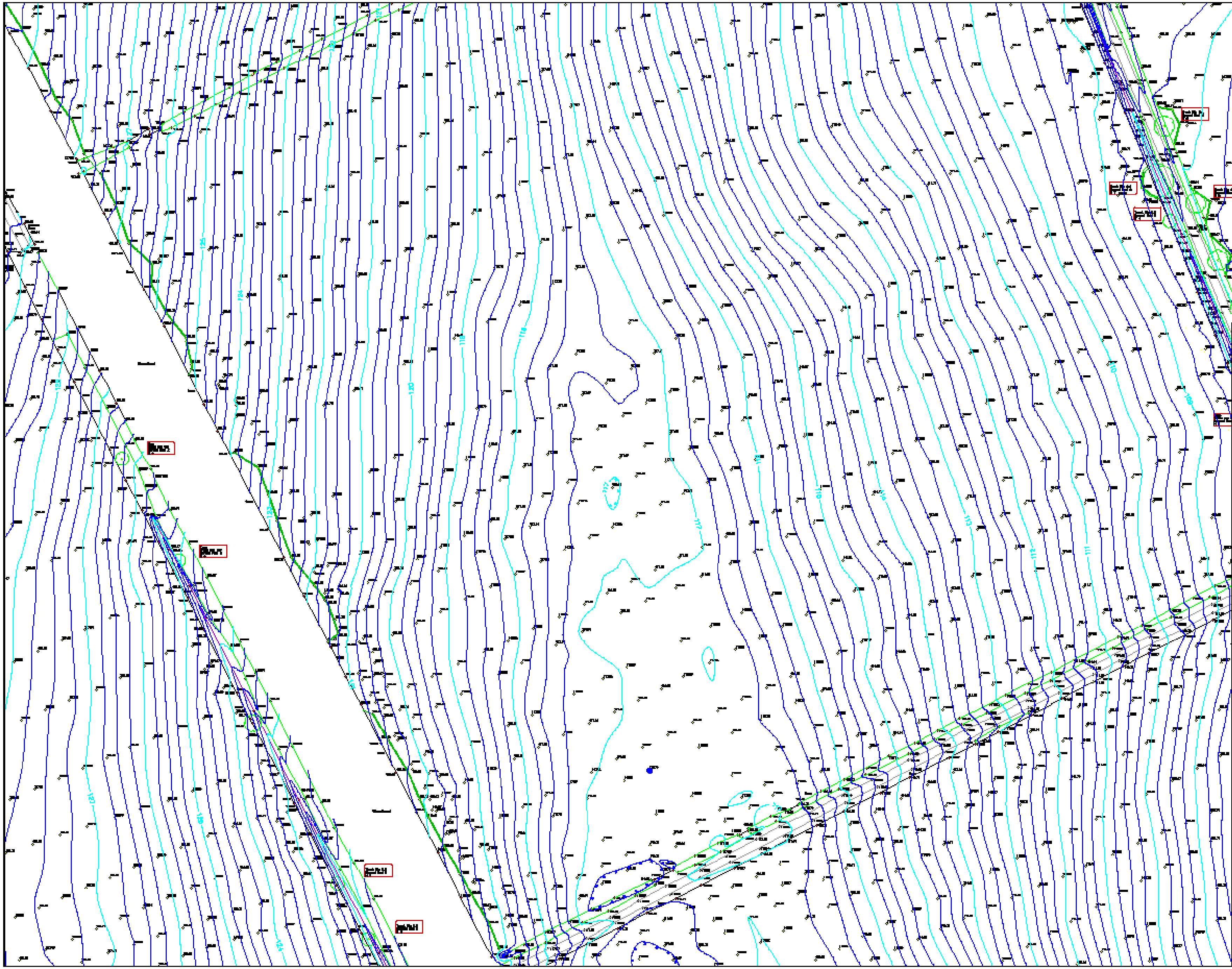
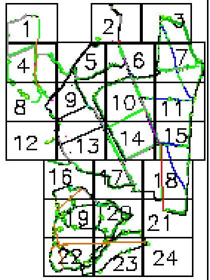
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1
Drawing No. 3233/500/13	Revision





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bi.g	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tw	top of wall
fp	footpath	tp	top pipe
flp	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

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3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

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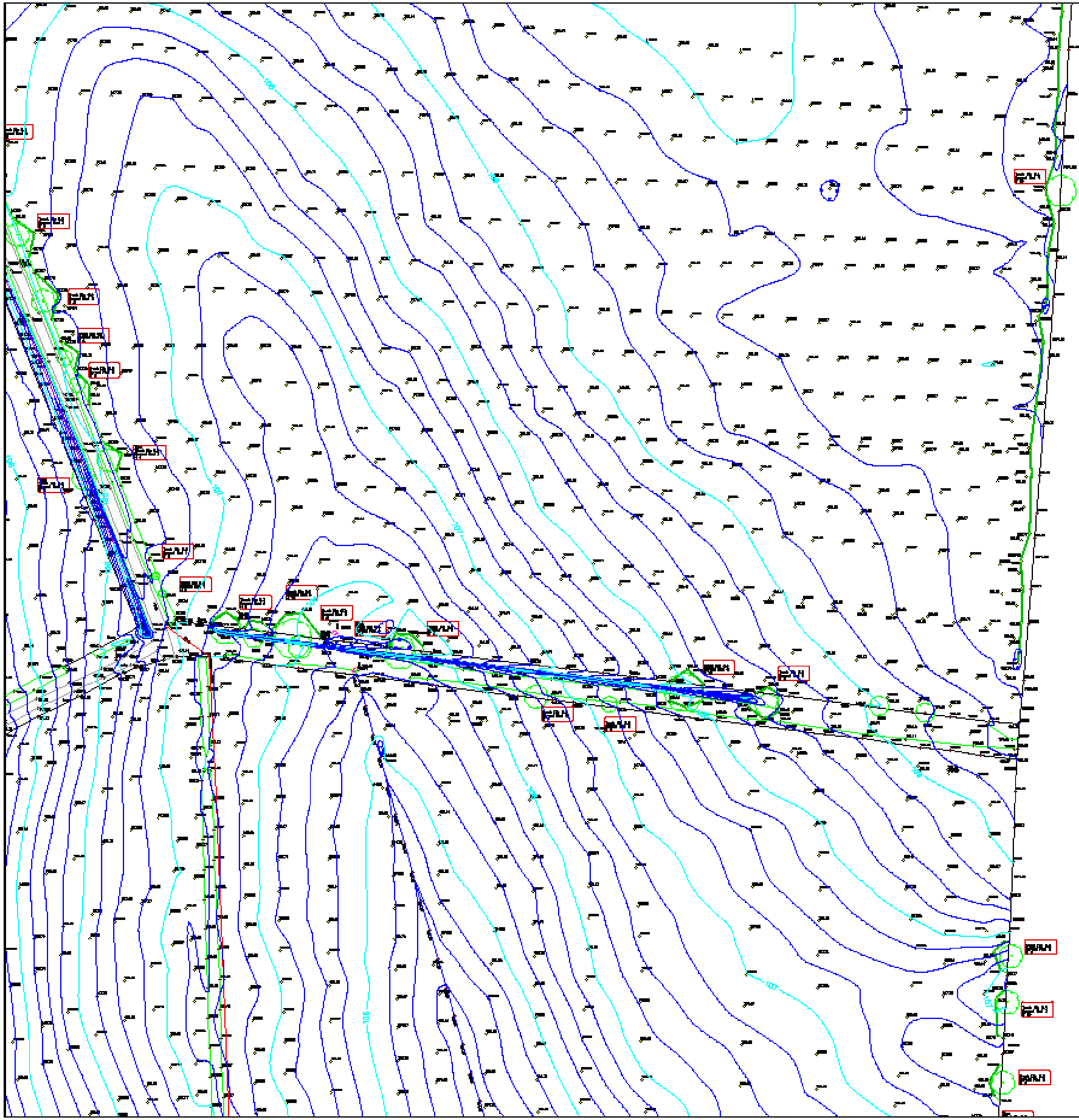
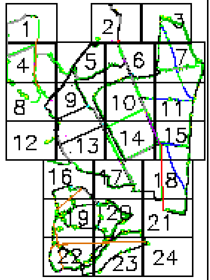
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale 1:500	Sheet Size A1
Drawing No. 3233/500/14	Revision 0





ABBREVIATIONS

Notes

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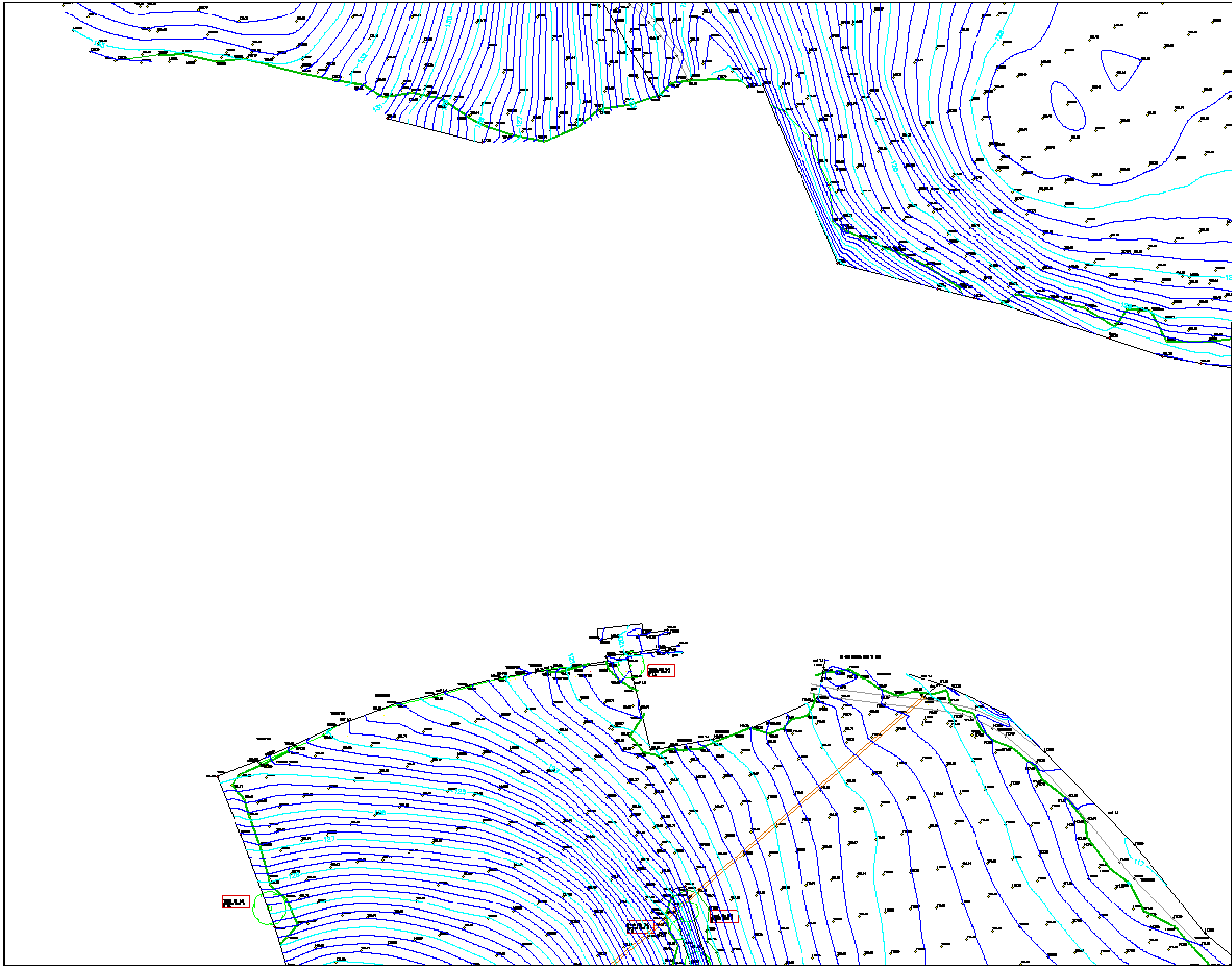
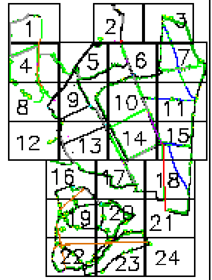
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale 1:500	Sheet Size A1
Drawing No. 3233/500/15	Revision 0





N

ABBREVIATIONS

Notes

1. This survey has been computed and drawn about the Ordnance Survey grid and datum and the appropriate scale factor needs to be applied to use true ground distances.
2. All heights are to OS Newlyn and are derived from OS active network smartnet data.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

Revision No.	Description	Date	Issued By
0	First Issue	28.08.2020	AG

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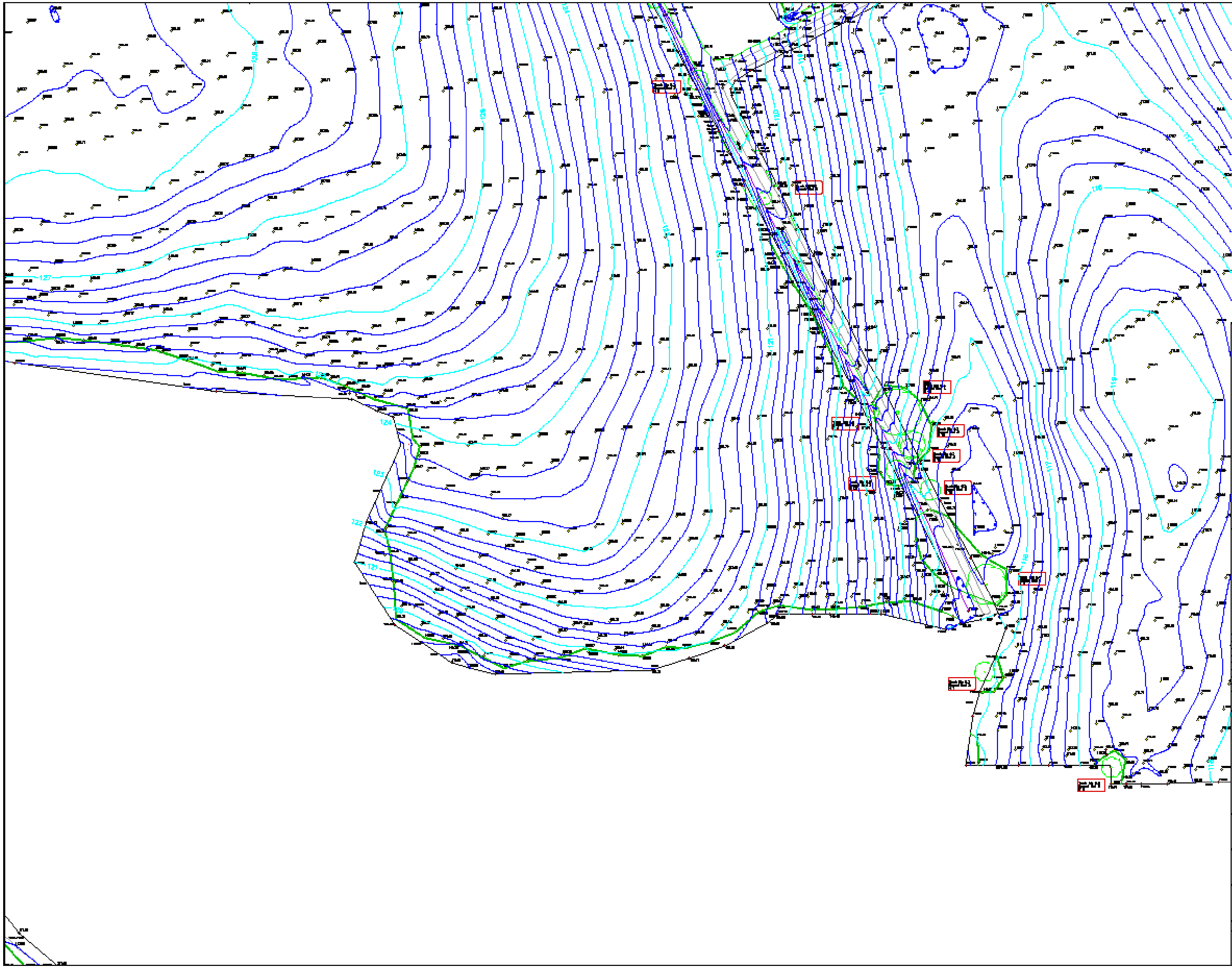
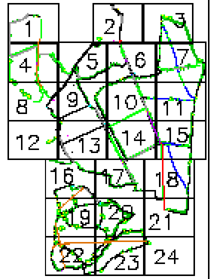
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey

Scale 1:500 | Sheet Size A1

Drawing No. 3233/500/16 | Revision 0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bk/g	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable TV cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity fs	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	top pipe
flp	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

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3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

Revision No.	Description	Date	Issued By
0	First Issue	28.09.2020	AG

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Client: Lightsource Renewable UK Development Limited

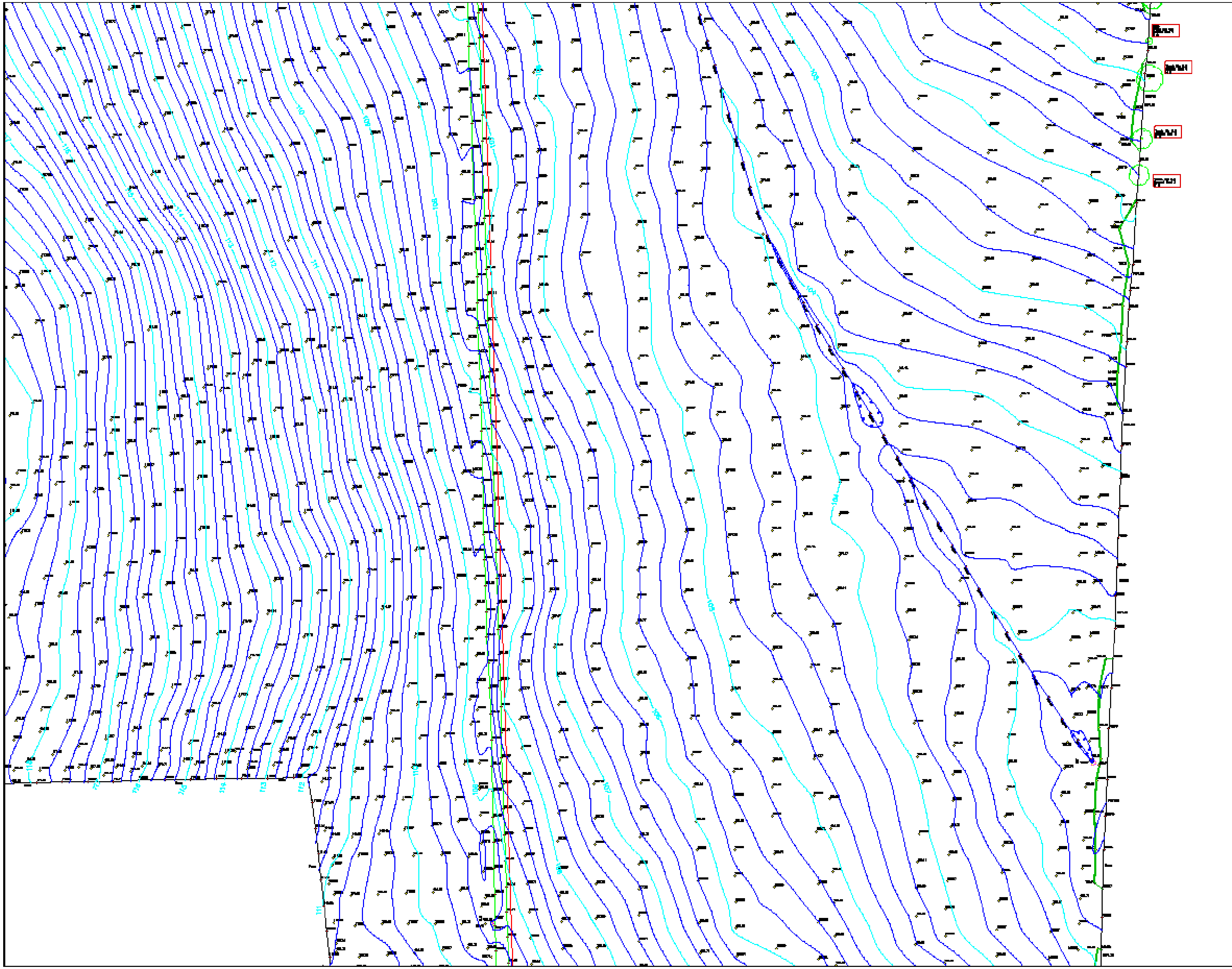
Location: Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham

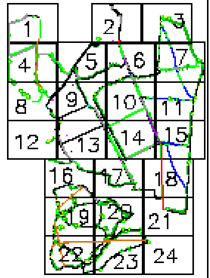
Drawing: Topographical Survey

Scale: 1:500 | Sheet Size A1

Revision

Drawing No. 3233/500/17





N

ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bt	British Telecom	mh	manhole
bwf	barbed wire fence	nb	notice board
cl	cover level	p	post
el	electricity	pr	post and rail fence
ep	electricity pole	rg	road gully
fb	flower bed	rp	reflector post
fh	fire hydrant	rs	road sign
fl	floor level	rwp	rainwater pipe
fp	footpath	sp	signpost
g	gully	st	stop tap
gv	gas valve	sv	stop valve
ic	inspection cover	tow	top of wall
il	invert level	tp	top pipe
irf	iron rail fence	ts	traffic signal
lb	letter box	utl	unable to locate
		utr	unable to raise
		vp	vent pipe
		wm	water meter
		DT	door threshold
		DHH	door head height

Notes

1. This survey has been computed and drawn about the Ordnance Survey grid and datum and the appropriate scalefactor needs to be applied to use true ground distances.
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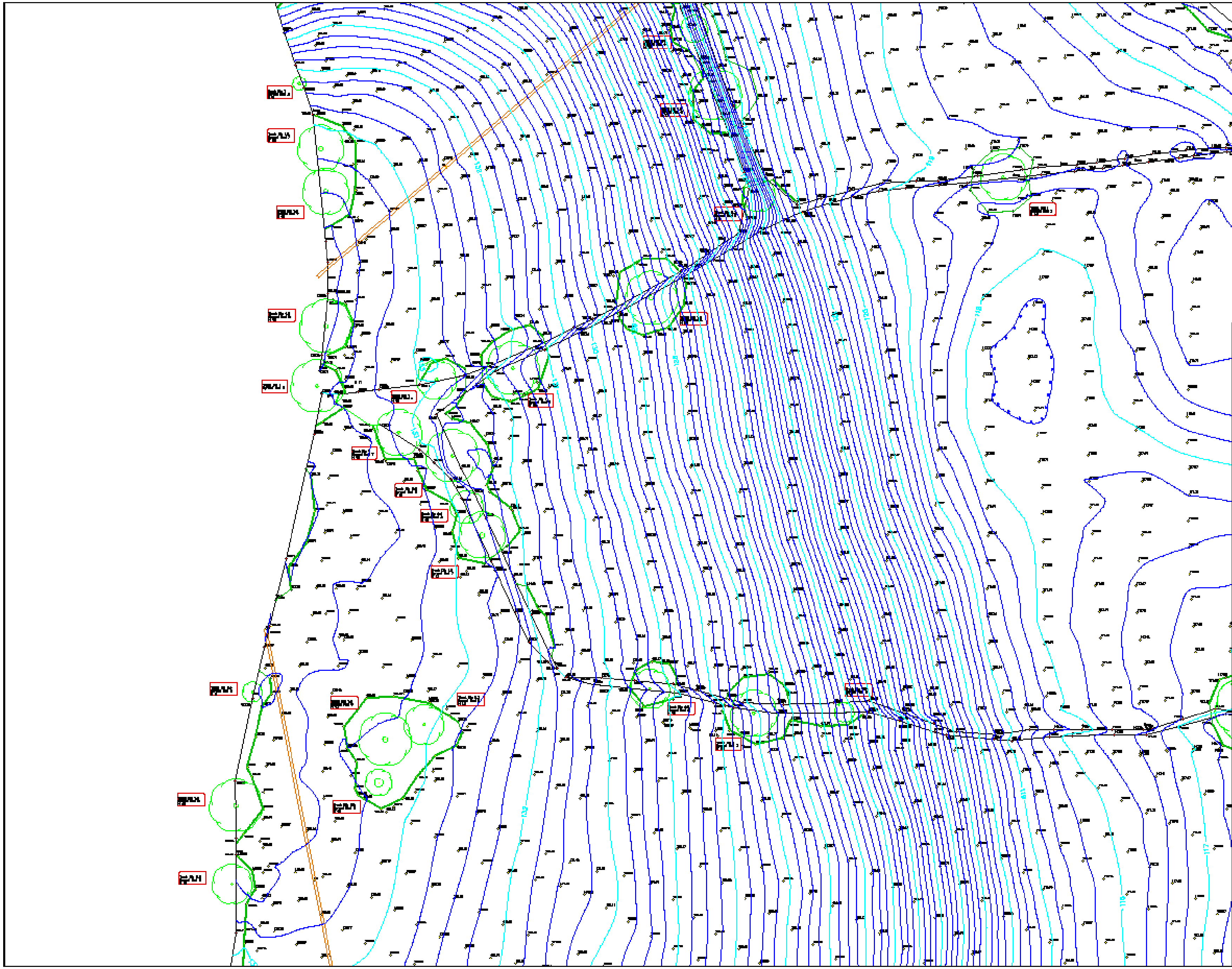
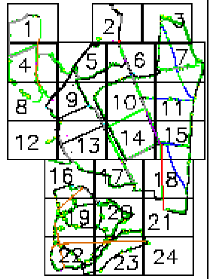
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale 1:500	Sheet Size A1

Drawing No. 3233/500/18

Revision 0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bk/g	back kerb gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable TV cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity [illegible]	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop top
fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

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2. All heights are to OS Newlyn and are derived from OS active network smartnet line.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

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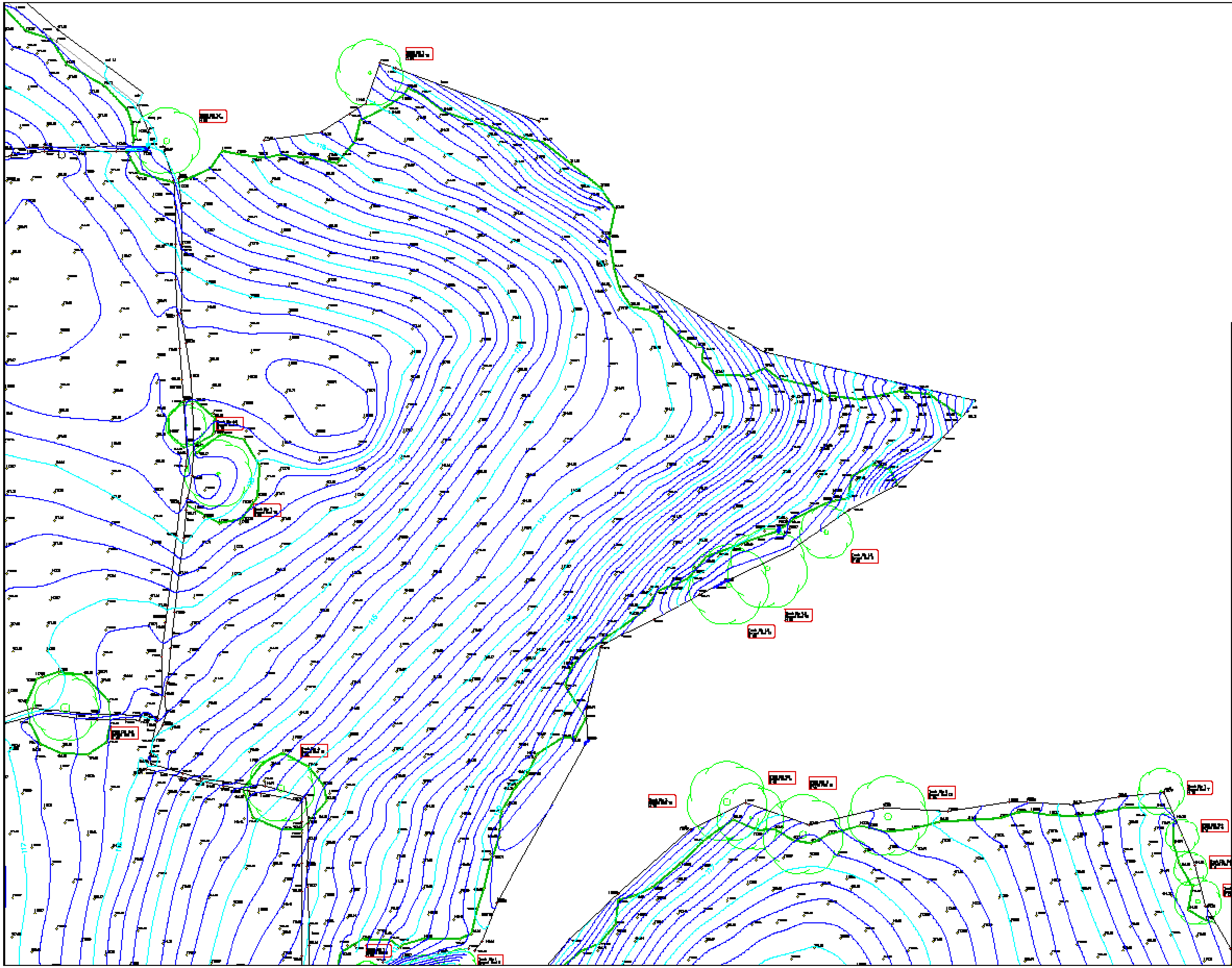
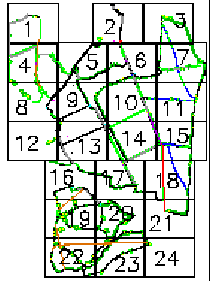
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale: 1:500	Sheet Size A1
Drawing No. 3233/500/19	Revision 0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bi.g	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity fs	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
ffl	floor level	tow	top of wall
fp	footpath	tp	top pipe
fl.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door head height
lb	letter box		

Notes

1. This survey has been computed and drawn about the Ordnance Survey grid and datum and the appropriate scalefactor needs to be applied to use true ground distances.
2. All heights are to OS Newlyn and are derived from GK active network smartnet line.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

Revision No.	Description	Date	Issued By
0	First Issue	28.02.2020	AG

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GPS & Land Surveys

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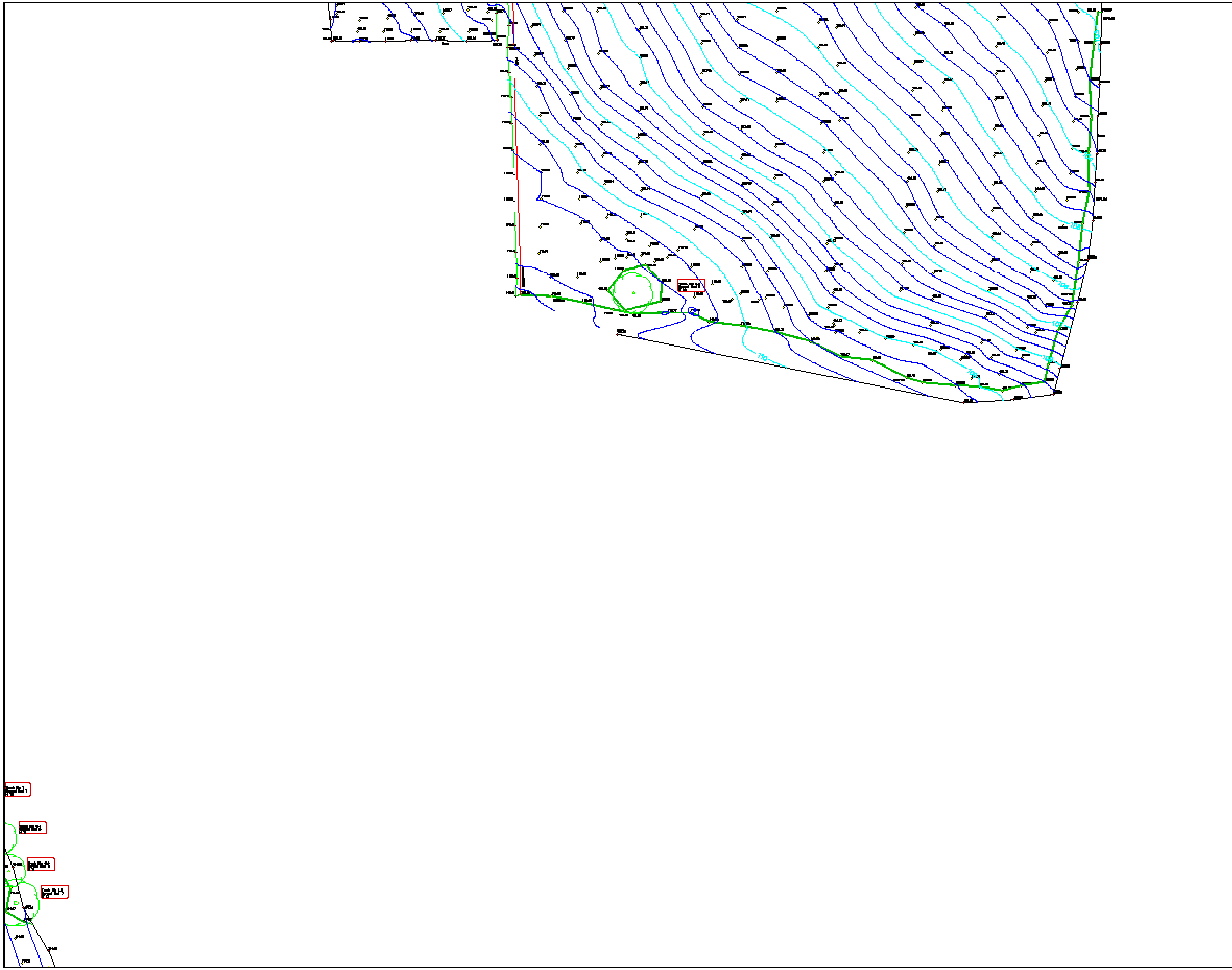
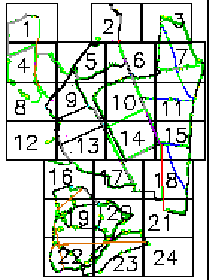
www.AGsurveys.co.uk

Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale 1:500	Sheet Size A1
Drawing No. 3233/500/20	Revision 0





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
b.t.g	back inlet gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable TV cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity fc	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	top pipe
f.p	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
to	tank outlet	DHH	door height height
lb	letter box		

Notes

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2. All heights are to OS Newlyn and are derived from OS active network smartnet tie.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

Revision No.	Description	Date	Issued By
0	First issue	28.08.2020	AG

AGsurveys
GPS & Land Surveys

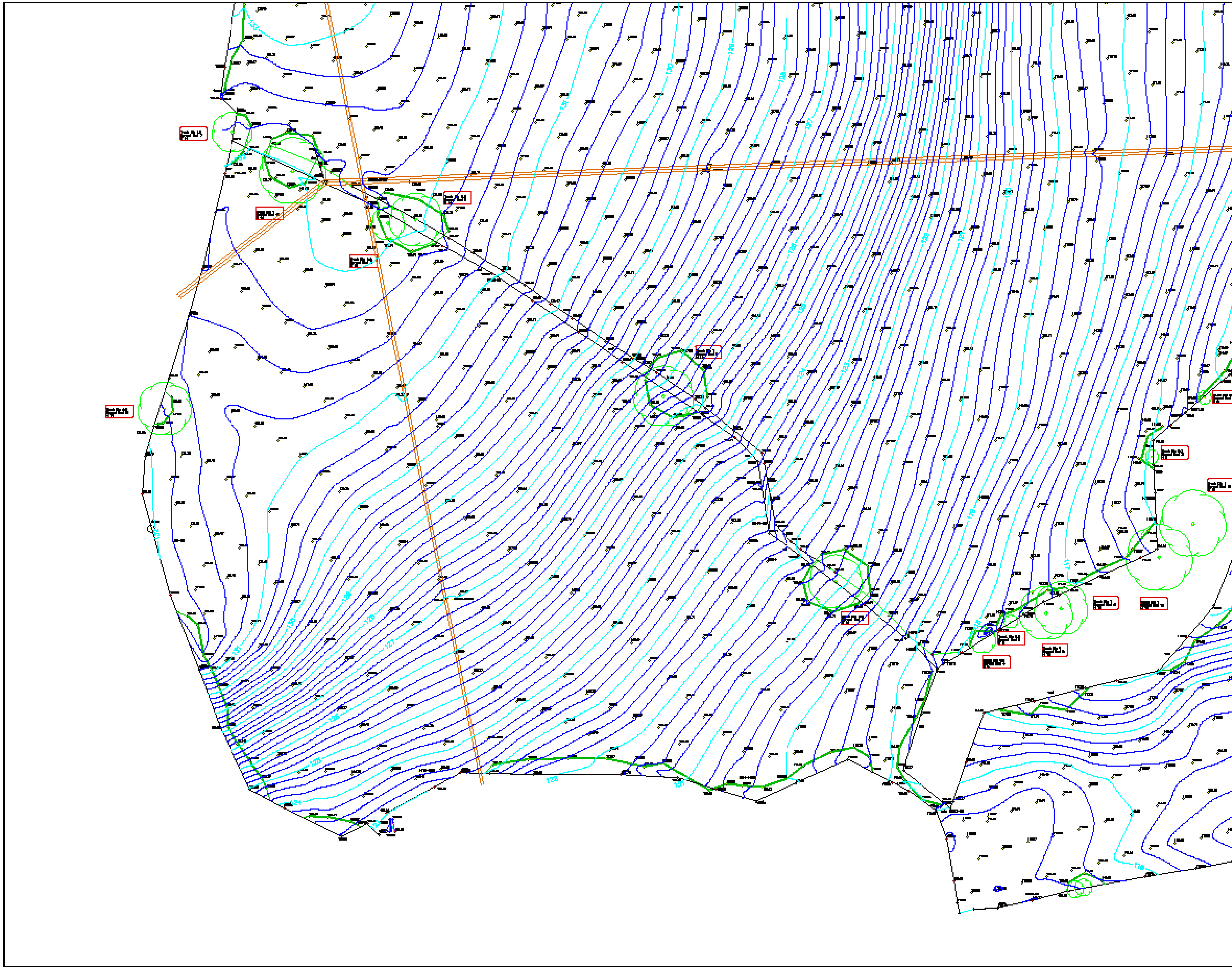
205 Overndale Road
Downend
Bristol BS16 2RQ
Tel: 0117 9394336 / 07790 997405
e-mail:andrew@agsurveys.co.uk
www.AGsurveys.co.uk

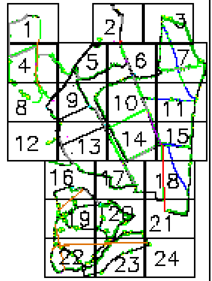
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey

Scale: 1:500 Sheet Size A1

Drawing No. 3233/500/21

Revision





ABBREVIATIONS

Notes

Revision No.	Description	Date	Issued By
0	First Issue	28.08.2020	AG

AGsurveys
GPS & Land Surveys
305 Overndale Road
Downend
Bristol BS16 2RQ
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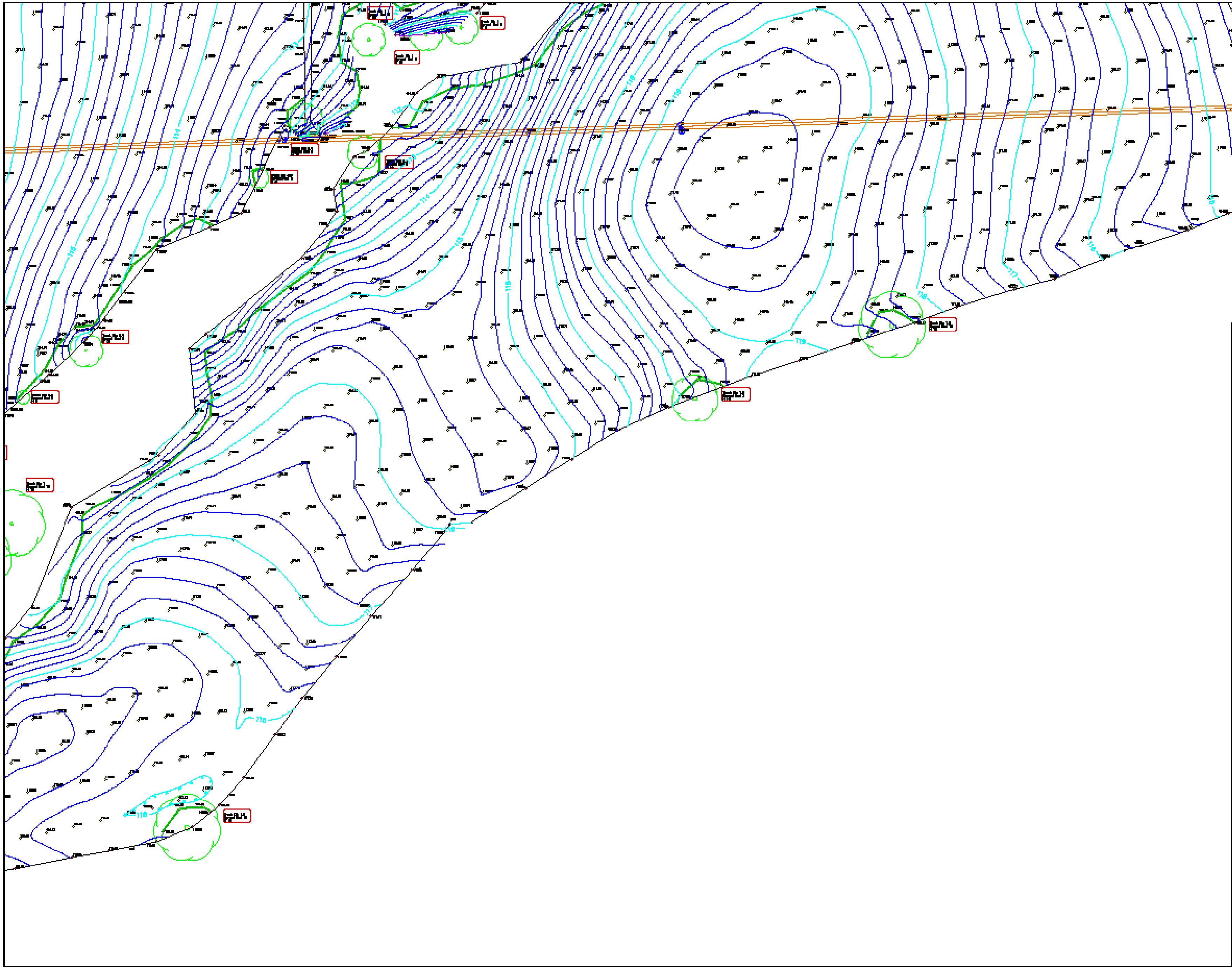
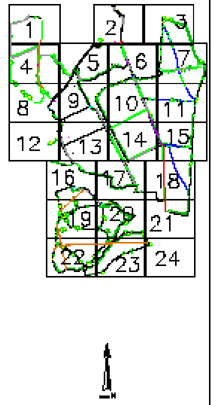
www.AGsurveys.co.uk

Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale 1:500	Sheet Size A1
Drawing No. 3233/500/22	Revision





ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
bkg	back kerb gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
cabv	cable TV cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity fo	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	stop tap
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	top pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door height height
lb	letter box		

Notes

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2. All heights are to OS Newlyn and are derived from OS active network smartnet files.
3. This survey was surveyed for a scale of 1:500, any subsequent enlargements should be verified on site.

Revision No.	Description	Date	Issued By
0	First Issue	28.09.2020	AG

AGsurveys
GPS & Land Surveys

305 Overndale Road
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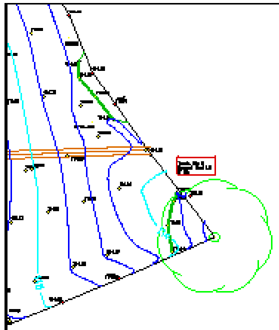
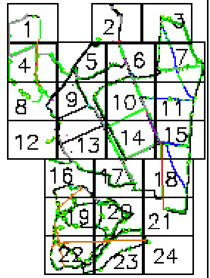
www.AGsurveys.co.uk

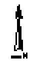
Client	Lightsource Renewable UK Development Limited
Location	Land @ Plas Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey

Scale 1:500 | Sheet Size A1

Drawing No. 3233/500/23 | Revision 0







ABBREVIATIONS

b	bollard	lp	lamp post
bb	belisha beacon	mp	marker post
btg	bank total gully	mh	manhole
bs	bus stop	nb	notice board
bt	British Telecom	np	nameplate(road)
bwf	barbed wire fence	p	post
catv	cable tv cover	prf	post and rail fence
cbf	close boarded fence	re	rodding eye
cl	cover level	rg	road gully
dk	drop kerb	rp	reflector post
elc	electricity [illegible]	rs	road sign
ess	elec. sub-station	rwp	rainwater pipe
ep	electricity pole	sp	signpost
fb	flower bed	st	step top
fh	fire hydrant	sv	stop valve
fl	floor level	tow	top of wall
fp	footpath	tp	top pipe
flg	flagpole	ts	traffic signal
g	gully	utl	unable to locate
gv	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	wm	water meter
irf	iron rail fence	DT	door threshold
ko	kerb outlet	DHH	door head height
lb	letter box		

Notes

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0	First Issue	28.08.2020	AG
Revision No.	Description	Date	Issued By

AGsurveys

GPS & Land Surveys

205 Overndale Road
Downend
Bristol BS16 2RQ
Tel: 0117 9394336 / 07790 997405
e-mail:andrew@agsurveys.co.uk
www.AGsurveys.co.uk

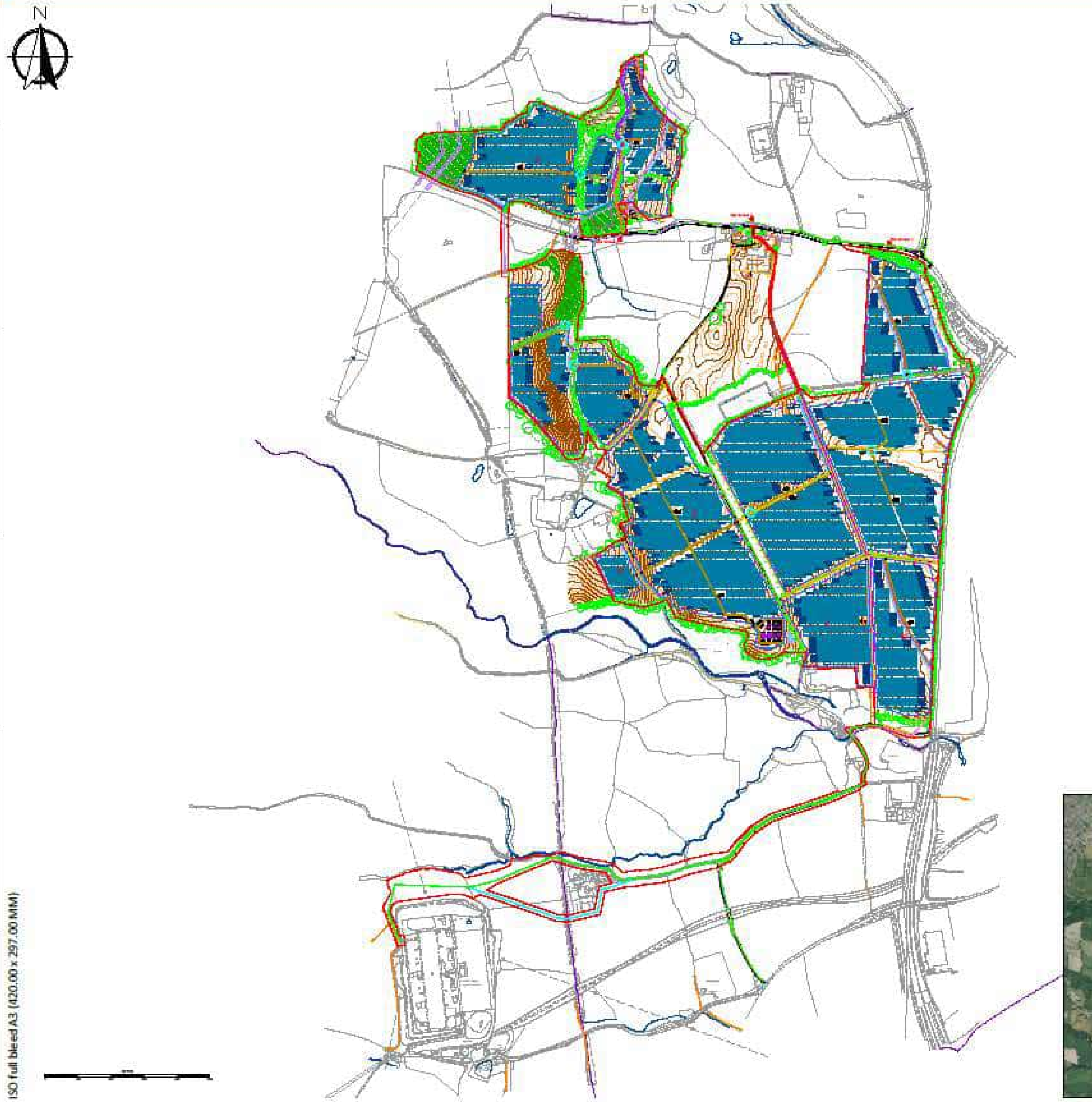
Client	Lightsource Renewable UK Development Limited
Location	Land @ Pics Power Ruthin Rd, Coedpoeth LL11 3BP Wrexham
Drawing	Topographical Survey
Scale 1:500	Sheet Size A1
Drawing No. 3233/500/24	Revision 0

Appendix B.1

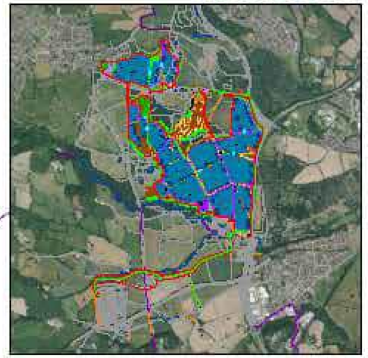
Development Plan

GBR_Plas Power Solar & Battery Project_LP2 - Indicative Site layout_12

Area 1,355,397 m2 (334.93 acres)



Scale 1:50000



Site Boundary	Site Access
Security Fence	Module Table 30 x 2
Transformer	Switchgear Substation
PV Intake Substation	Customer Substation
Access Road	Access Gates
CCTV	BESS Enclosure x 4
BIC	Twin MV Skid
Backup Generator	BESS Intake Substation
BESS Security Fence	Landscape / Biodiversity
Preferred Cable Route Option	Cable Route Option 1
Cable Route Option 2	Cable Route Option 3
Cable Route	Existing PRoW
Proposed PRoW diversion	Indicative Swales
Attenuation Pond	Existing Tree
Existing Hedgerow/Vegetation	Existing Ditch

DA			02.02.2024
DRAWN	CHECKED	APPROVED	DATE

PROJECT NAME & ADDRESS:
Location: Plas Power Estate, Rhosrobin
Postcode: Caego, Wrexham, Wales

NOTES:

Paper Size:	Scale:	Sheet:
A3	1:12500	1

CAPACITY:

DRAWING TITLE:
GBR_Plas Power Solar & Battery Project_LP2 - Indicative Site Layout_12

DRAWING NUMBER:	STATUS:
LP2-PDL	Pre-application Consultation

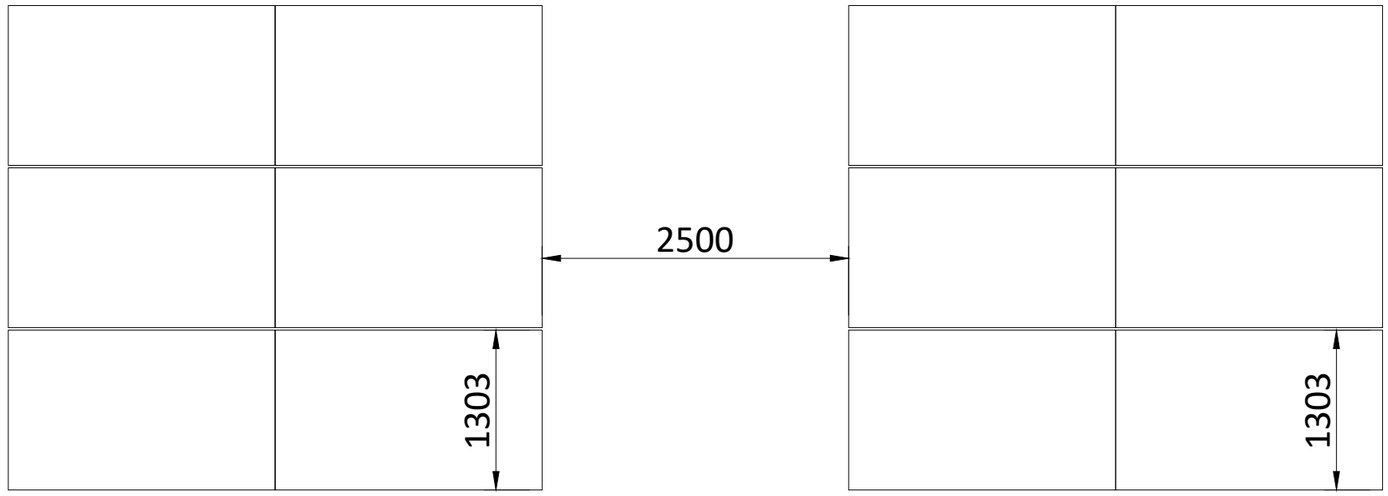
Lightsource Renewable Development Limited,
7th Floor, 33 Holborn, London, EC1N 2HU
General: +44 (0) 333 200 0755
Web: www.lightsourcebp.com
info@lightsourcebp.com

ISO full bleed A3 (420.00 x 297.00 MM)

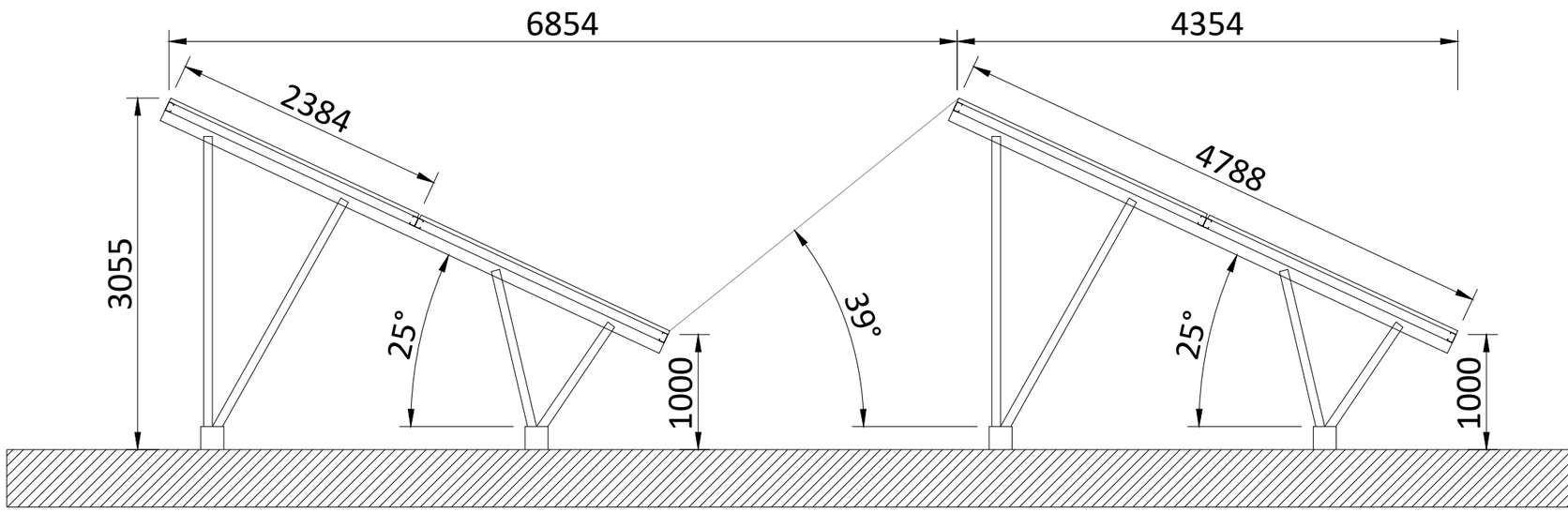
Appendix B.2

Solar Panels

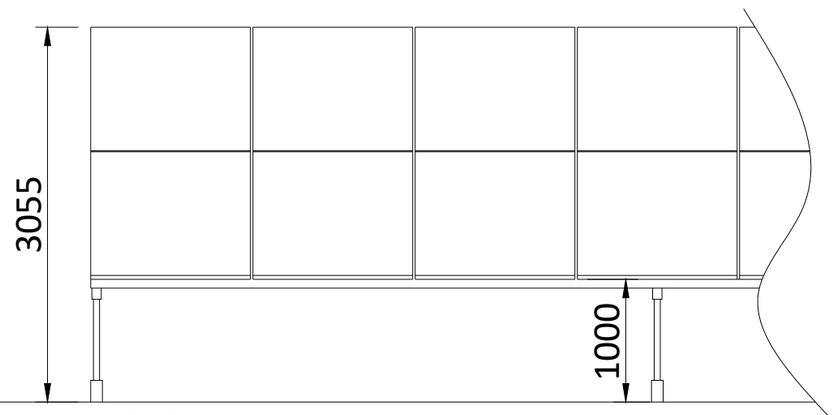
Panel Elevation 2 Portrait 25/6854



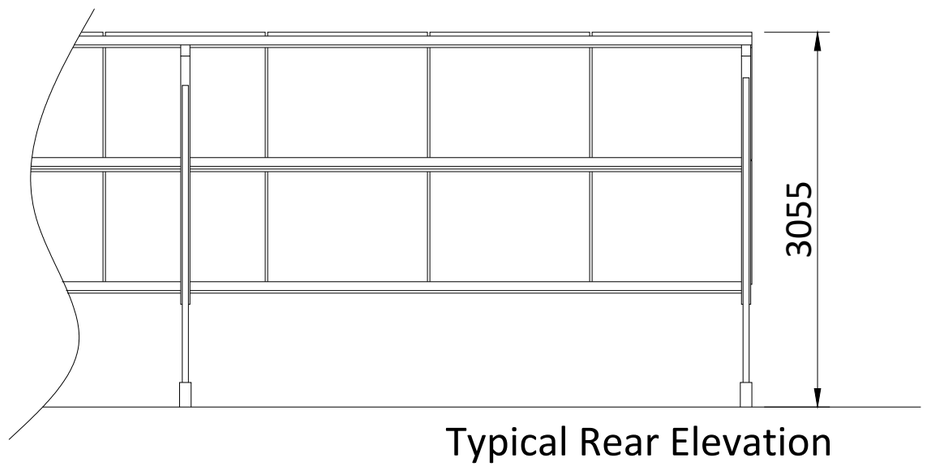
Plan



Typical Section



Typical Elevation



Typical Rear Elevation

METERS

0 1 2 3 4 5

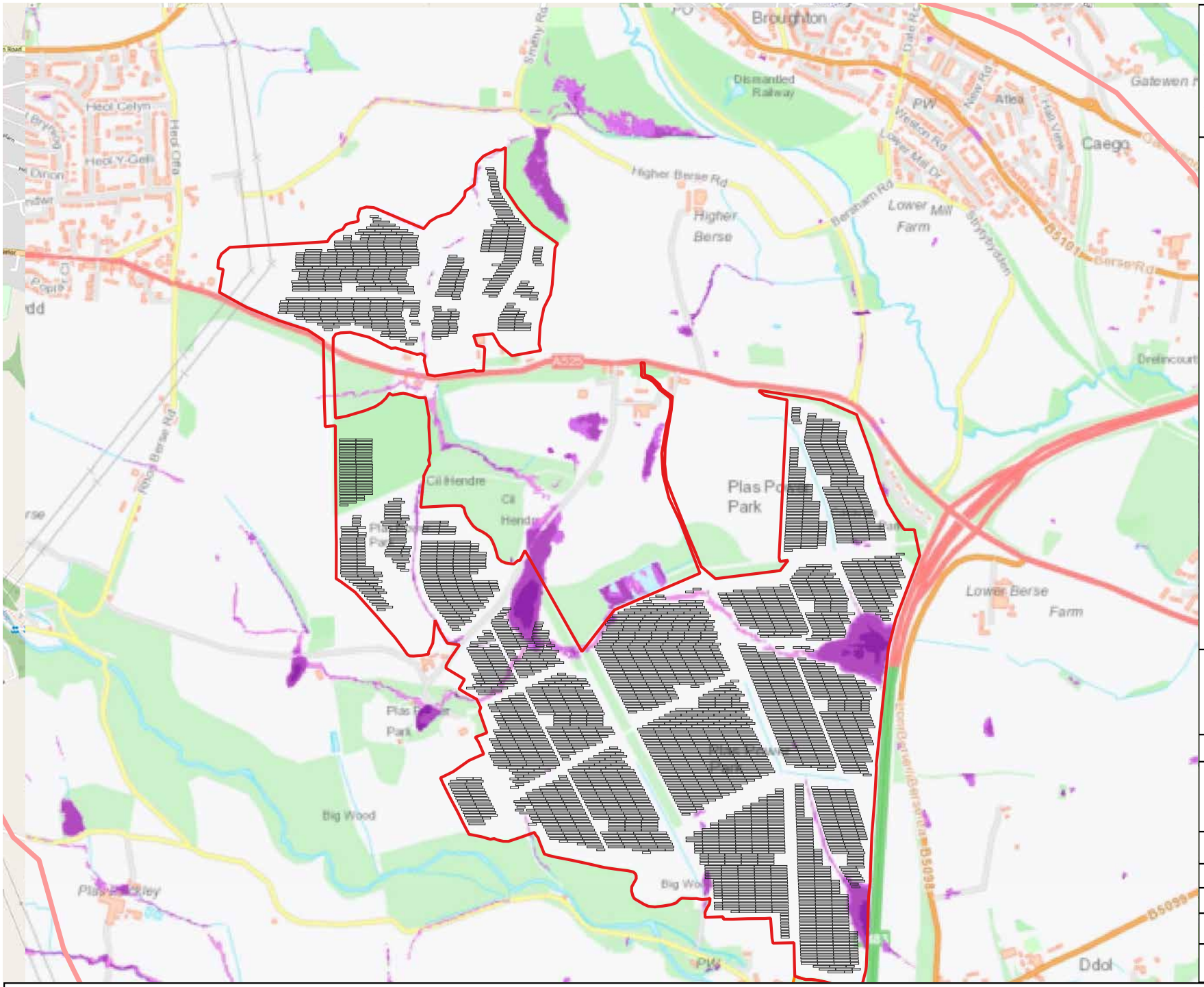
A3 - (420 x 297)mm

Panel Elevation 2 Portrait 25/6854			
DA			12.01.2022
DRAWN	CHECKED	APPROVED	DATE
Paper Size: A3	Scale: 1:50	Sheet: 1	
DRAWING NUMBER: PNL_2P_25/6854	STATUS: Preliminary		

Lightsource Renewable Development Limited,
7th Floor, 33 Holborn, London, EC1N 2HU
General: +44 (0) 333 200 0755
Web: www.lightsourcebp.com
info@lightsourcebp.com

Appendix C

NRW Flood Maps



Notes

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2. If received electronically it is the recipients responsibility to print to the correct scale. Only written dimensions should be used.

Legend

- Site Plan
- Less than 0.15m
- 0.15 - 0.30m
- 0.30 - 0.90m
- Greater than 0.9m

rps
A TETRA TECH COMPANY
20 Farringdon Street
London, EC4A 4AB
E:rpshydrologyservices@rpsgroup.com

Client: Lightsource BP

Title: Proposed Development and High Risk Flood Depths

Site: Plas Power

Date: 07-02-2024

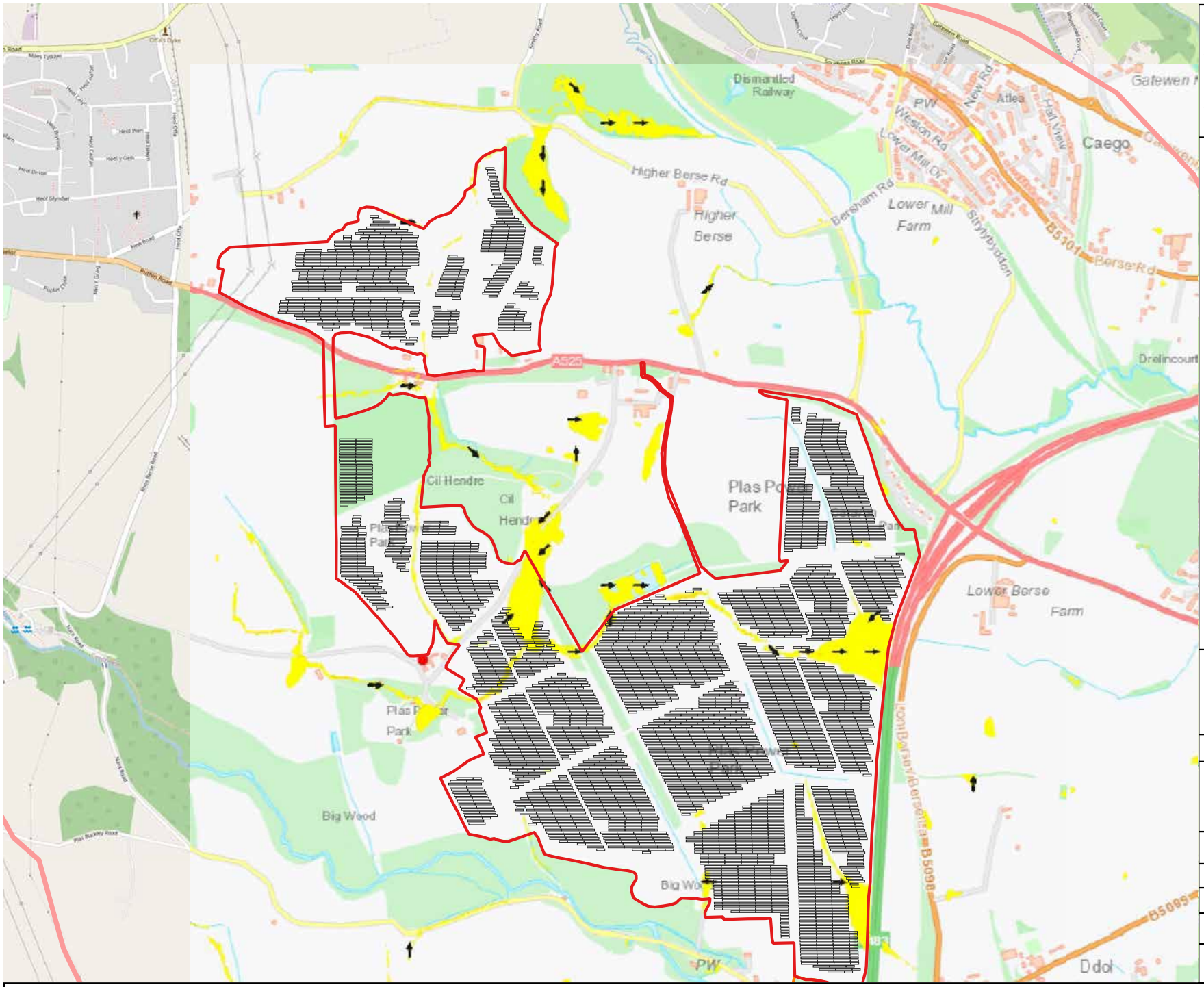
Scale:1:12,500	Size: A3
Job Ref: HLEF85062	Rev: 2

Drawn	Checked	Approved
TJ	JM	JM

0 0.25 0.5 0.75 1 km

N

rpsgroup.com



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Legend

- Site Plan
- Flow Direction
- Less than 1m/s
- 1 - 2m/s
- 2 - 3m/s
- Greater than 3m/s

20 Farringdon Street
London, EC4A 4AB
E:rpshydrologyservices@rpsgroup.com

Client: Lightsource BP

Title: Proposed Development and High Risk Velocity

Site: Plas Power

Date: 07-02-2024

Scale:1:12,500	Size: A3
Job Ref: HLEF85062	Rev: 2

Drawn	Checked	Approved
TJ	JM	JM

0 0.25 0.5 0.75 1 km

N

rpsgroup.com

Appendix D

Greenfield Runoff Rate (MicroDrainage)

ICP SUDS Mean Annual Flood

Input

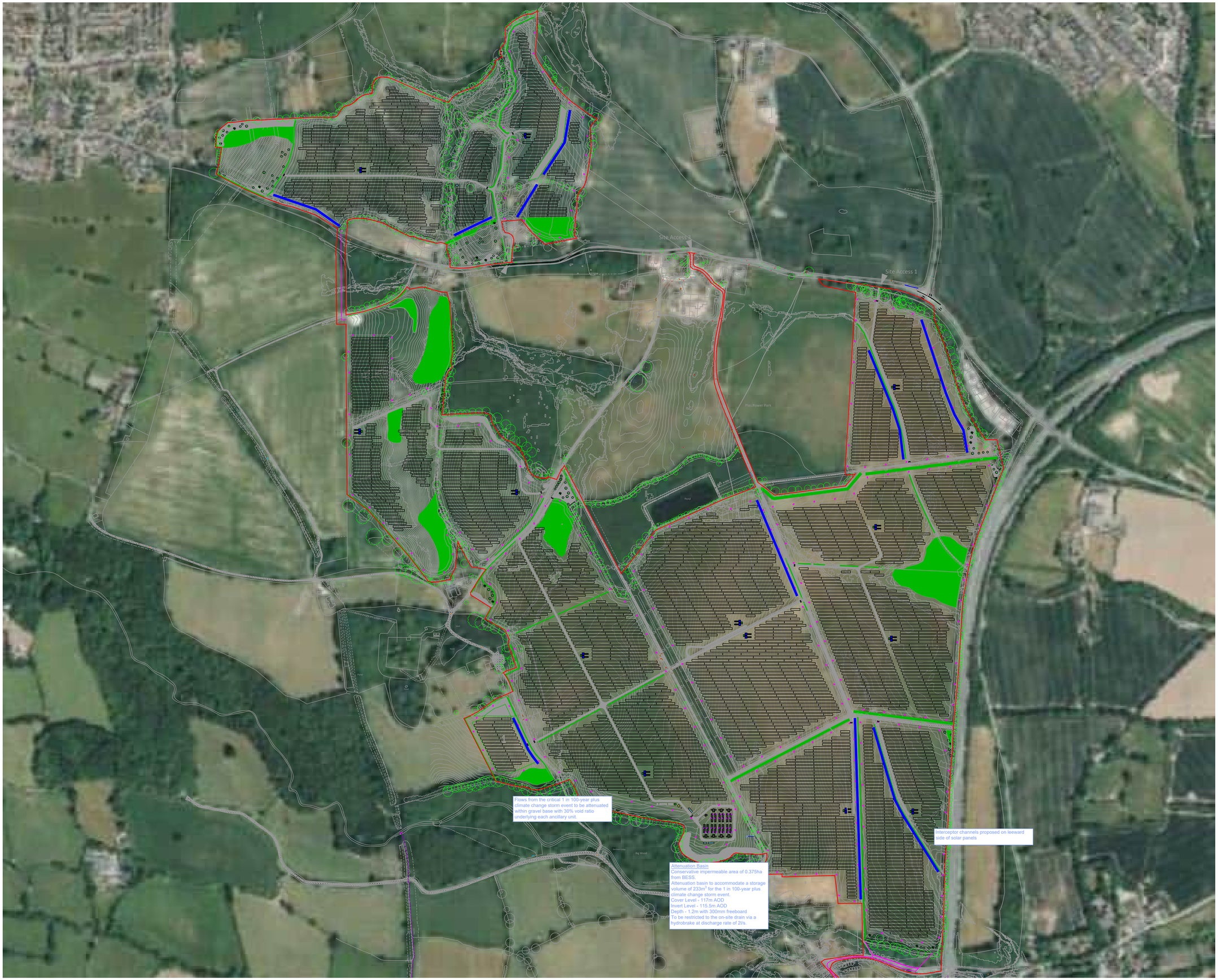
Return Period (years)	100	Soil	0.300
Area (ha)	1.000	Urban	0.000
SAAR (mm)	967	Region Number	Region 9

Results l/s

QBAR Rural	2.7
QBAR Urban	2.7
Q100 years	5.8
Q1 year	2.3
Q30 years	4.7
Q100 years	5.8

Appendix E

Conceptual Drainage Plan



Notes

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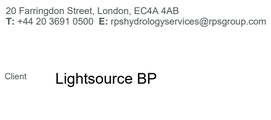
2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.
3. This drawing should be read in conjunction with all other relevant drawings and specifications.

KEY

Surface Water Pipe Line

Surface Water Headwall

Cross Section - Swale



30cm deep, 1 in 3 slope

4	Updated in line with new plan	TJ	JM	02.02.24
3	Updated in line with new plan	TJ	JM	25.10.23
2	Updated to include BESS	AM	JM	02.10.23
1	Conceptual Drainage Strategy	TJ	JM	19.09.23

A TETRA TECH COMPANY

20 Farringdon Street, London, EC4A 4AB
T: +44 20 3691 0500 **E:** rpshydrologyservices@rpsgroup.com

Client: Lightsource BP

Project: Plas Power Solar Farm

Title: Conceptual Drainage Strategy

Status	Scale	Date Created
FINAL	1:1 @A1	19.09.2023

Task Team Manager	Information Author	Task Information Manager
JM	TJ	JM

Document Number: HLEF85062-RPS-Plas Power_CD-DR-2-01022024

RPS Project Number: HLEF 85062

Revision: 4

rpsgroup.com

O:\Environment\01 Projects\HLEF - Flood\HLEF 85062 - Plas Power ES\7 CAD\AM HLEF 85062 Plas Power Conceptual Drainage D v0.3 TJ.dwg

Appendix F

Attenuation Features (MicroDrainage)

Summary of Results for 100 year Return Period (+20%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.718	0.018	0.0	0.4	Flood Risk
30 min Summer	9.725	0.025	0.0	0.5	Flood Risk
60 min Summer	9.733	0.033	0.0	0.7	Flood Risk
120 min Summer	9.742	0.042	0.0	0.8	Flood Risk
180 min Summer	9.747	0.047	0.0	0.9	Flood Risk
240 min Summer	9.751	0.051	0.0	1.0	Flood Risk
360 min Summer	9.757	0.057	0.0	1.2	Flood Risk
480 min Summer	9.762	0.062	0.0	1.2	Flood Risk
600 min Summer	9.766	0.066	0.0	1.3	Flood Risk
720 min Summer	9.769	0.069	0.0	1.4	Flood Risk
960 min Summer	9.775	0.075	0.0	1.5	Flood Risk
1440 min Summer	9.783	0.083	0.0	1.7	Flood Risk
2160 min Summer	9.792	0.092	0.0	1.8	Flood Risk
2880 min Summer	9.798	0.098	0.0	2.0	Flood Risk
4320 min Summer	9.808	0.108	0.0	2.2	Flood Risk
5760 min Summer	9.816	0.116	0.0	2.3	Flood Risk
7200 min Summer	9.822	0.122	0.0	2.5	Flood Risk
8640 min Summer	9.828	0.128	0.0	2.6	Flood Risk
10080 min Summer	9.833	0.133	0.0	2.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	95.156	0.0	27
30 min Summer	65.779	0.0	42
60 min Summer	43.553	0.0	72
120 min Summer	27.859	0.0	132
180 min Summer	21.105	0.0	192
240 min Summer	17.183	0.0	252
360 min Summer	12.816	0.0	372
480 min Summer	10.402	0.0	492
600 min Summer	8.838	0.0	612
720 min Summer	7.732	0.0	732
960 min Summer	6.253	0.0	972
1440 min Summer	4.625	0.0	1452
2160 min Summer	3.411	0.0	2172
2880 min Summer	2.744	0.0	2892
4320 min Summer	2.014	0.0	4332
5760 min Summer	1.618	0.0	5776
7200 min Summer	1.366	0.0	7216
8640 min Summer	1.190	0.0	8656
10080 min Summer	1.059	0.0	10096

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	9.720	0.020	0.0	0.4	Flood Risk
30 min Winter	9.727	0.027	0.0	0.6	Flood Risk
60 min Winter	9.736	0.036	0.0	0.7	Flood Risk
120 min Winter	9.747	0.047	0.0	0.9	Flood Risk
180 min Winter	9.753	0.053	0.0	1.1	Flood Risk
240 min Winter	9.757	0.057	0.0	1.2	Flood Risk
360 min Winter	9.764	0.064	0.0	1.3	Flood Risk
480 min Winter	9.770	0.070	0.0	1.4	Flood Risk
600 min Winter	9.774	0.074	0.0	1.5	Flood Risk
720 min Winter	9.778	0.078	0.0	1.6	Flood Risk
960 min Winter	9.784	0.084	0.0	1.7	Flood Risk
1440 min Winter	9.793	0.093	0.0	1.9	Flood Risk
2160 min Winter	9.803	0.103	0.0	2.1	Flood Risk
2880 min Winter	9.810	0.110	0.0	2.2	Flood Risk
4320 min Winter	9.821	0.121	0.0	2.4	Flood Risk
5760 min Winter	9.830	0.130	0.0	2.6	Flood Risk
7200 min Winter	9.837	0.137	0.0	2.8	Flood Risk
8640 min Winter	9.843	0.143	0.0	2.9	Flood Risk
10080 min Winter	9.849	0.149	0.0	3.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	95.156	0.0	27
30 min Winter	65.779	0.0	42
60 min Winter	43.553	0.0	72
120 min Winter	27.859	0.0	132
180 min Winter	21.105	0.0	192
240 min Winter	17.183	0.0	252
360 min Winter	12.816	0.0	372
480 min Winter	10.402	0.0	492
600 min Winter	8.838	0.0	612
720 min Winter	7.732	0.0	732
960 min Winter	6.253	0.0	972
1440 min Winter	4.625	0.0	1452
2160 min Winter	3.411	0.0	2172
2880 min Winter	2.744	0.0	2892
4320 min Winter	2.014	0.0	4332
5760 min Winter	1.618	0.0	5776
7200 min Winter	1.366	0.0	7216
8640 min Winter	1.190	0.0	8656
10080 min Winter	1.059	0.0	10096

Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Blanket Structure

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	33.5
Safety Factor	2.0	Length (m)	2.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	9.700		

Summary of Results for 100 year Return Period (+20%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.726	0.026	0.0	0.5	Flood Risk
30 min Summer	9.737	0.037	0.0	0.7	Flood Risk
60 min Summer	9.748	0.048	0.0	1.0	Flood Risk
120 min Summer	9.762	0.062	0.0	1.3	Flood Risk
180 min Summer	9.770	0.070	0.0	1.4	Flood Risk
240 min Summer	9.776	0.076	0.0	1.5	Flood Risk
360 min Summer	9.785	0.085	0.0	1.7	Flood Risk
480 min Summer	9.792	0.092	0.0	1.9	Flood Risk
600 min Summer	9.798	0.098	0.0	2.0	Flood Risk
720 min Summer	9.803	0.103	0.0	2.1	Flood Risk
960 min Summer	9.811	0.111	0.0	2.3	Flood Risk
1440 min Summer	9.823	0.123	0.0	2.5	Flood Risk
2160 min Summer	9.836	0.136	0.0	2.8	Flood Risk
2880 min Summer	9.846	0.146	0.0	3.0	Flood Risk
4320 min Summer	9.861	0.161	0.0	3.3	Flood Risk
5760 min Summer	9.873	0.173	0.0	3.5	Flood Risk
7200 min Summer	9.882	0.182	0.0	3.7	Flood Risk
8640 min Summer	9.890	0.190	0.0	3.9	Flood Risk
10080 min Summer	9.898	0.198	0.0	4.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	95.156	0.0	27
30 min Summer	65.779	0.0	42
60 min Summer	43.553	0.0	72
120 min Summer	27.859	0.0	132
180 min Summer	21.105	0.0	192
240 min Summer	17.183	0.0	252
360 min Summer	12.816	0.0	372
480 min Summer	10.402	0.0	492
600 min Summer	8.838	0.0	612
720 min Summer	7.732	0.0	732
960 min Summer	6.253	0.0	972
1440 min Summer	4.625	0.0	1452
2160 min Summer	3.411	0.0	2172
2880 min Summer	2.744	0.0	2892
4320 min Summer	2.014	0.0	4332
5760 min Summer	1.618	0.0	5776
7200 min Summer	1.366	0.0	7216
8640 min Summer	1.190	0.0	8656
10080 min Summer	1.059	0.0	10096

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	9.730	0.030	0.0	0.6	Flood Risk
30 min Winter	9.741	0.041	0.0	0.8	Flood Risk
60 min Winter	9.754	0.054	0.0	1.1	Flood Risk
120 min Winter	9.769	0.069	0.0	1.4	Flood Risk
180 min Winter	9.779	0.079	0.0	1.6	Flood Risk
240 min Winter	9.786	0.086	0.0	1.7	Flood Risk
360 min Winter	9.796	0.096	0.0	1.9	Flood Risk
480 min Winter	9.804	0.104	0.0	2.1	Flood Risk
600 min Winter	9.810	0.110	0.0	2.2	Flood Risk
720 min Winter	9.815	0.115	0.0	2.3	Flood Risk
960 min Winter	9.825	0.125	0.0	2.5	Flood Risk
1440 min Winter	9.838	0.138	0.0	2.8	Flood Risk
2160 min Winter	9.853	0.153	0.0	3.1	Flood Risk
2880 min Winter	9.864	0.164	0.0	3.3	Flood Risk
4320 min Winter	9.880	0.180	0.0	3.7	Flood Risk
5760 min Winter	9.893	0.193	0.0	3.9	Flood Risk
7200 min Winter	9.904	0.204	0.0	4.1	Flood Risk
8640 min Winter	9.913	0.213	0.0	4.3	Flood Risk
10080 min Winter	9.921	0.221	0.0	4.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	95.156	0.0	27
30 min Winter	65.779	0.0	42
60 min Winter	43.553	0.0	72
120 min Winter	27.859	0.0	132
180 min Winter	21.105	0.0	192
240 min Winter	17.183	0.0	252
360 min Winter	12.816	0.0	372
480 min Winter	10.402	0.0	492
600 min Winter	8.838	0.0	612
720 min Winter	7.732	0.0	732
960 min Winter	6.253	0.0	972
1440 min Winter	4.625	0.0	1452
2160 min Winter	3.411	0.0	2172
2880 min Winter	2.744	0.0	2892
4320 min Winter	2.014	0.0	4332
5760 min Winter	1.618	0.0	5776
7200 min Winter	1.366	0.0	7216
8640 min Winter	1.190	0.0	8656
10080 min Winter	1.059	0.0	10096

Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Blanket Structure

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	22.5
Safety Factor	2.0	Length (m)	3.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	9.700		

Summary of Results for 100 year Return Period (+20%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.727	0.027	0.0	0.9	Flood Risk
30 min Summer	9.737	0.037	0.0	1.2	Flood Risk
60 min Summer	9.749	0.049	0.0	1.6	Flood Risk
120 min Summer	9.763	0.063	0.0	2.1	Flood Risk
180 min Summer	9.771	0.071	0.0	2.4	Flood Risk
240 min Summer	9.777	0.077	0.0	2.6	Flood Risk
360 min Summer	9.786	0.086	0.0	2.9	Flood Risk
480 min Summer	9.794	0.094	0.0	3.1	Flood Risk
600 min Summer	9.799	0.099	0.0	3.3	Flood Risk
720 min Summer	9.804	0.104	0.0	3.5	Flood Risk
960 min Summer	9.812	0.112	0.0	3.8	Flood Risk
1440 min Summer	9.825	0.125	0.0	4.2	Flood Risk
2160 min Summer	9.838	0.138	0.0	4.6	Flood Risk
2880 min Summer	9.848	0.148	0.0	4.9	Flood Risk
4320 min Summer	9.863	0.163	0.0	5.4	Flood Risk
5760 min Summer	9.875	0.175	0.0	5.8	Flood Risk
7200 min Summer	9.884	0.184	0.0	6.1	Flood Risk
8640 min Summer	9.893	0.193	0.0	6.4	Flood Risk
10080 min Summer	9.900	0.200	0.0	6.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	95.156	0.0	27
30 min Summer	65.779	0.0	42
60 min Summer	43.553	0.0	72
120 min Summer	27.859	0.0	132
180 min Summer	21.105	0.0	192
240 min Summer	17.183	0.0	252
360 min Summer	12.816	0.0	372
480 min Summer	10.402	0.0	492
600 min Summer	8.838	0.0	612
720 min Summer	7.732	0.0	732
960 min Summer	6.253	0.0	972
1440 min Summer	4.625	0.0	1452
2160 min Summer	3.411	0.0	2172
2880 min Summer	2.744	0.0	2892
4320 min Summer	2.014	0.0	4332
5760 min Summer	1.618	0.0	5776
7200 min Summer	1.366	0.0	7216
8640 min Summer	1.190	0.0	8656
10080 min Summer	1.059	0.0	10096

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	9.730	0.030	0.0	1.0	Flood Risk
30 min Winter	9.741	0.041	0.0	1.4	Flood Risk
60 min Winter	9.755	0.055	0.0	1.8	Flood Risk
120 min Winter	9.770	0.070	0.0	2.3	Flood Risk
180 min Winter	9.780	0.080	0.0	2.7	Flood Risk
240 min Winter	9.787	0.087	0.0	2.9	Flood Risk
360 min Winter	9.797	0.097	0.0	3.2	Flood Risk
480 min Winter	9.805	0.105	0.0	3.5	Flood Risk
600 min Winter	9.811	0.111	0.0	3.7	Flood Risk
720 min Winter	9.817	0.117	0.0	3.9	Flood Risk
960 min Winter	9.826	0.126	0.0	4.2	Flood Risk
1440 min Winter	9.840	0.140	0.0	4.7	Flood Risk
2160 min Winter	9.855	0.155	0.0	5.2	Flood Risk
2880 min Winter	9.866	0.166	0.0	5.5	Flood Risk
4320 min Winter	9.882	0.182	0.0	6.1	Flood Risk
5760 min Winter	9.895	0.195	0.0	6.5	Flood Risk
7200 min Winter	9.906	0.206	0.0	6.9	Flood Risk
8640 min Winter	9.916	0.216	0.0	7.2	Flood Risk
10080 min Winter	9.924	0.224	0.0	7.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	95.156	0.0	27
30 min Winter	65.779	0.0	42
60 min Winter	43.553	0.0	72
120 min Winter	27.859	0.0	132
180 min Winter	21.105	0.0	192
240 min Winter	17.183	0.0	252
360 min Winter	12.816	0.0	372
480 min Winter	10.402	0.0	492
600 min Winter	8.838	0.0	612
720 min Winter	7.732	0.0	732
960 min Winter	6.253	0.0	972
1440 min Winter	4.625	0.0	1452
2160 min Winter	3.411	0.0	2172
2880 min Winter	2.744	0.0	2892
4320 min Winter	2.014	0.0	4332
5760 min Winter	1.618	0.0	5776
7200 min Winter	1.366	0.0	7216
8640 min Winter	1.190	0.0	8656
10080 min Winter	1.059	0.0	10096

Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Blanket Structure

Infiltration Coefficient Base (m/hr)	0.00000	Diameter/Width (m)	10.8
Safety Factor	2.0	Length (m)	10.3
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	9.700		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.024	0.524	1.6	65.1	O K
30 min Summer	9.133	0.633	1.6	89.7	O K
60 min Summer	9.236	0.736	1.6	117.2	O K
120 min Summer	9.329	0.829	1.6	146.3	O K
180 min Summer	9.376	0.876	1.6	162.5	O K
240 min Summer	9.404	0.904	1.6	172.4	O K
360 min Summer	9.437	0.937	1.6	184.8	O K
480 min Summer	9.455	0.955	1.6	192.0	O K
600 min Summer	9.465	0.965	1.6	196.0	O K
720 min Summer	9.470	0.970	1.6	197.8	O K
960 min Summer	9.469	0.969	1.6	197.6	O K
1440 min Summer	9.458	0.958	1.6	193.1	O K
2160 min Summer	9.438	0.938	1.6	185.3	O K
2880 min Summer	9.417	0.917	1.6	177.5	O K
4320 min Summer	9.373	0.873	1.6	161.2	O K
5760 min Summer	9.327	0.827	1.6	145.7	O K
7200 min Summer	9.281	0.781	1.6	130.9	O K
8640 min Summer	9.234	0.734	1.6	116.9	O K
10080 min Summer	9.187	0.687	1.6	103.6	O K
15 min Winter	9.062	0.562	1.6	73.2	O K
30 min Winter	9.176	0.676	1.6	100.8	O K
60 min Winter	9.284	0.784	1.6	131.9	O K
120 min Winter	9.384	0.884	1.6	165.2	O K
180 min Winter	9.435	0.935	1.6	184.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	95.156	0.0	66.7	26
30 min Summer	65.779	0.0	92.2	41
60 min Summer	43.553	0.0	122.4	70
120 min Summer	27.859	0.0	156.6	130
180 min Summer	21.105	0.0	177.9	188
240 min Summer	17.183	0.0	193.1	248
360 min Summer	12.816	0.0	216.0	366
480 min Summer	10.402	0.0	233.5	484
600 min Summer	8.838	0.0	247.3	604
720 min Summer	7.732	0.0	253.7	722
960 min Summer	6.253	0.0	252.6	936
1440 min Summer	4.625	0.0	249.1	1162
2160 min Summer	3.411	0.0	345.3	1556
2880 min Summer	2.744	0.0	370.3	1964
4320 min Summer	2.014	0.0	407.4	2776
5760 min Summer	1.618	0.0	436.8	3632
7200 min Summer	1.366	0.0	461.0	4400
8640 min Summer	1.190	0.0	481.9	5192
10080 min Summer	1.059	0.0	500.3	6048
15 min Winter	95.156	0.0	74.7	26
30 min Winter	65.779	0.0	103.1	41
60 min Winter	43.553	0.0	137.1	70
120 min Winter	27.859	0.0	175.4	128
180 min Winter	21.105	0.0	199.2	186

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
240 min Winter	9.465	0.965	1.6	196.0	O K
360 min Winter	9.503	1.003	1.7	211.3	O K
480 min Winter	9.525	1.025	1.7	220.7	O K
600 min Winter	9.538	1.038	1.7	226.6	O K
720 min Winter	9.546	1.046	1.7	230.0	O K
960 min Winter	9.552	1.052	1.7	232.4	O K
1440 min Winter	9.541	1.041	1.7	227.6	O K
2160 min Winter	9.515	1.015	1.7	216.7	O K
2880 min Winter	9.488	0.988	1.7	205.1	O K
4320 min Winter	9.425	0.925	1.6	180.2	O K
5760 min Winter	9.357	0.857	1.6	155.9	O K
7200 min Winter	9.288	0.788	1.6	133.1	O K
8640 min Winter	9.216	0.716	1.6	111.5	O K
10080 min Winter	9.137	0.637	1.6	90.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
240 min Winter	17.183	0.0	216.2	244
360 min Winter	12.816	0.0	241.5	360
480 min Winter	10.402	0.0	256.1	476
600 min Winter	8.838	0.0	256.8	590
720 min Winter	7.732	0.0	256.6	702
960 min Winter	6.253	0.0	256.8	924
1440 min Winter	4.625	0.0	258.7	1334
2160 min Winter	3.411	0.0	386.7	1664
2880 min Winter	2.744	0.0	414.7	2132
4320 min Winter	2.014	0.0	454.2	3032
5760 min Winter	1.618	0.0	489.2	3920
7200 min Winter	1.366	0.0	516.4	4760
8640 min Winter	1.190	0.0	539.7	5616
10080 min Winter	1.059	0.0	560.4	6448

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 8.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	58.0	1.500	719.7	1.501	720.4

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0061-2000-1500-2000
Design Head (m)	1.500
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	61
Invert Level (m)	8.500
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

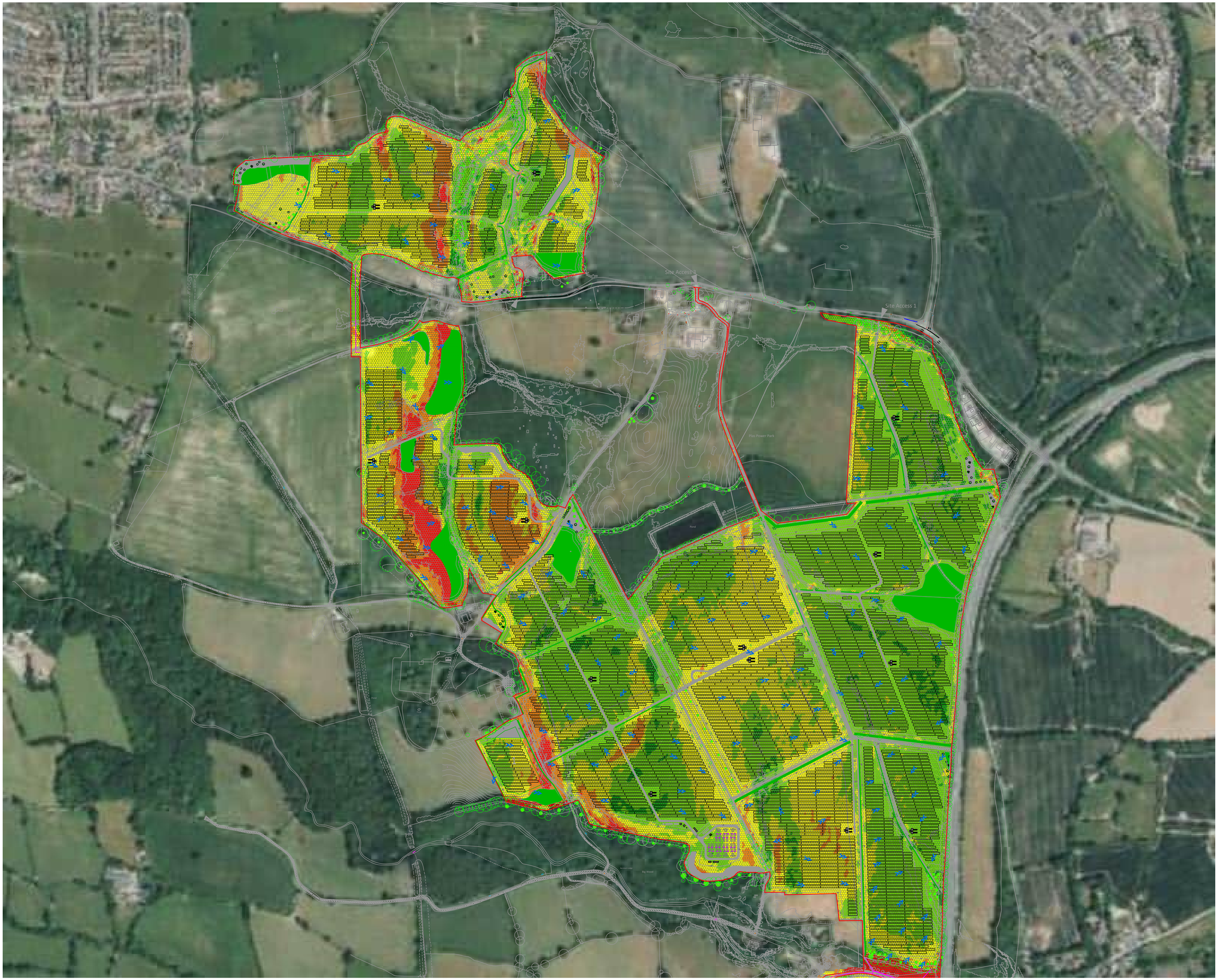
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.0	Kick-Flo®	0.545	1.3
Flush-Flo™	0.269	1.6	Mean Flow over Head Range	-	1.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.3	1.200	1.8	3.000	2.7	7.000	4.1
0.200	1.5	1.400	1.9	3.500	3.0	7.500	4.2
0.300	1.6	1.600	2.1	4.000	3.1	8.000	4.3
0.400	1.5	1.800	2.2	4.500	3.3	8.500	4.5
0.500	1.4	2.000	2.3	5.000	3.5	9.000	4.6
0.600	1.3	2.200	2.4	5.500	3.6	9.500	4.7
0.800	1.5	2.400	2.5	6.000	3.8		
1.000	1.7	2.600	2.6	6.500	3.9		

Appendix G

Flow Exceedance Plan



Notes

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2. If received electronically it is the recipients responsibility to print to correct scale. Only written dimensions should be used.
3. This drawing should be read in conjunction with all other relevant drawings and specifications.

FOR INFORMATION

KEY

Indicative overland flow exceedance route

2	Updated with new site layout	TJ	JM	02.02.24
1	Flow Exceedance Plan	AM	JM	23.10.23

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Client: Lightsource BP

Project: Plas Power Solar Farm

Title: Flow Exceedance Plan

Status	Scale	Date Created
DRAFT	1:1 @A1	19.09.23

Task Team Manager	Information Author	Task Information Manager
JM	TJ	JM

Document Number: HLEF 85062-RPS-PlasPower-FE-DR-1-190923

RPS Project Number	Revision
HLEF 85062	2

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