Proposed Solar PV Development

Byers Gill Solar
EN010139

6.4.10.1 Environmental Statement Appendix 10.1 Flood Risk Assessment and Drainage Strategy

Planning Act 2008

APFP Regulation 5(2)(e)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

Deadline 4 - October 2024

Revision 4

RWE
14 Bird Street
London
W1U 1BU
United Kingdom
www.rwe.com

Table of Contents

Page

Table of Tables

Table of Figures

1. Introduction

1.1. Background

1.1.1. Wallingford HydroSolutions Ltd (WHS) has been commissioned on behalf of RWE (the Applicant) to produce a Flood Risk Assessment (FRA) and Outline Drainage Strategy for Byers Gill Solar (the Proposed Development). The Proposed Development is located in the land between Newton Aycliffe and Stockton-on-Tees (E: 433197, N: 521107).

1.1.2. This report details the findings of a comprehensive desk-based review detailing flood risk to the Proposed Development and provides recommendations for the management of surface water runoff on-site, utilising sustainable drainage systems (SuDS) options where appropriate.

1.2. The Proposed Development

1.2.1. The Proposed Development consists of a solar farm capable of generating over 50MW Alternating Current (AC) of electricity with co-located Battery Energy Storage Systems (BESS), located between Darlington and Stockton-on-Tees in north-east England. The Proposed Development is approximately 490ha and comprises six solar photovoltaic (PV) panel areas (Panel Areas A-F). The solar PV panels would be mounted on a metal frame in groups, fixed in position. An on-site substation would be located within Panel Area C.

1.2.2. The Proposed Development includes up to 32.5km of 33kilovolt (kV) underground cabling between the Panel Areas and the on-site substation, as well as approximately 10km of 132kV underground cable to connect the Proposed Development to the grid connection at the existing Norton substation (located to the north-west of Stockton-on-Tees) with both on-road and off road options. A range of supporting infrastructure is required for the Proposed Development, comprising BESS; transformers and inverters for managing the electricity produced; storage containers to hold this equipment; and security measures such as fencing, CCTV and lighting. The Proposed Development includes environmental mitigation and enhancement measures to avoid or reduce adverse impacts on the surrounding environment and nearby communities.

1.2.3. The majority of area comprising the Proposed Development (the Order Limits) is located within the administrative boundary of Darlington Borough Council, with a section of the cable route situated within the administrative boundary of Stockton-on-Tees Borough Council. A very small section of the Order Limits is within the administrative boundary of Durham County Council.

1.3. Scope of work

1.3.1. An FRA is required in accordance with Paragraph 5.8.13 of the National Policy Statement (NPS) EN-1, as the Proposed Development is more than 1 hectare in size and part of the Order Limits is within Flood Zone 3.

1.3.2. In summary, this FRA will:

- introduce the Proposed Development in terms of its location and topography;
- assess the flood risk to the Proposed Development using available data; and
- provide a surface water drainage strategy for the Proposed Development.

1.4. Data Sources

1.4.1. The key data sources used to inform this assessment are:

- 1m resolution LiDAR data, flown in 2018 [1];
- Environment Agency (EA) National Flood Maps [2];
- EA Groundwater Contours [3];
- EA Groundwater Levels [4];
- GeoSmart Groundwater Flood Risk Map [5];
- British Geological Survey (BGS) 50k Geology;
- CIRIA SuDS Manual [6];
- Site visit undertaken by WHS on 16 February 2023; and
- Little Stainton Beck Hydraulic Modelling Technical Note (Document Reference 8.18)

1.5. Relevant Legislation, Policy and Guidance

Legislation

1.5.1. The following key legislation is applicable to the assessment:

- Water Act 2003;
- Water Act 2014;
- Land Drainage Act 1991;
- Water Industry Act 1991;
- Water Resources Act 1991;
- The Flood Risk Regulations 2009 (which implemented the EC Flood Directive 2007/60/EC); and
- Flood and Water Management Act 2010.

Policy

1.5.2. Under Section 104 of the Planning Act 2008 (the Act), the Secretary of State (SoS) is directed to determine a DCO application with regard to the relevant NPS, the local impact report, matters prescribed in relation to the Proposed Development, and any other matters regarded by the SoS as important and relevant. Following their designation on 17 January 2024, there are three NPSs which are considered to be 'relevant NPS' under Section 104 of the Act:

- Overarching NPS for energy (NPS EN-1)
- NPS for renewable energy infrastructure (NPS EN-3)
- NPS for electricity networks infrastructure (NPS EN-5)

1.5.3. It is considered that other national and local planning policy will be regarded by the SoS as 'important and relevant' to the Proposed Development. A detailed account of the planning policy framework relevant to the Proposed Development is provided in the Planning Statement (Document Reference 7.1). The Policy Compliance Document (Document Reference 7.1.1) evidences how this assessment has been informed by and is in compliance with the NPSs and relevant national and local planning policies. It provides specific reference to relevant sections of the ES which address requirements set out in policy.

Guidance

1.5.4. The following guidance has informed the assessment:

- The CIRIA SuDS Manual [6]; and
- Planning practice guidance on flood risk and coastal change including the sequential and exception tests [7];

2. The Order Limits

2.1. Location

2.1.1. The location of the Proposed Development and nearby watercourses is shown in Figures 1.1 to 1.4[1]. Panel Area A is shown in Figure 1.1, Panel Areas B-D in Figure 1.2 and Panel Areas E-F in Figure 1.3. The Panel Areas are subdivided using field numbers which are labelled in the figures for reference. Figure 1.4 presents the underground cable route and connection to Norton Substation, it does not present any proposed above ground infrastructure. This document focuses on the areas where above ground infrastructure is proposed, with the exception of where the cable route crosses Flood Zones 2 and 3.

2.1.2. The Proposed Development is located within an area of undulating mixed farmland that is mainly arable.

2.1.3. The entire Order Limits is within the River Tee catchment. Panel Areas A and fields B01-06, within Panel Area B, drain southward to the River Skerne, with the most notable tributary being the Newton Beck. Fields B07-10 within Panel Area B and Panel Areas C-F drain eastward to the Bishopton Beck, with notable tributaries including Little Stainton Beck and Newbiggin Beck.

2.1.4. A number of minor watercourses or drains run through the Order Limits which are also highlighted in Figures 1.1 to 1.4. The River Skerne and the Bishopton Beck are EA main rivers and therefore they are responsible for flood risk associated with these watercourses.

2.1.5. The Proposed Development consists of solar PV modules, switchgear, inverters, hybrid inverters (containing Battery Energy Storage Systems (BESS)), spare containers, a substation, access tracks and fencing. Details of the proposed impermeable areas are displayed in Table 2-1.

Table 2-1 Proposed impermeable areas

Infrastructure	Number of units	Total area (ha)	Impermeable area (ha)
Hybrid Inverter	▪ up to 53	▪ 1.272	▪ 0.522
Inverter	▪ up to 44	▪ 0.132	▪ 0.132
Spare Container	▪ 9	▪ 0.027	▪ 0.027
Switchgear	▪ 5	▪ 0.015	▪ 0.015
Substation	▪ 1	▪ 0.310	▪ 0.040

[1] Due to the large size of the Proposed Development four figures are provided to show sufficient detail.

2.2. Topography

2.2.1. Figures 2.1 to 2.4 show the general ground levels based on 1m LiDAR survey data across the Order Limits. As the Order Limits covers a wide geographical area the topography in this area is variable with the land draining to the north, south, east and west to meet the River Skerne or Bishopton Beck.

2.2.2. The Order Limits is highest in Panel Area B with a maximum elevation of approximately 109.8m AOD. Levels fall to the east and west from here, notably more so to the west. The minimum ground level is approximately 36.2m AOD and is located in Panel Area F.

3. Sources of Flood Risk

3.1. Fluvial Flood Risk

3.1.1. Flood risk to the Proposed Development has been assessed by reviewing the EA online flood maps [2]. The EA flood maps consider the risk associated with the fluvial and tidal flood events during an undefended scenario, i.e. the presence of the fluvial or tidal defences are not considered. A data request was submitted to the EA in November 2022 who confirmed that they hold no detailed hydraulic modelling informing the extent of the flood maps.

3.1.2. The EA flood maps indicate that the Proposed Development is largely situated within Flood Zone 1 and is therefore considered to not be at a significant risk of river flooding, see Figures 3.1 to 3.4. Flood Zone 1 is defined as an area having less than a 0.1% annual exceedance probability (AEP) of flooding from main rivers. Fields D02 and F01 are partially located within Flood Zone 2 and 3 associated with the Little Stainton Beck and the Bishopton Beck respectively. Flood Zone 3 is defined as an area having more than a 1.0% AEP of flooding from main rivers.

3.1.3. Flood Zone 2 and 3 associated with the Bishopton Beck at Field F01, see Figure 3.3 of this document, is immediately adjacent to the proposed solar PV modules but does not encroach on them. An access track and crossing is proposed in this location, but it will be at grade and utilises an existing bridge crossing. Therefore, the installation of an access track will not impact the existing flood risk. Further to the northeast, Flood Zone 2 and 3 encroach on the Order Limits. However, no infrastructure or ground raising is proposed within these areas therefore there would be no impact here.

3.1.4. Flood Zone 2 and 3 associated with the Little Stainton Beck in Field D02, see Figure 3.2 of this document, indicates that flooding occurs at a sharp turn in the watercourse in low-lying land. The mapped flood zone does however cut off abruptly, it has therefore been presumed that the EA online flood map is inaccurately displaying flood risk at this location. To understand flood risk at this location, a bespoke detailed hydraulic model of the Little Stainton Beck has been developed. The development of the 2D only model is described in the Little Stainton Beck Hydraulic Modelling Technical Note (Document Reference 8.18).

3.1.5. The modelling showed that the panel areas to the south and west in this field were flooded for return periods up to the 0.1% AEP event. For the design 1.0% AEP plus higher central climate change event, maximum flood depths within the field are quite shallow for the most part, below 300mm. However, in the southeastern most corner depths reach a peak of 550mm which overlaps with a very small portion of one of the solar PV modules. Approximately 10m^2 of the panel area has a flood depth greater than 500mm. Solar PV modules will by default be raised 800mm above the ground at the toe, therefore all panels will be raised above the design flood level. A 300mm freeboard is provided for all panels except the 10m^2 area which has flood depths greater than

500mm where a slightly reduced freeboard of 250mm will be provided. The provided freeboard accounts for any uncertainty in the detailed model results. The assessment is considered to be conservative as it uses LiDAR data to represent the watercourse which would have a lower channel conveyance area than using data from a detailed topographic survey. As this is a small watercourse with a catchment <5km^2 with the solar PV modules offset from it within the adjacent floodplain, the risk of large floating debris in the vicinity of the solar PV modules is considered to be low. Therefore the amount of freeboard provided is considered appropriate.

3.1.6. Post-development modelling also demonstrated that there is no flood risk detriment downstream of Field D02 and that minor detriment is isolated to the field itself and a small amount within the adjacent watercourse itself.

3.1.7. The Order Limit crosses Flood Zone 2 and 3 just northeast of panel area E03 (see Figure 3.3) and just east of Carlton village (see Figure 3.4). Both are at the locations of existing highways crossings which will be utilised for access. No changes are proposed to these crossings and therefore there will be no impact on existing flood risk at these locations.

3.1.8. Lastly, the Order Limits crosses Flood Zone 2 and 3a east of panel area E03 (see Figure 3.3) and just south of Carlton village (see Figure 3.4) At both of these locations underground cables are proposed which would cross underneath the watercourses. Therefore no ground raising or above ground watercourse crossings are proposed. Therefore, these will not impact flood risk at these locations. As the cable crossings would go underneath the watercourses they would also cross the functional floodplain, Flood Zone 3b. However, as the cables would be located underneath the waterbodies they would not have an impact on the floodplain storage.

3.1.9. No electrical infrastructure associated with the Proposed Development will be placed within 10m of an EA main river or any other watercourses. This buffer comprises of 8m from the watercourse to the perimeter fence and 2m from the fence to the electrical infrastructure.

3.2. Surface Water and Minor Watercourse Flood Risk

3.2.1. A review of the EA surface water flood risk map indicates that the majority of the Proposed Development is at low risk of surface water flooding, with a chance of flooding of less than 0.1% AEP across the majority of the Order Limits. No critical infrastructure (all electrical infrastructure except for solar PV modules) has been placed within the 0.1% AEP surface water flood zone. Access tracks will be at grade so as not to impede overland flows routes.

3.2.2. No electrical infrastructure associated with the Proposed Development will be placed within 10m of a minor watercourse. Solar PV modules will by default be raised 800mm above the ground at the toe, allowing overland flow routes to operate as normal. It has been confirmed whether this raising is sufficient by checking the 1.0% AEP surface water flood depth banding map. See Figures 4.1 to 4.4 for these flood depths relative to the Proposed Development and field numbers. Table 31 highlights the fields within Panel Areas that have the most notable surface water flood risk spots and the associated maximum depth bands.

Table 3-1 Surface water flood depth bands

Panel Area	Field	1.0% AEP depth band (mm)
Panel Area A	▪ A12	▪ 300-600
	▪ A16	▪ 300-600
	▪ A21	▪ 300-600
Panel Area B	▪ B05	▪ 150-300
Panel Area C	▪ C04	▪ 300-600
	▪ C06	▪ >1200
Panel Area D	▪ D02	▪ 600-900
Panel Area E	▪ E01	▪ 300-600
Panel Area F	▪ F03	▪ 300-600

3.2.3. Only Fields C06 and D02 highlight depths which may potentially be greater than 800mm and therefore have been investigated further to determine the risk these present. The risk in Field D02 is associated with fluvial flood risk which has been assessed using a detailed hydraulic model as described in section 3.1. The surface water flood extent has been compared against the LiDAR data in Field C06 by assuming the water surface is horizontal to estimate more precise flood depths within the bands presented in Table 3-1.

3.2.4. Based on the data collected during a site visit attended by WHS on 16 February 2023 and looking at the topography and aerial imagery, we have gathered strong evidence to determine that the mapped area of surface water pooling in field C06 has been inaccurately represented in the EA surface water flood maps. As the topography slopes downwards to Square Wood and is not obstructed or blocked significantly anywhere, there is no reason for pooling here at depths exceeding 1.2m. To verify this, the site visit was conducted which concluded that there is no barrier to flow or significant low spot at the location. It has therefore been concluded that the depths of >1200mm are in fact not realistic. A review of the LiDAR estimates that depths up to 600mm are possible behind a bund within Square Wood before overtopping this and flowing downslope. Therefore, the 800mm panel raising is considered to be sufficient. The LLFA has been consulted regarding the flood risk present in this area, and further information can be found in Section 4.2. It was agreed that the surface water flood maps at this location appears inaccurate.

3.3. Reservoir Flood Risk

3.3.1. A review of the EA's reservoir flood risk maps (wet and dry day) indicate that the site is largely not at risk of flooding from a reservoir flooding. The only risk mapped is associated with the Bishopton Beck and the extents are similar to the fluvial flood risk mapping. Therefore, no infrastructure associated with the Proposed Development has been proposed in an at risk area except for the access track and crossing at this location (E: 436070, N: 521592). However, it should be noted that reservoir flooding is a rare event with a very low probability of occurrence. Current reservoir regulation, which has been further enhanced by the Flood and Water Management Act, aims to make sure that all reservoirs are properly maintained and monitored to detect and repair any problem. Therefore, the risk of reservoir flooding at this location is not considered to be of concern.

3.4. Groundwater Flood Risk

3.4.1. Groundwater flooding occurs when sub-surface water emerges from the ground at the surface. To assess groundwater flooding, the GeoSmart Groundwater Flood Risk Map (5m grid) [5] for the Order Limits has been obtained and BGS 50k geology data has been reviewed. The map was provided as a shapefile which is shown in Figure 5.1. The GeoSmart flood risk map is informed by Ordnance Survey topographical data, EA LiDAR data, BGS geological maps and BGS groundwater level data. This data was processed internally using hydrogeological and risk models and was calibrated using a database of recorded groundwater flood events. More information on the dataset can be found on their website [5].

3.4.2. Using the GeoSmart Groundwater Flood Risk Map, groundwater flood risk has been assessed. This mapping ranks the likelihood of the 1.0% AEP event or greater occurring across a site on a scale from negligible to high. It indicates that the majority of the Order Limits has a negligible risk of groundwater flooding, see Figure 5.1. This suggests a negligible risk and any groundwater flooding incidence has a chance of less than 1.0% annual probability of occurrence. Small pockets across the Order Limits are classed as low risk and moderate risk however no electrical infrastructure has been located within these.

3.4.3. The Proposed Development is underlain by bedrock consisting largely of Ford formation Dolostone, largely present on the western extent of the site. Limestone and mudstone underly the centre of the Proposed Development with mudstone predominantly underlying the eastern extent of the site. Areas of sandstone also underlie areas on the eastern extent. Superficial deposits of Till, Alluvium, Glaciofluvial deposits and a small pocket of Peat are also present within the catchment.

3.4.4. Available EA groundwater level data and contours have been acquired and reviewed to understand where the water table is relative to the ground surface across the Proposed Development. The data includes groundwater contours for the bedrock but does not include shallow groundwater data. Generally, groundwater levels have been higher in recent years as the aquifer has been recovering from what is assumed to be industrial abstraction in the 1970s and 90s. The EA groundwater contours produced in 2023 for the 2009 Magnesian Limestone Conceptual Model Report [3], indicate what the groundwater levels could be across the Proposed Development. Digitised contours for both high and low levels were reviewed. The groundwater level stations used to inform these contours provide data to the current day and will also be assessed to understand current levels and sense check the contour lines. The contours and station locations are shown in Figure 5.1.

3.4.5. Table 3-2 lists the stations, the maximum level on record and comments on these in relation to the contour lines. Newton Ketton and Ketton Hall are most relevant as they are in the closest proximity to the Proposed Development.

3.4.6. The contour lines generally align well in comparison with the maximum water levels recorded at the various stations. Some discrepancies were observed, more so to the east which could be attributed to the approximation of the contour lines. However, based on this review of the data the contour lines are deemed suitable to approximate where the highest water table could be under the Proposed Development.

Table 3-2 Groundwater Stations

Station	Max level on record (m AOD)	Year of max	Comment
Newton Ketton	▪ 57.64	▪ 1969	▪ Aligns reasonably well with the low contour lines which is between the 50 and 55m AOD lines. LiDAR indicates the max recorded level is approximately 15m below the surface.
Ketton Hall	▪ 56.90	▪ 1977	▪ Aligns well with both contour lines being near 55m AOD. LiDAR indicates the max recorded level is approximately 10m below the surface.
Howes Hills	▪ 56.96	▪ 1970	▪ Both sets of contour lines indicate level between 40 and 45m AOD contour lines which is below the max recorded level. Even so, LiDAR indicates the max recorded level is approximately 24m below the surface.
Heley House	▪ 48.41	▪ 2016	▪ Alignment differs somewhat as the station is closer to the 40m AOD contour line rather than the 50m line.
Diamond Hall	▪ 38.34	▪ 2022	▪ Aligns well with the both contour lines despite more recent higher observed groundwater level.
Aycliffe 2	▪ 88.12	▪ 2013	▪ Just below the 85m AOD high contour line rather than 90m AOD.
Low Copelaw	▪ 76.50	▪ 2013	▪ Aligns well with the high contour lines within a few metres.

Swan Carr	▪ 74.78	▪ 2013	▪ Aligns well with both contour lines within a few metres.
Great Isle	▪ 75.52	▪ 2013	▪ Aligns well with both contour lines within a few metres.
Bradbury	▪ 73.73	▪ 2013	▪ Aligns well with both contour lines within a few metres.
Lowfield	▪ 80.70	▪ 1987	▪ Aligns well with the high contour lines within a few metres.

3.4.7. To assess whether the Proposed Development will intersect the groundwater, a raster grid of groundwater levels was produced by Triangulated Irregular Network (TIN) interpolation of both the high and low contour lines. The raster values were then subtracted from the LiDAR values to determine the approximate depth of the groundwater table for both sets of contour lines. This indicated for both scenarios that the vast majority of the Order Limits is at least 10m above the groundwater table. A minimal amount of infrastructure consisting of the ends of some solar PV modules, the associated underground cables and none of the critical infrastructure are located in areas where the water table is between 7 and 10m below the surface. For both scenarios the groundwater table is closer to the surface nearer the River Skerne, east of Panel Area A, and the Billingham Beck to the north of Panel Area F. The lowest depth recorded is in Panel Area A and is 3.5m and is associated with the low groundwater contour lines.

3.4.8. The solar PV modules piles would be approximately 1.0m deep as set out in ES Chapter 2 The Proposed Development (Document Reference 6.2.2). Where in certain locations ballast slabs are proposed instead of piles as an archaeological mitigation, these will sit on the surface and will not penetrate the ground. Underground cables, the final location of which will be subject to detailed design, will also not be deep enough to interact with the groundwater. Based on the groundwater data assessed the subsurface infrastructure has a minimal risk of interacting with the groundwater. Therefore, groundwater flow paths will not be intercepted. The impact of the surface water drainage strategy on groundwater flood risk and groundwater water balance is discussed in section 4.4.

3.5. Safe Access and Egress

3.5.1. Access should be demonstrated to be operational during times of flooding to allow movement of onsite workers from areas at risk, or to allow access for emergency services. Due to the large size of the Proposed Development, access to the Proposed Development will be from multiple points including the tracks off Brafferton Lane, High House Lane, Lodge Lane, Bishopton Lane and Church View. None of these tracks cross the mapped Flood Zones 2 or 3 as alternative access to the crossing over the Bishopton Beck is available.

3.5.2. In addition to the above, justification for safe access and egress is on the basis that no staff will be permanently based on the site and that access will not be attempted during extreme fluvial or pluvial flood events. This will ensure that the risk to people and vehicles is removed.

3.6. Sequential Test

3.6.1. NPS EN-1 requires, in reference to The Planning Practice Guidance [7], that the Sequential Test is conducted to steer new development to areas with the lowest risk of flooding.

3.6.2. The Applicant has carefully considered a series of alternative locations for the Proposed Development. A detailed account of this process has been provided in ES Chapter 3 Alternatives and Design Iteration [APP-026]. Flood risk was one of the key considerations in site selection and the consideration of alternative sites and the Applicant has worked to identify land through voluntary agreement with landowners in areas of lower risk of flooding wherever possible.

3.6.3. The ability to connect the Proposed Development to the national grid via a 'Point of Connection' (POC) is the first critical factor in considering the location of the Proposed Development. The Applicant have secured a POC at the Norton Substation and no alternative connection locations were therefore considered by the Applicant. NPS EN-3 through Paragraph 2.10.25 highlights *"To maximise existing grid infrastructure, minimise disruption to existing local community infrastructure or biodiversity and reduce overall costs applicants may choose a site based on nearby available grid export capacity"*, reinforcing the relevance of the POC as a key factor in site selection.

3.6.4. As outlined in Chapter 3 of the ES [APP-026], the Applicant identified an area of search around the POC at a distance of 12km in order to consider potential land that would meet the requirements of the connection agreement, and provide sufficient area to deliver the generating capacity required. In considering land within this area of search, the following factors were taking into consideration:

- An area of land, ideally within a single or connected block which offers sufficient space to accommodate the generating capacity to maximise the connection agreement at Norton.
- Avoidance of key environmental constraints including flood risk wherever possible.
- Consideration of other land uses.
- Willingness of land owners to engage in the potential use of their land for the Proposed Development.

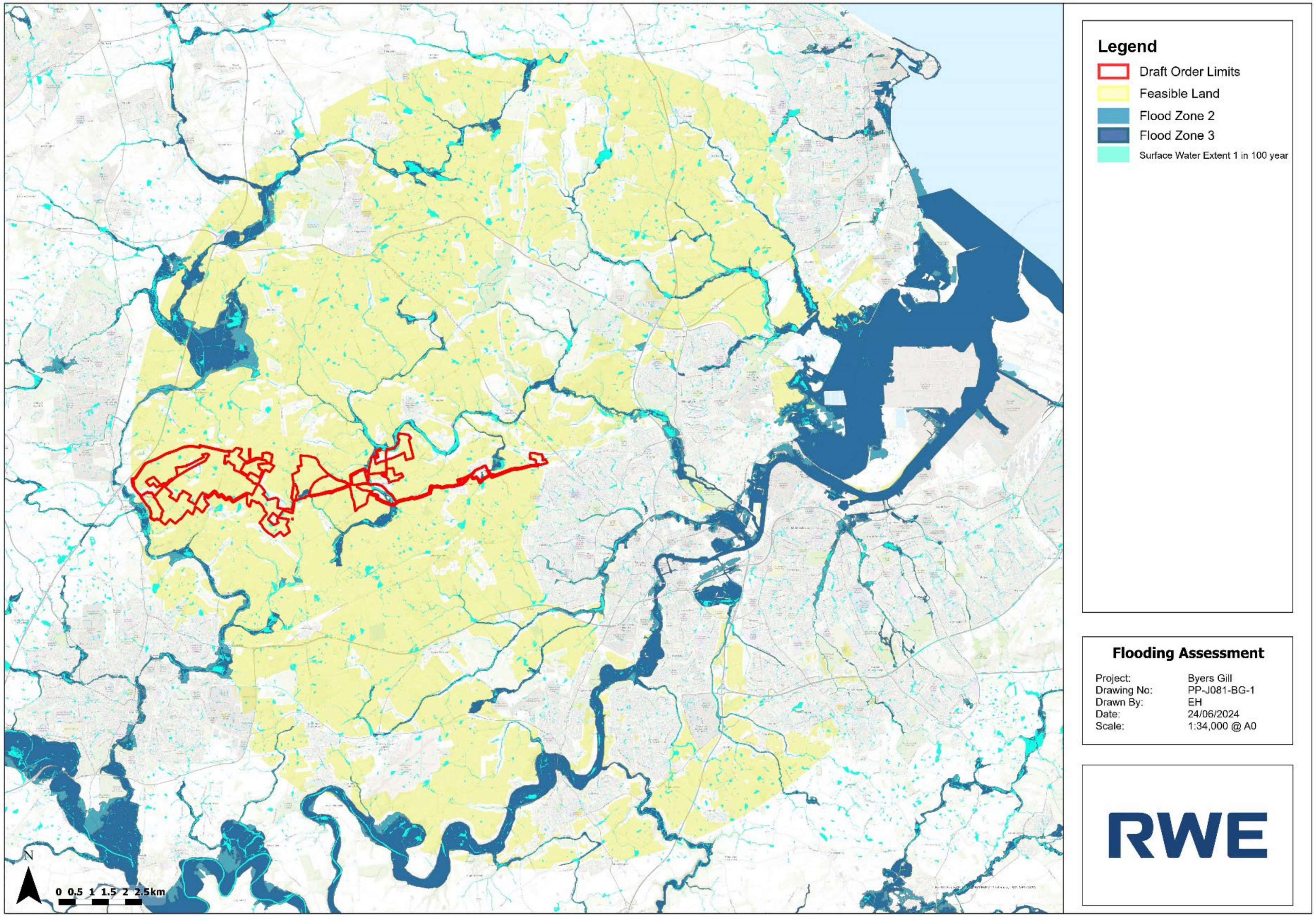
3.6.5. Given the generating capacity of the Proposed Development and associated area of land required, and in considering the factors above, the Applicant was not able to locate reasonably available alternative sites which avoid any fluvial flood risk entirely. This is illustrated in part by Drawing 1 overleaf, and is considered to be appropriate at site selection stage. Taking account of the factors outlined above, the Applicant was not able to identify any available sites which were at a lower or no risk of flood when compared to the Order Limits.

3.6.6. In choosing this location, the drawing illustrates that there is limited land within the area of search where the Applicant could have fully avoided areas of flood risk in developing to maximise the grid connection. The only area which offered potential to achieve this was a swath of land broadly to the southwest of the Norton Substation. However, this area contains three existing consented or built solar projects and sufficient land was therefore not available at the scale required, also considering wider environmental constraints.

3.6.7. The final location of the Proposed Development is mostly within low risk Flood Zone 1 except for a small area of solar panels in Field D02, two existing access routes and two underground cable crossings as described in sections 3.1 and 3.2. It has been demonstrated that no alternative sites with no flood risk are reasonably available (i.e. excluding Flood Zones 2 and 3). This has taken into account other constraints such as proximity to a grid connection and wider environmental constraints such as visual effects and biodiversity constraints.

3.6.8. Having demonstrated that there are no other sites reasonably available within the search radius that are at a lower flood risk, it is considered that the Sequential Test has been satisfied for this development.

Drawing 1 Flood Risk within initial search area



3.7. Sequential Approach

3.7.1. A sequential approach to the location of a development should be undertaken to ensure that development is steered towards areas at little or no risk of flooding from any source (as required by the Planning Practice Guidance [7]). It is preferable that infrastructure is sited in areas of low risk instead of medium and high risk areas.

3.7.2. Within the Site, a sequential approach has been used for the layout and placement of infrastructure to avoid medium and high flood risk areas. This has been informed by the data assessed in sections 3.1 to 3.4 including the EA's flood map for planning, surface water flood risk maps, reservoir flood risk maps, groundwater contour lines and the GeoSmart groundwater flood risk map. The sequential approach has been considered since site selection and throughout the scheme design within the site area. This approach resulted in:

- No electrical infrastructure being placed within a 10m buffer of any watercourses;
- No sensitive electrical infrastructure including inverters, hybrid inverters, switchgears, substations and spare containers being placed within the 1.0% and 0.1% AEP fluvial or surface water flood risk zones;
- No solar PV module except for those in Panel Area D02 have been located in Flood Zone 2 and 3.

3.7.3. A cable route and an access route to the substation are required. The existing access route that will be used crosses Flood Zone 2 and 3 at two locations and the proposed underground cable route also crosses at two locations. The exact locations are specified in section 3.1. These utilise existing crossings and cables will be located underground below the waterbodies. Therefore, these will not result in changes to existing flood risk and the cables will not be impacted by above ground flooding. Panel area D02 is located in Flood Zone 2 and 3. The PV modules will be raised 800mm above the ground such that they sit above the design flood level with only the legs submerged. These have a small cross-sectional area and would have a negligible impact on fluvial flood risk. Detailed hydraulic modelling has been undertaken as described in section 3.1 which has demonstrated that the solar PV modules will be raised sufficiently so as not to impede overland flow routes.

3.7.4. Based on the above it is concluded that a sequential approach to the placement of infrastructure has been adopted throughout the development process in reference to the assessed flood risk data. Where parts of the development have been sited in fluvial or surface water flood risk zones, it has been demonstrated how it is either not impacted by flood risk or how it has been mitigated.

3.8. Exception Test

3.8.1. NPS-EN-1 states (as required by the Planning Practice Guidance [7]) that the development of essential infrastructure in areas of higher flood risk is only permitted if the exception test is passed. The exception test is required to demonstrate that:

- the development provides wider benefits for the sustainability of the community;
- the development will be safe for its lifetime and will not have any adverse effects on third party flood risk, reducing overall flood risk where possible; and
- the development will not result in a net loss of floodplain storage and will not impede water flows.

3.8.2. The wider benefits of the development and the overall planning balance are set out in the Planning Statement [APP-163], namely sections 3 and 6. This statement demonstrates the need for the development and considers the additional benefits and how they align with broader goals and strategies, weighing them up against the residual adverse impacts. In summary, the benefits include:

- Making a positive impact on the UK's energy market and a key contribution to meeting national and local renewable energy targets;
- Significant biodiversity net gain improvements within the Order Limits to facilitate nature recovery;
- Enhanced local connectivity and provision of interpretation at points of interest; and
- Provision of a Community Benefit Fund across the lifecycle of the Proposed Development.

3.8.3. The need of the Proposed Development in respect to the urgent need for national significant energy infrastructure is further described in the Energy Generation and Design Evolution Document [REP2-010]. In establishing the overall critical national priority for the Proposed Development, and a planning balance in favour of the development, these documents demonstrate that its benefits outweigh flood risk, particularly in the context of a low flood risk across the site as a whole.

3.8.4. The Proposed Development design life is expected to be at least 40 years therefore the higher central peak river flow allowance for the 2080s should be considered. For the Tees Management Catchment this is 40%.

3.8.5. As detailed in Sections 3.1 and 3.2:

- No critical infrastructure has been placed inside of the fluvial or pluvial 1.0% and 0.1% AEP flood zones;
- Access tracks will be at grade;

- The crossing proposed over the Bishopton Beck will utilise an existing bridge crossing; and
- For the area of the solar PV modules located in D02 within a flood zone, the panels will be a minimum of 800mm above the ground, placing them above the 1.0% AEP + 40% climate change fluvial flood level as demonstrated by the outputs of a detailed hydraulic model. The cross sectional area of the panel struts is minimal so the impact on floodplain storage is considered to be negligible. Detailed post-development modelling showed that the panels would not have an adverse impact on flood risk outside of the site.

3.8.6. Based on the above it is concluded that the Proposed Development will deliver significant sustainability and community benefits whilst also being safe for its lifetime and not impacting flood risk on site or off site. The infrastructure is positioned such as not to impede flow routes and will have a negligible impact on floodplain storage.

4. Management of Surface Water Runoff

4.1. Planning Requirements

4.1.1. Based on guidance outlined in NPS EN-1 and set out in the NPPF, any development should include measures to manage post-development surface water run-off rates. As the Order Limits are currently a greenfield site, effective management of surface water runoff from the Proposed Development is required to maintain the existing hydrological regime. The following sections describe how surface water runoff will change and how any changes will be sustainably managed on site.

4.2. Correspondence with the Lead Local Flood Authority (LLFA)

4.2.1. The LLFA and Stockton-on-Tees Borough Council, have been consulted and initial pre-application advice was received in August 2022. The key points were as follows:

- an 8m buffer zone must be maintained from the top of any watercourse embankment where no development must take place; and
- soakaways/infiltration as a primary source of disposal of surface water runoff is not accepted due to unsuitable ground conditions and long term maintenance issues.

4.2.2. As per the above, soakaways have not been considered further. As stated in Section 3.2.2, an 8m buffer is provided around all mapped watercourses to inform the layout of the Proposed Development. All solar PV modules and supporting infrastructure has been placed outside of this buffer except for any existing access tracks being utilised.

4.2.3. A meeting was held with the Stockton-on-Tees Borough Council and Darlington Borough Council on 10 February 2023 to discuss the approach to flood risk and drainage and inform the development of this FRA. The following key points were summarised:

- the approach to not provide formal SuDS features (outlined in the following sections) to attenuate runoff was agreed in principle;
- solar PV modules located within the surface water and minor watercourse flood zones can be raised above the flood level with no further mitigation required. The key being to ensure overland flow routes are not impeded; and
- where the surface water flood depths are shown to be >1200mm in the surface water flood mapping for Field C06 and believed to be inaccurate, this can be disputed with sufficient evidence from a site visit and reviewing LiDAR data.

4.2.4. The Consultation Report (Document Reference 5.1) submitted alongside the DCO application contains a full account of the previous statutory consultation process and issues raised in feedback.

4.2.5. A second meeting was held with the Stockton-on-Tees Borough Council and Darlington Borough Council on 14 November 2023 to discuss the implication of proposing ballast slabs under some panels on the surface water drainage strategy. In certain locations across the Proposed Development, archaeology constraints have been identified and therefore alternative mounting structures have been proposed in the form of ballast slabs that sit on the surface rather than penetrating the ground. It was therefore agreed that the drainage strategy needed to be revisited to account for the introduction of the ballast slabs. The details of this are described below in section 4.4. Agreement in principle to the solution was received from both Darlington LLFA and Stockton-on-Tees LLFA.

4.3. Summary of Drainage Strategy

4.3.1. The overarching principle of the drainage strategy for the Proposed Development is to provide SuDS at source, ensuring that surface water run-off is managed as per existing site conditions. Formal SuDS features including engineered pipe runs, manholes and storage features are not proposed due to the nature of the development and the perceived minimal impact on surface water runoff, justified below. A summary of the SuDS components that are proposed to manage surface water run-off at source are summarised in Table 4-1 and a detailed discussion of the proposed SuDS scheme is provided in the following sections.

Table 4-1 Summary of proposed drainage scheme

Infrastructure	Drainage Component	Comment
Solar PV Modules	▪ Grassland/wildflower mix under the panels.	▪ Increase in run-off is expected to be negligible due to the design of the solar PV modules. However, filter strips are proposed as a precautionary measure. ▪ Where ballast foundations are proposed, these will sit upon a porous subbase that will allow runoff to pass under the slab and over natural ground and not impede overland flow routes. As the ballasts will be located under the solar panels they will not result in effective additional impermeable area.
BESS, Inverters, Spare Containers, Switchgears, and Sub-station	▪ Apron of clean crushed stone	▪ Small impermeable areas (listed in Table 2-1) are surrounded by clean crushed stone to promote local natural land drainage conditions.
Access Tracks	▪ No drainage required as no increase to impermeable area.	▪ Construction will be a permeable aggregate over a geotextile membrane with an aggregate sub-base layer beneath.

4.4. Solar PV Modules

4.4.1. The solar PV modules will intercept rainwater and shed it onto the ground on the lower edge of each solar PV module, referred to as the drip line. Gaps within the centre of the solar PV modules act to reduce this concentration of water flow towards the drip line and provide an alternate route for rainwater to reach the ground. Whilst solar PV modules would result in an increased concentration of rainwater in these locations, landscaping is proposed to reduce, slow and distribute the surface water run-off.

4.4.2. Using wildflower seed mixes for planting beneath the solar PV modules will promote infiltration into the underlying soils and the interception of rainwater, mimicking baseline natural land drainage conditions. By mimicking baseline conditions and not using formal infiltration SuDS the risk of groundwater flooding increasing due to the presence of the development will be mitigated. Mimicking baseline conditions will also mean that the drainage strategy will have a null impact water balance below ground when comparing pre and post development. During more extreme events, some water will run-off through the vegetation, in a similar way to the greenfield site response. As most of the existing land is arable/grazed farmland the change in landscaping itself is expected to reduce run-off rates.

4.4.3. A study on the hydrological implications of solar farms confirmed this to be the case [8]. Solar PV modules themselves will not have a significant impact on runoff volumes, peak rates or time to peak rates, provided the ground beneath the panels remains vegetated. The study accounted for changes in soil type, slope angle and rainfall intensity, concluding that ground cover has the most significant impact on runoff rates. On this basis, providing that vegetation cover beneath the solar arrays is maintained, no significant increase in surface water runoff is anticipated as a result of the solar PV modules.

4.4.4. The management of the landscape and ecological features will be undertaken in accordance with ES Appendix 2.14 Outline Landscape and Ecology Management Plan (LEMP) (Document Reference 6.4.2.14).

4.4.5. In certain locations across the Proposed Development, archaeology constraints have been identified and therefore alternative mounting structures have been proposed in the form of ballast slabs which sit on the surface rather than penetrating the ground. These areas include fields B06, B08, B09, B10, C01 and a portion of fields A04, A05, F02 and are depicted in ES Figure 8.4 Areas of Known and Potential Archaeology (Document Reference 6.3.8.4). Phase 2 archaeological surveys are to be conducted post consent to determine whether these foundations are required for any other fields. Taking a typical field, the area of the slabs will be approximately 15% of the total solar panel area or 5% of the total field area. As this will be the case for some fields and not all, the overall coverage across the entire site would be very low compared to the change in land type from arable land to grassland that will be implemented across the entirety of the site.

4.4.6. The slabs will be located underneath the solar panels and therefore there will be no effective additional impermeable area for rainfall akin to urban developments. The pads will be evenly spaced out and will not span the length or width of the panels, see ES Figure 2.9 (Document Reference 6.3.2.9). Additionally, it is proposed that the pad foundations will sit upon a 100mm thick, porous subbase with a permeable geotextile membrane underneath. This detail is also shown in the drawing. This permeable layer will allow runoff to pass under the slabs and over the natural ground below them. Given the small size of the pads relative to the panels in addition to the permeable layer underneath them, the pads would not interrupt overland flow routes. With the details of the proposed slabs more clearly defined it is considered that additional intervention is not required as there will be a negligible impact on surface water runoff volume.

4.5. Battery Energy Storage Systems

4.5.1. The small impermeable areas are primarily associated with the BESS in addition to the spare containers, inverters, switchgears, and sub-station. These cover a total area of 0.68ha and will have an apron of clean crushed stone to promote natural land drainage conditions in the vicinity of the structures. The apron will be at least 1m wide beyond the structure footprint with a depth of at least 300mm consisting of 40-70mm crushed stone. This is common practice for solar farm developments across the UK and deemed an appropriate measure to account for the introduction of a small impermeable area in a rural location.

4.6. Access Tracks

4.6.1. The proposed on-site access tracks will be constructed from Type 1 aggregate with a geogrid used to stabilise the sub-base and hold the aggregate in place. The tracks will also be at grade, therefore the access tracks are considered to be permeable and will not lead to a significant increase in run-off or impede natural overland drainage routes.

4.7. Maintenance Plan

4.7.1. This section has been produced as per the guidance provided in the CIRIA SuDS manual. The primary maintenance requirements for the Proposed Development relates to the landscaping and gravel aprons. The key maintenance items have been broken down in Table 4-2. The maintenance plan has been produced using the relevant guidance from the CIRIA SuDS Manual.

Table 4-2 Maintenance Plan

Feature	Maintenance Activity	Frequency	Responsible Body
Landscaping	▪ Inspect sward for problematic weeds and deal with them as required.	▪ Annually	▪ Landowner / Landscape Contractor
	▪ Inspect the ground at the toe of the panels and around structures for strips of bare soil (rilling). These areas will be scarified, the soil cultivated locally and reduced to a fine till, and re-seeded with a hardy water-tolerant grass seed mix.	▪ Annually	
	▪ Cut the grass to a minimum height of 50mm and remove cuttings from site.	▪ Annually, or as required	
Gravel Aprons	▪ Remove litter and debris.	▪ Monthly, or as required	▪ Landowner / Maintenance Contractor
	▪ Inspect silt accumulation rates and establish appropriate removal frequencies.	▪ Monthly at start, then half yearly	
	▪ At locations with high pollution loads, wash or replaced overlying filter medium	▪ Five yearly, or as required	

4.8. Surface Water Management during Construction

4.8.1. The production of a Construction Surface Water Management Plan (CSWMP) will be secured via requirement 4 of the Development Consent Order (DCO). The outline principles of this plan can be found in the Outline CEMP (Document Reference 6.4.2.6). This will be a site wide water management plan and mitigation plan which includes rainfall runoff, site drainage, surface water and groundwater and any additional monitoring requirements if necessary subject to future changes and ground investigation work.

5. Conclusions

5.1.1. This FRA and drainage strategy outlines how flood risk and surface water will be managed during the operational phases of the Proposed Development and provides an overview maintenance plan for the drainage mitigations proposed. In summary:

- No critical infrastructure has been placed within the mapped fluvial and pluvial flood zones;
- Some solar PV modules are located within the mapped flood zones; however, this is considered acceptable in line with NPS EN-1 and current NPPF guidance for essential infrastructure. The exception test is required for infrastructure in Flood Zone 3 and to manage flood risk. Therefore, solar panels will be raised sufficiently above the 1.0% AEP flood level and not impede overland flow routes;
- Where solar panels have been sited in fluvial Flood Zone 2 and 3 in D02, a detailed hydraulic model has been developed to demonstrate that the solar PV modules will be above the 1.0% AEP plus climate change flood level with only the legs submerged. Post-development modelling has been undertaken that demonstrates that the panel legs will not impact flood risk outside of the site.
- The Proposed Development will not interact with the groundwater table and the drainage strategy will be mimic baseline conditions, mitigating the risk of groundwater flood risk increasing, subsurface flow routes being intercepted or the water balance being impacted;
- New landscaping will improve upon existing arable farmland by intercepting runoff and promoting natural sedimentation, filtration and infiltration;
- The proposed solar PV modules and access tracks will not lead to any significant increase in runoff; and
- Ancillary infrastructure will be surrounded by a crushed stone apron consisting of clean 40-70mm stone to promote natural land drainage conditions locally.

References

[1] DEFRA, "National LIDAR Programme," 2022. [Online]. Available: https://environment.data.gov.uk/DefraDataDownload/?Mode=survey. [Accessed 10 March 2023].

[2] Environment Agency, "Flood Map for Planning," 2023. [Online]. Available: https://flo od-map-for-planning.service.gov.uk/. [Accessed 10 March 2023].

[3] Environment Agency, "Northumbrian Magnesian Limestone Aquifer Hydrogeological Conceptual Model Report Reference: 6886 R2," by ESI for the Environment Agency, April 2009.

[4] Environment Agency, "Hydrology Data Explorer," 2023. [Online]. Available: https://environment.data.gov.uk/hydrology/explore. [Accessed 8 September 2023].

[5] "GeoSmart Groundwater Flood Risk Map," GeoSmart Information, 4 January 2023. [Online]. Available: https://geosmartinfo.co.uk/data-and-services-for-asset-managers/groundwater-flood-risk-map/.

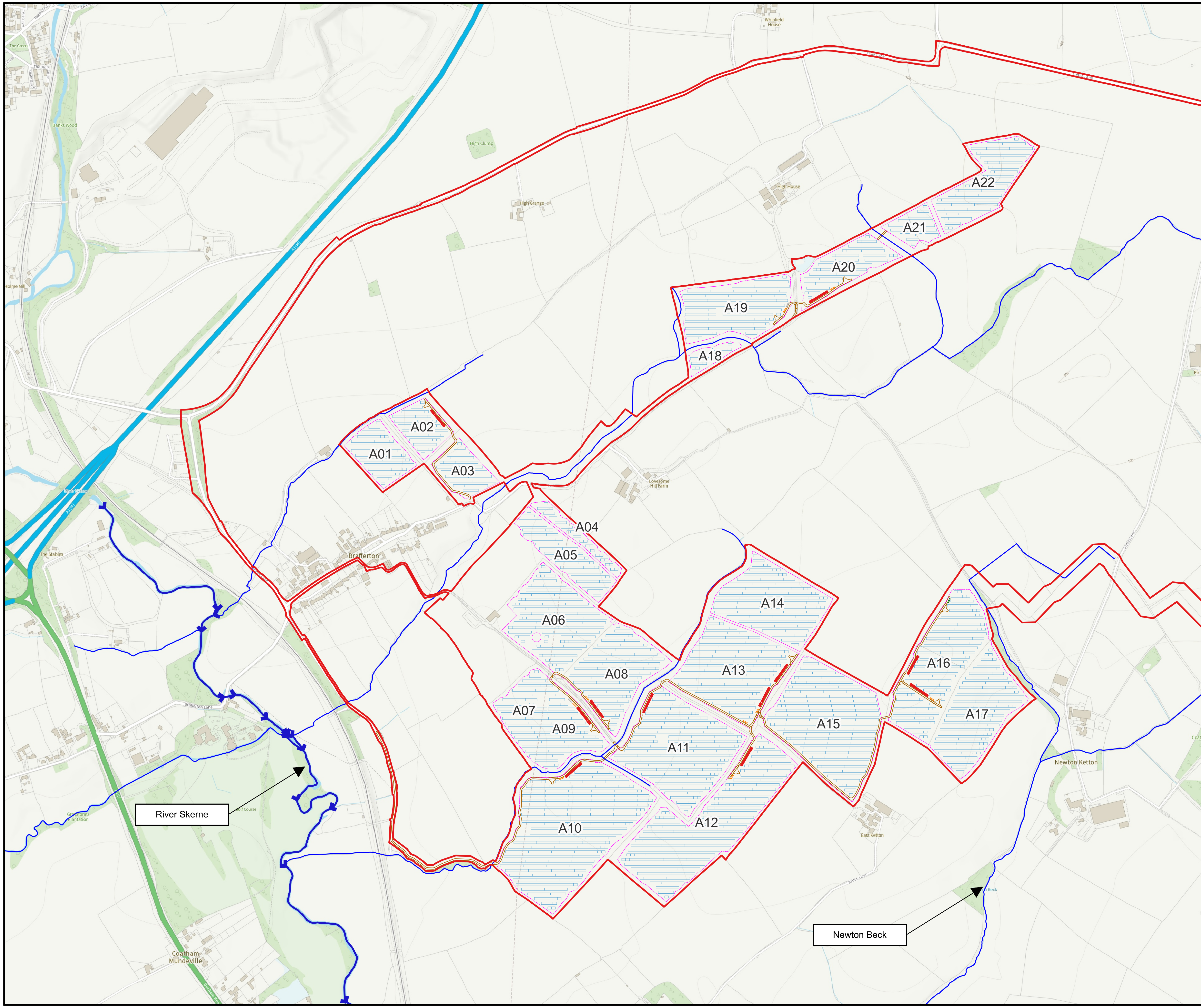
[6] CIRIA, "The SuDS Manual," CIRIA, London, 2015.

[7] Ministry of Housing, Communities and Local Government, "National Planning Practice Guidance," 2019.

[8] L. Cook and R. McCuen, "Hydrological response of solar farms," *Journal of Hydrologic Engineering,* vol. 18, no. 5, pp. 536-541, 2011.

[9] Department of Energy and Climate Change, "Overarching National Policy Statement for Energy (EN-1)," 2011. [Online]. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf. [Accessed 10 August 2023].

Figures



A3

Legend
- Environment Agency Main Rivers
- Watercourses (within boundary)
- Observed drainage pipes
- Observed drainage ditches
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name
Byers Gill Solar

Drawing Title
Figure 1.1
Site Layout and Watercourses
(1 of 4)

Scale at A3
1:10,000

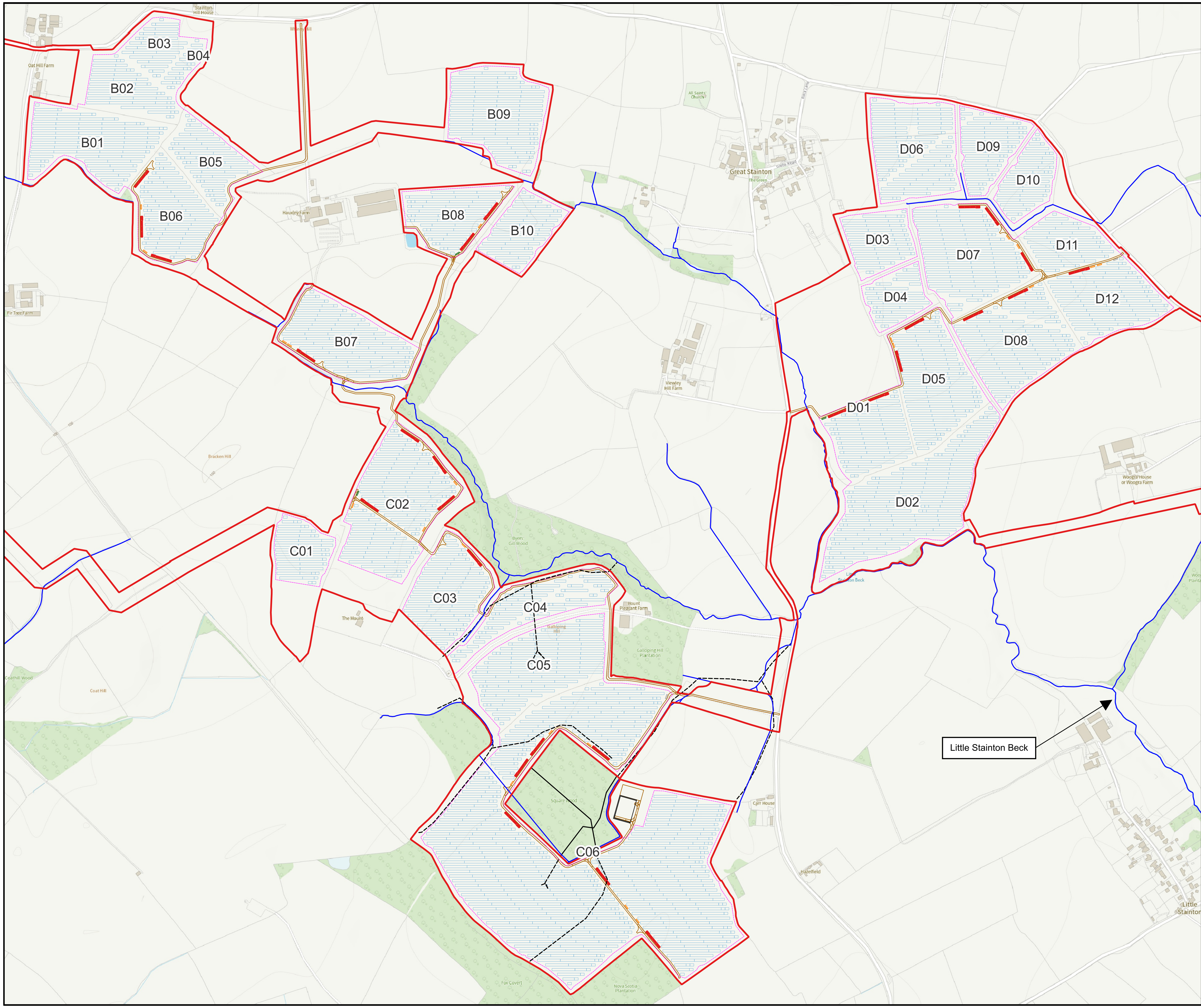
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00008



A3

Legend

- Environment Agency Main Rivers
- Watercourses (within boundary)
- Observed drainage pipes
- Observed drainage ditches
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

P03	08/01/24	SP	PB	PB	PB
Rev	Date	By	Chkd	Appd	Authd

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 1.2
Site Layout and Watercourses
(2 of 4)

Scale at A3
1:10,000

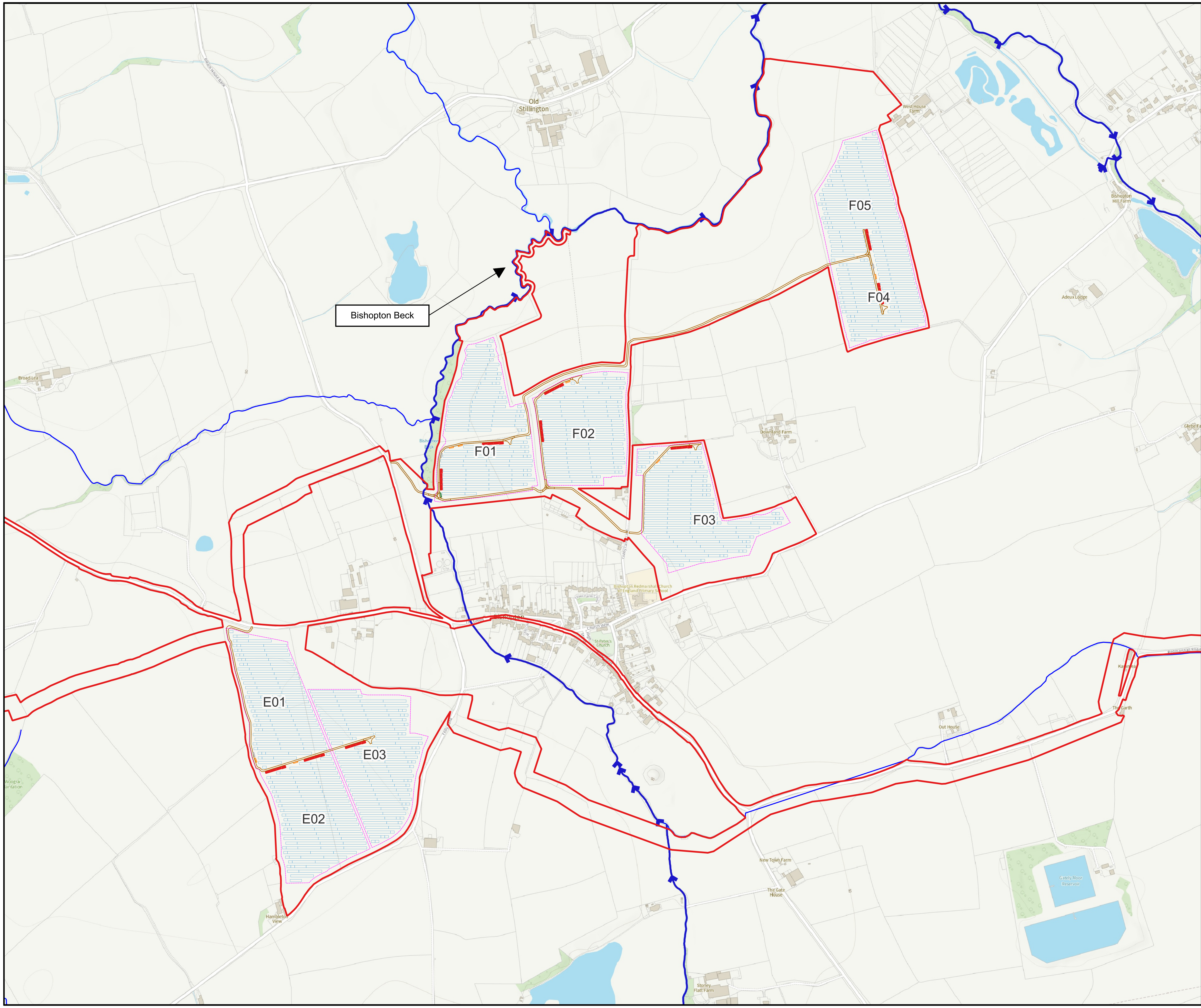
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00009



Legend
- Environment Agency Main Rivers
- Watercourses (within boundary)
- Observed drainage pipes
- Observed drainage ditches
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

A3

Coordinate System: British National Grid

0 0.25 0.5 km

P03	08/01/24	SP	PB	PB	PB
Rev	Date	By	Chkd	Appd	Authd

Client

RWE

Project Name
Byers Gill Solar

Drawing Title
Figure 1.3
Site Layout and Watercourses
(3 of 4)

Scale at A3
1:10,000

Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00010

A3

Legend

- Environment Agency Main Rivers
- Watercourses (within boundary)
- Observed drainage pipes
- Observed drainage ditches
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

P03	08/01/24	SP	PB	PB	PB
Rev	Date	By	Chkd	Appd	Authd

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 1.4
Site Layout and Watercourses
(4 of 4)

Scale at A3
1:10,000

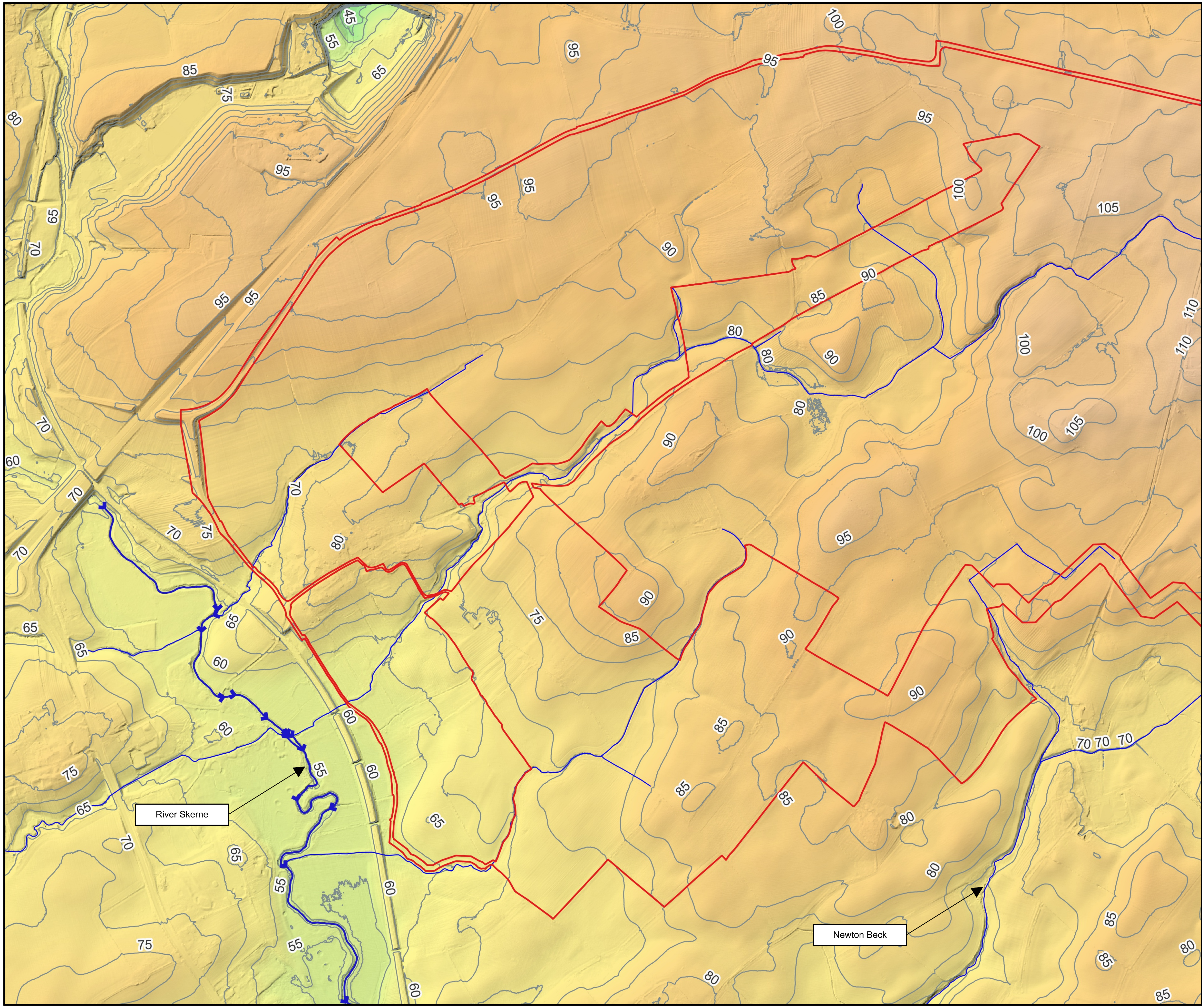
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00011



Legend

- Environment Agency Main Rivers
- Watercourses (within boundary)
- Observed drainage pipes
- Observed drainage ditches
- Order Limits
- 5m Contour Lines

Ground Level (m AOD)
120
30

A3

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name
Byers Gill Solar

Drawing Title
Figure 2.1
Site Topography (1 of 4)

Scale at A3
1:10,000

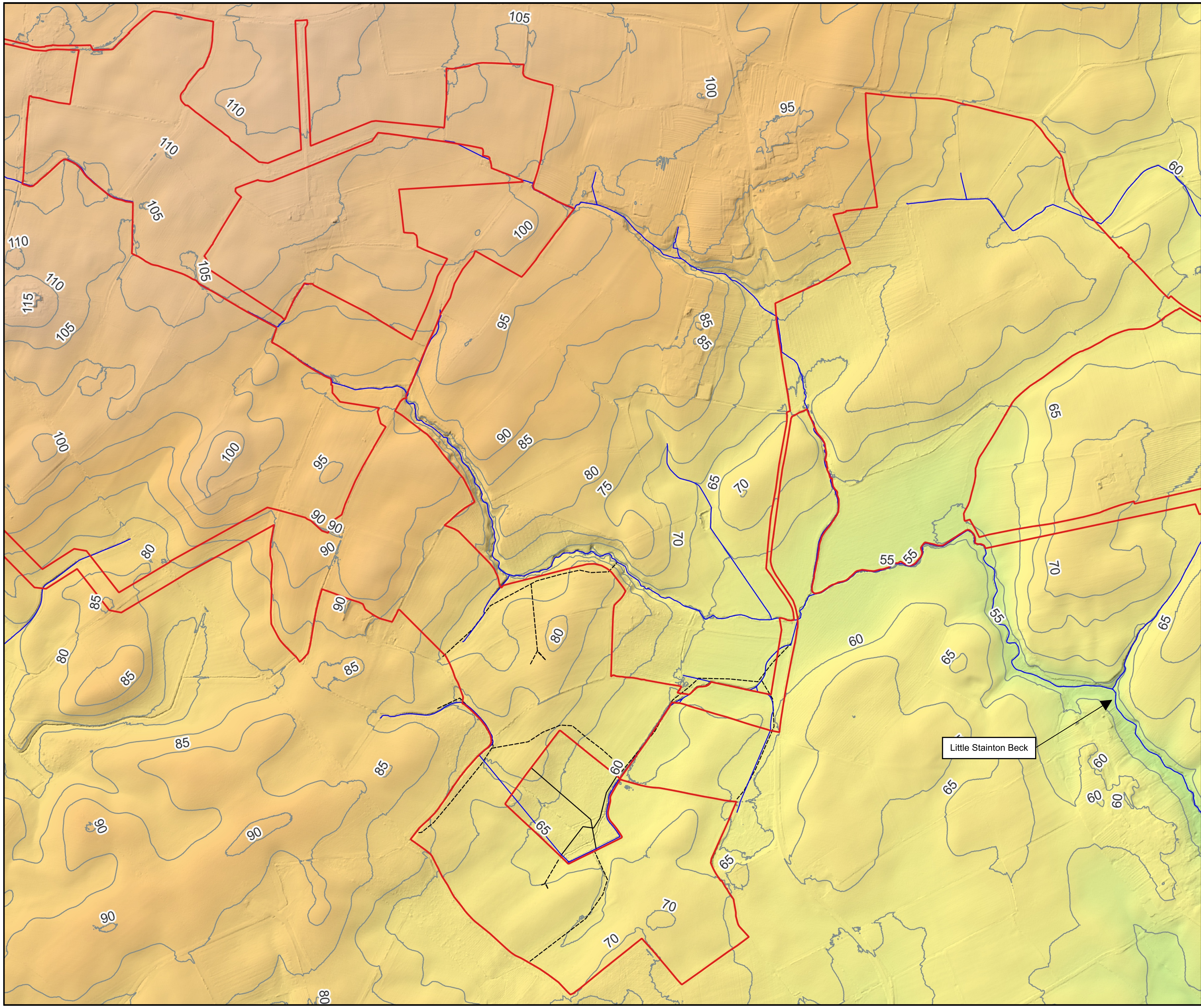
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00012



A3

Legend

- Environment Agency Main Rivers
- Watercourses (within boundary)
- Observed drainage pipes
- Observed drainage ditches
- Order Limits
- 5m Contour Lines

Ground Level (m AOD)

120

30

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 2.2
Site Topography (2 of 4)

Scale at A3

1:10,000

Role

Issue

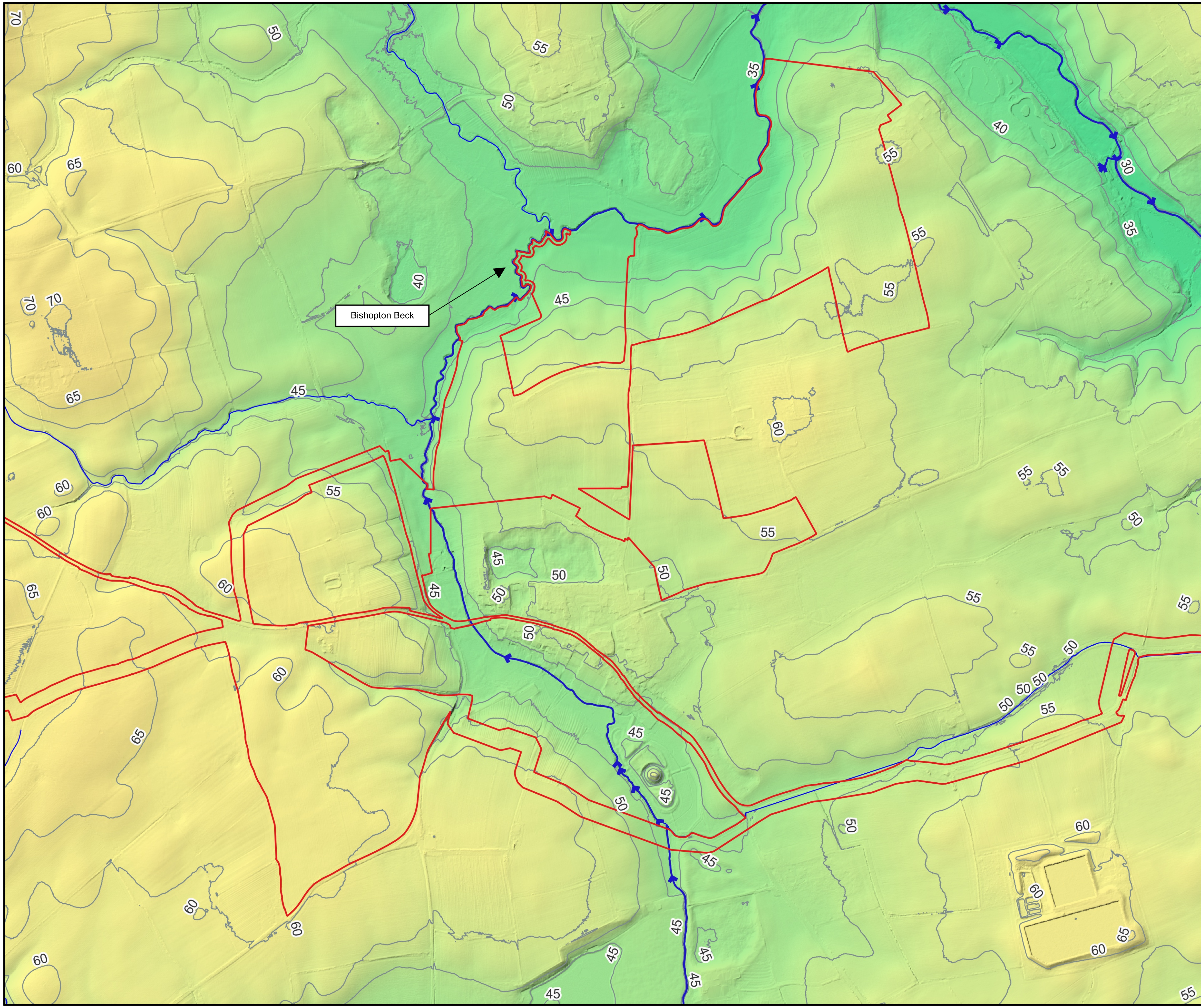
Suitability

Environmental Statement

Project Number	Rev
286386-00	**P03.01**

Drawing Number

BGS-ES10-00013



A3

Legend

- Environment Agency Main Rivers
- Watercourses (within boundary)
- Observed drainage pipes
- Observed drainage ditches
- Order Limits
- 5m Contour Lines

Ground Level (m AOD)

120

30

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 2.3
Site Topography (3 of 4)

Scale at A3

1:10,000

Role

Issue

Suitability

Environmental Statement

Project Number

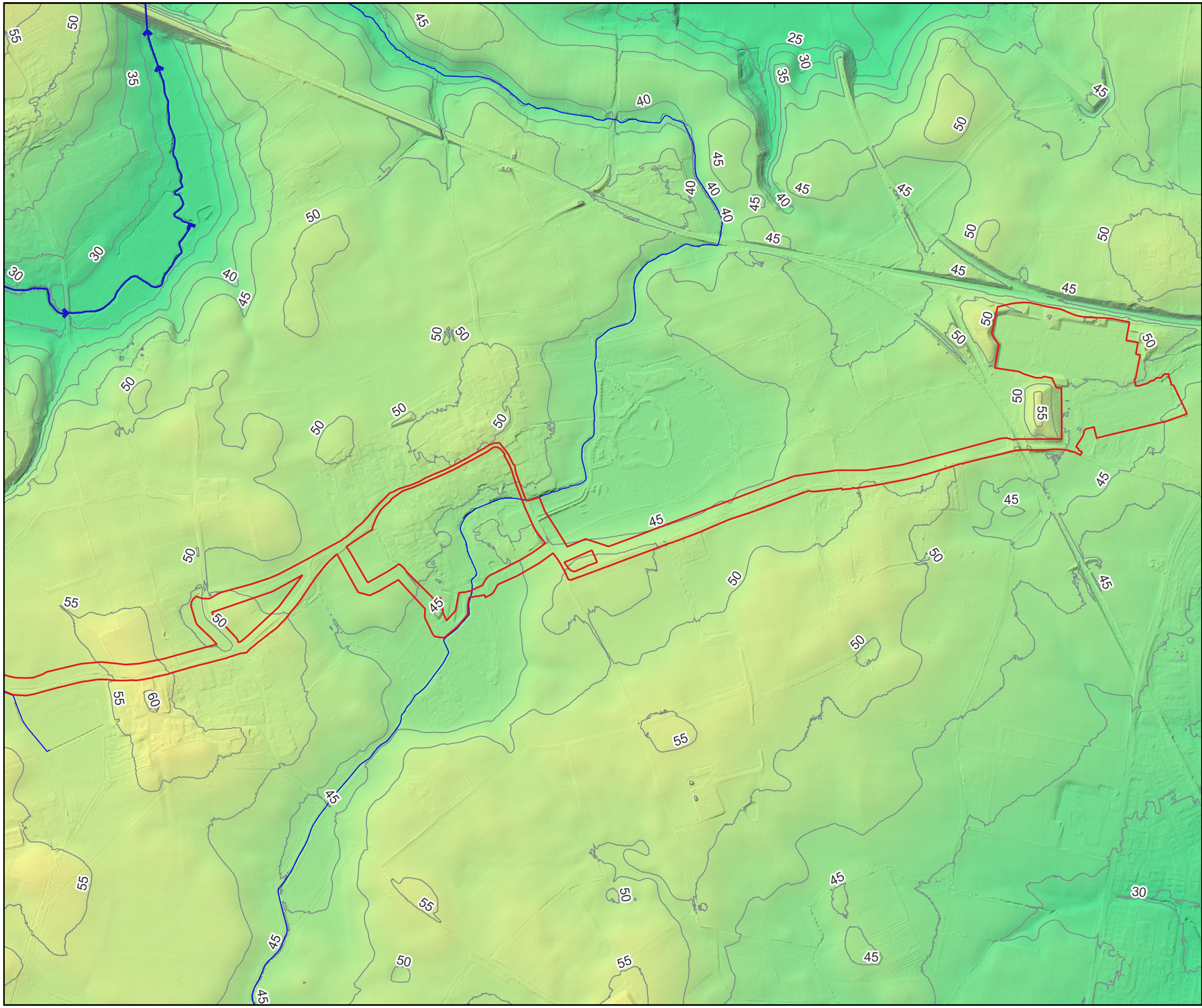
286386-00

Rev

P03.01

Drawing Number

BGS-ES10-00014



A3

Legend

- Environment Agency Main Rivers
- Watercourses (within boundary)
- Observed drainage pipes
- Observed drainage ditches
- Order Limits
- 5m Contour Lines

Ground Level (m AOD)

120

30

Coordinate System: British National Grid

0 0.25 0.5 km

P03	08/01/24	SP	PB	PB	PB
Rev	Date	By	Chkd	Appd	Authd

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 2.4
Site Topography (4 of 4)

Scale at A3

1:10,000

Role

Issue

Suitability

Environmental Statement

Project Number

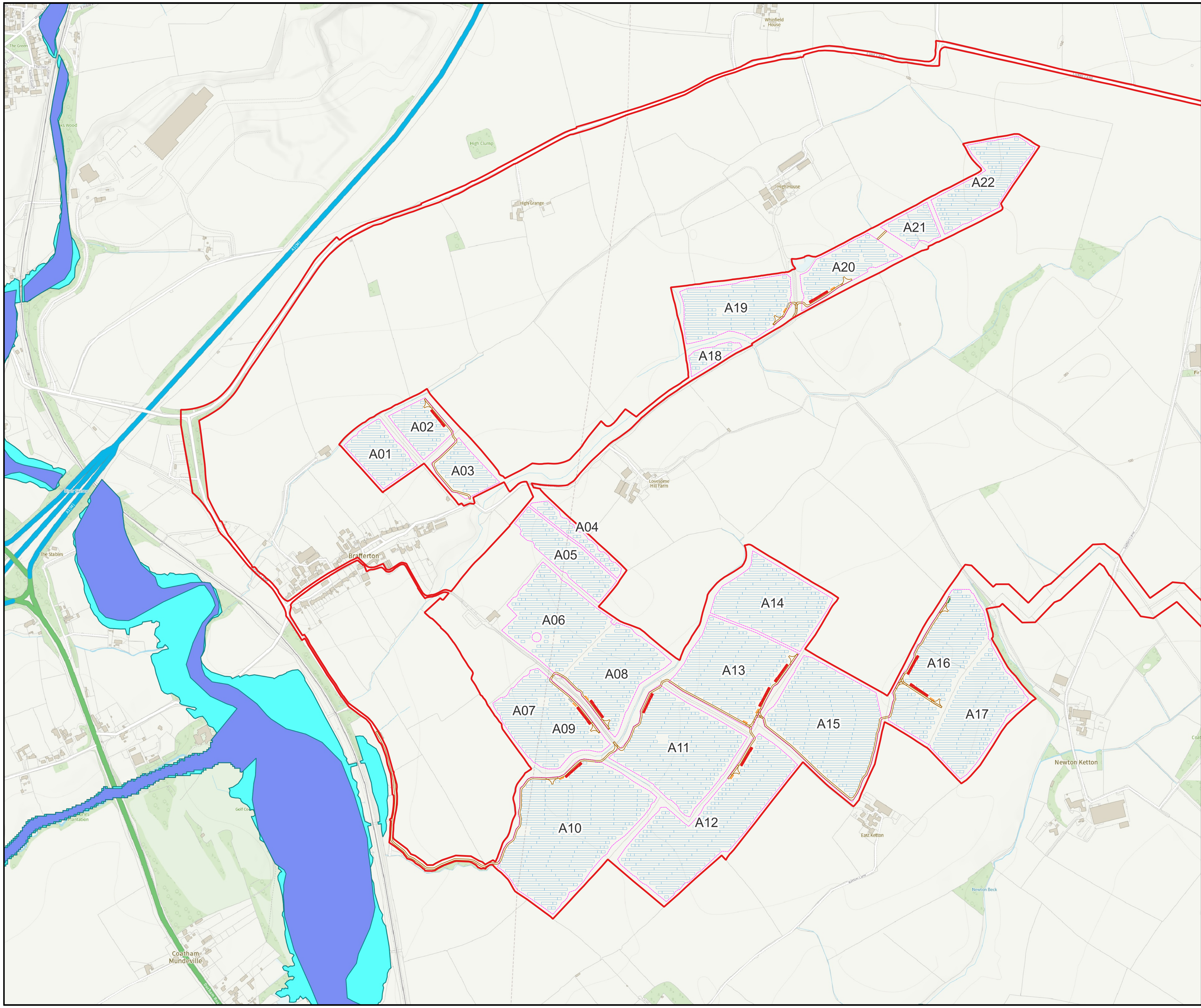
286386-00

Rev

P03.01

Drawing Number

BGS-ES10-00015



A3

Legend

- Flood Zone 3
- Flood Zone 2
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 3.1
Fluvial Flood Zones (1 of 4)

Scale at A3

1:10,000

Role

Issue

Suitability

Environmental Statement

Project Number

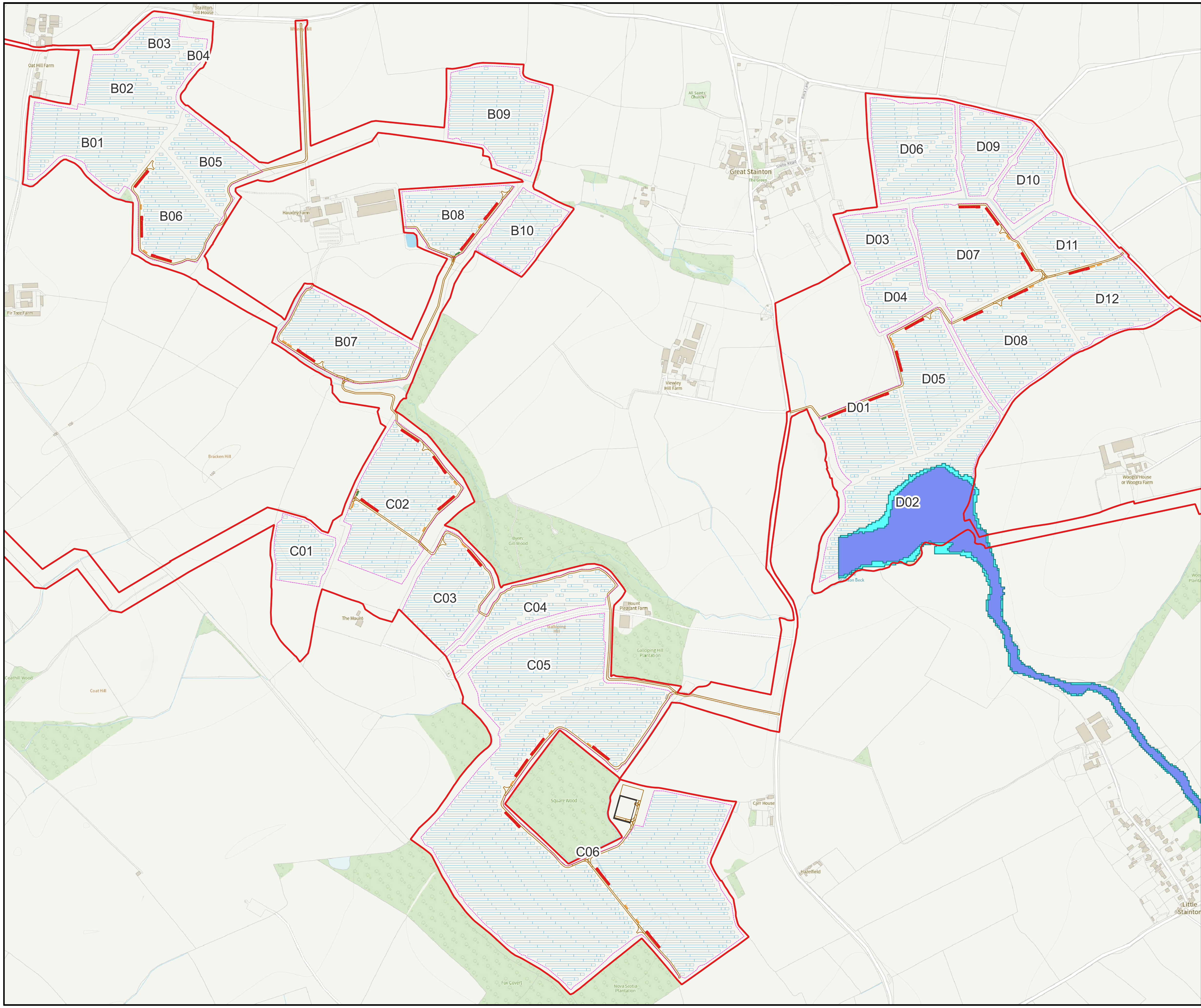
286386-00

Rev

P03.01

Drawing Number

BGS-ES10-00016



A3

Legend

- Flood Zone 3
- Flood Zone 2
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

P03	08/01/24	SP	PB	PB	PB
Rev	Date	By	Chkd	Appd	Authd

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 3.2
Fluvial Flood Zones (2 of 4)

Scale at A3

1:10,000

Role

Issue

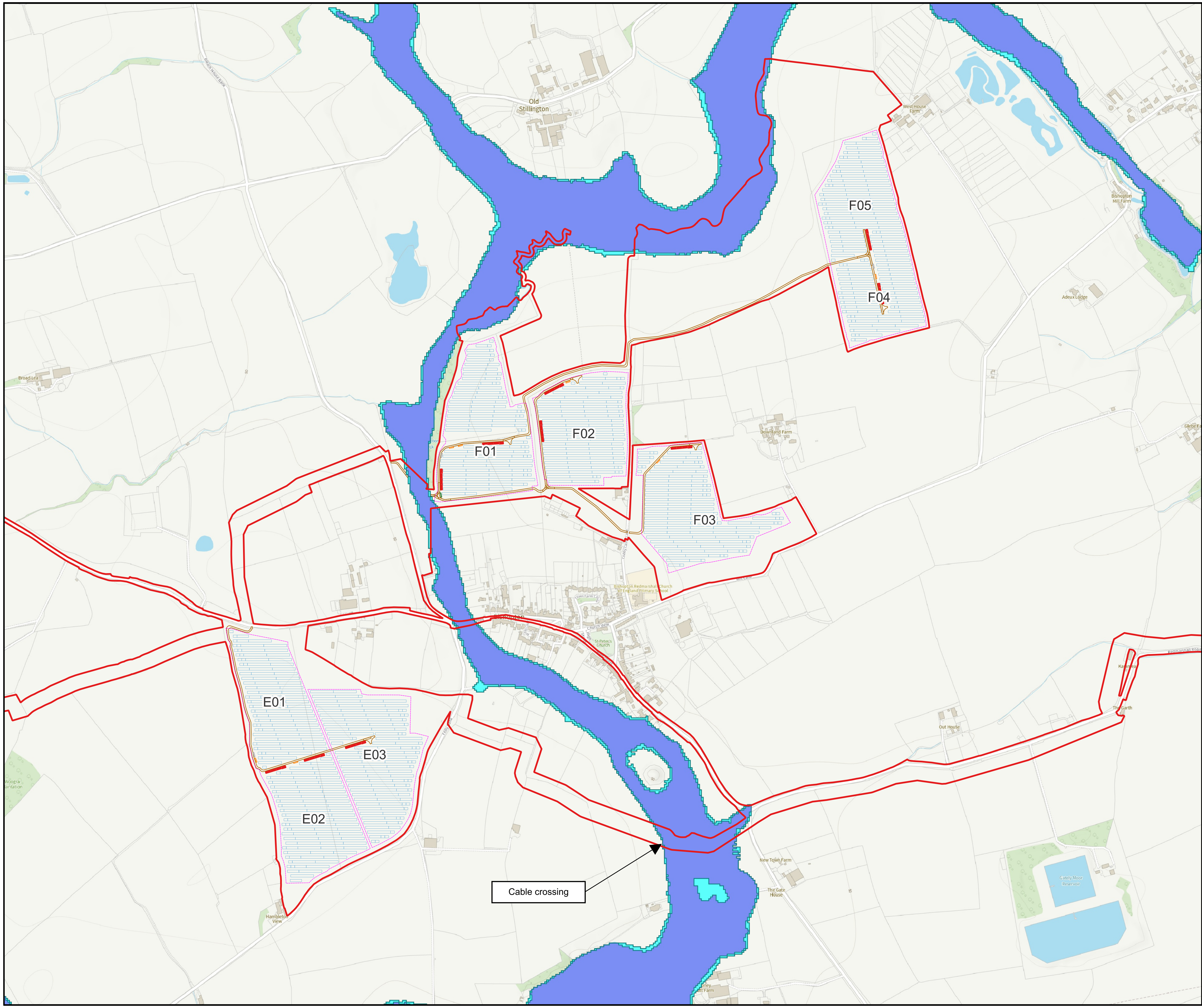
Suitability

Environmental Statement

Project Number	Rev
286386-00	P03.01

Drawing Number

BGS-ES10-00017



A3

Legend

- Flood Zone 3
- Flood Zone 2
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 3.3
Fluvial Flood Zones (3 of 4)

Scale at A3
1:10,000

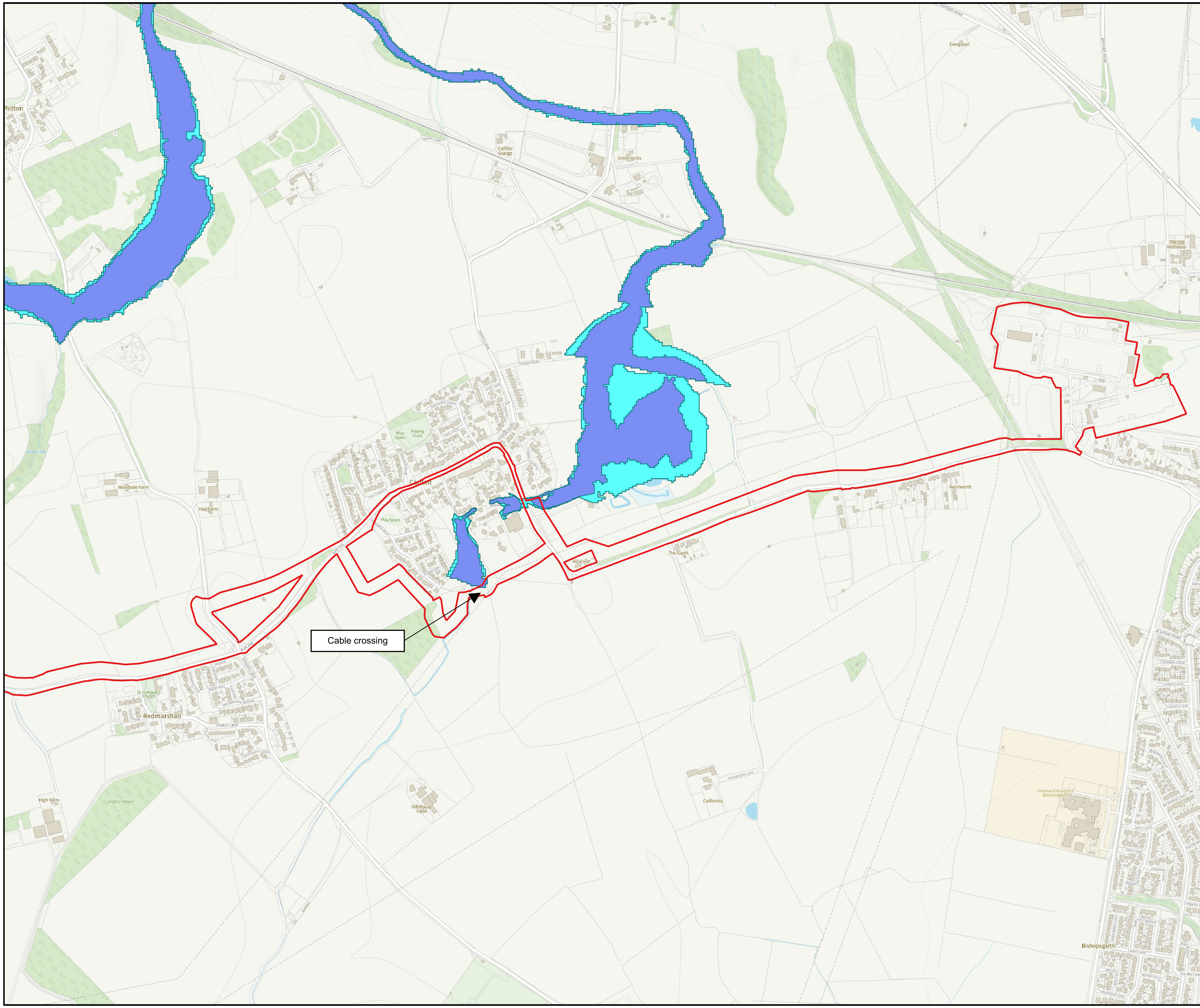
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00018



A3

Legend

- Flood Zone 3
- Flood Zone 2
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name
Byers Gill Solar

Drawing Title
Figure 3.4
Fluvial Flood Zones (4 of 4)

Scale at A3
1:10,000

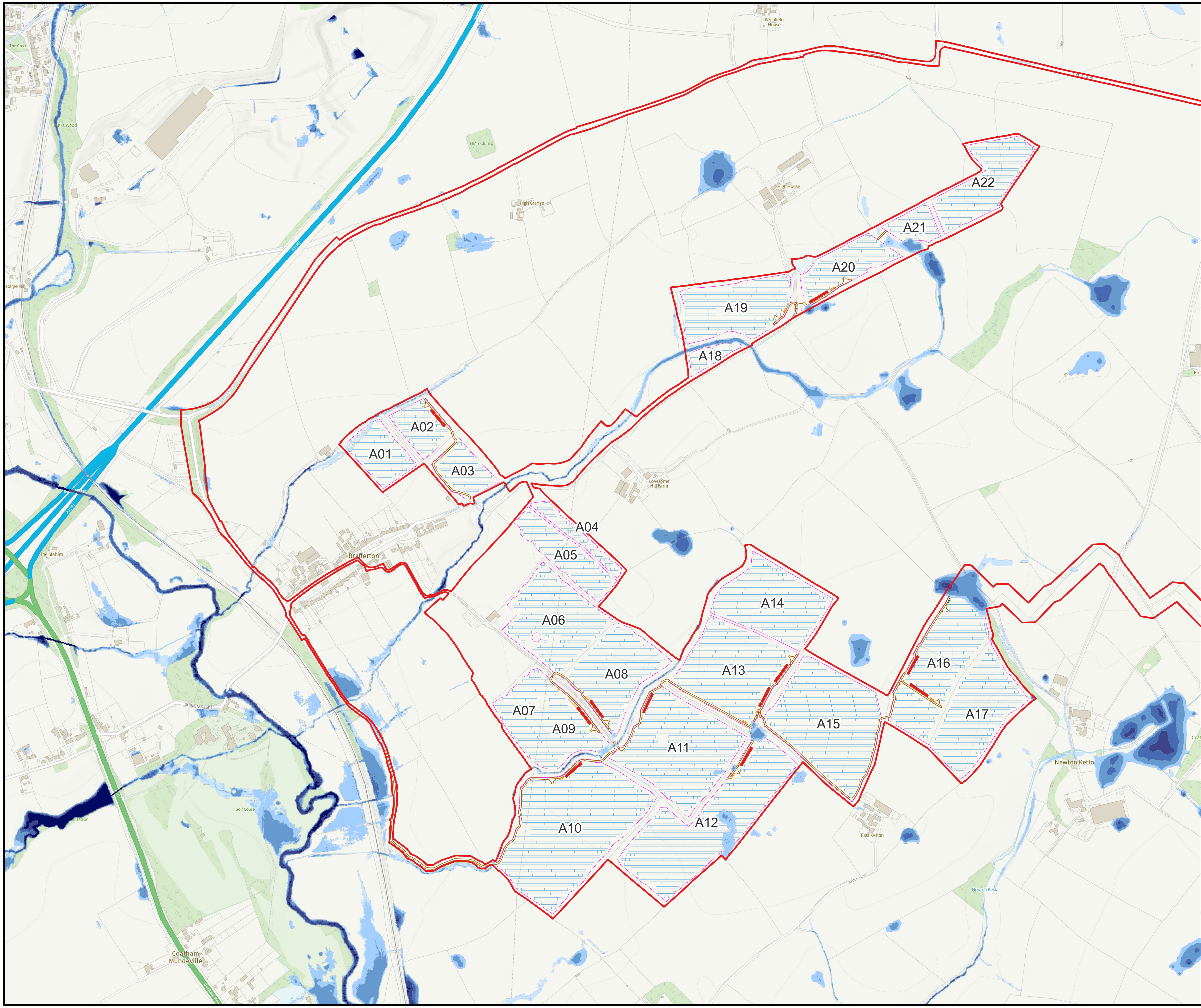
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00019



A3

Legend

1.0% Annual Exceedance Probability Surface Water Flood Depths

- Below 150mm
- 150-300mm
- 300-600mm
- 600-900mm
- 900-1200mm
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 4.1
1.0% AEP Surface Water Flood Risk Depths (1 of 4)

Scale at A3
1:10,000

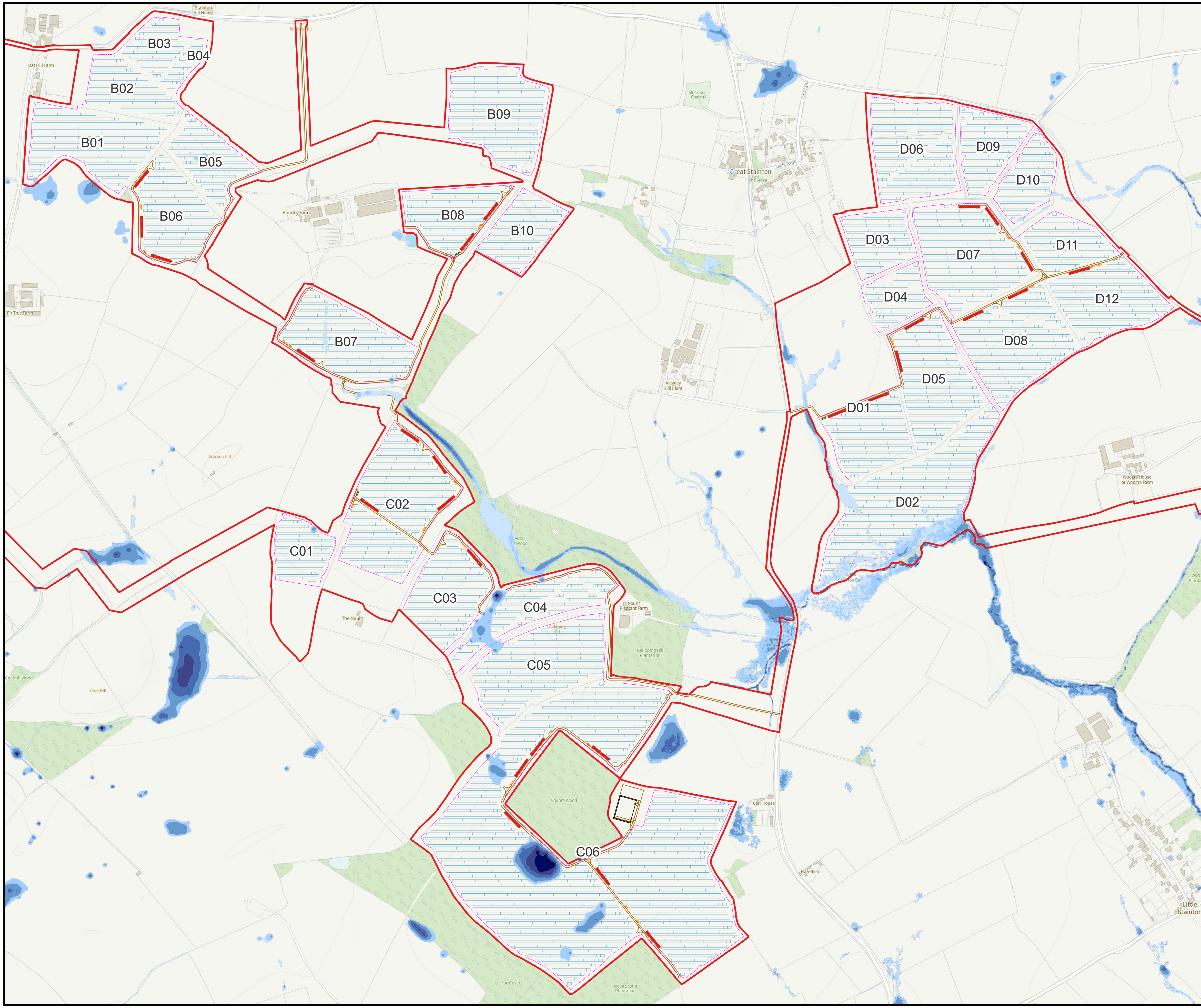
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00020



A3

Legend

1.0% Annual Exceedance Probability Surface Water Flood Depths

- Below 150mm
- 150-300mm
- 300-600mm
- 600-900mm
- 900-1200mm
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

P03	08/01/24	SP	PB	PB	PB
Rev	Date	By	Chkd	Appd	Authd

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 4.2
1.0% AEP Surface Water Flood Risk Depths (2 of 4)

Scale at A3

1:10,000

Role

Issue

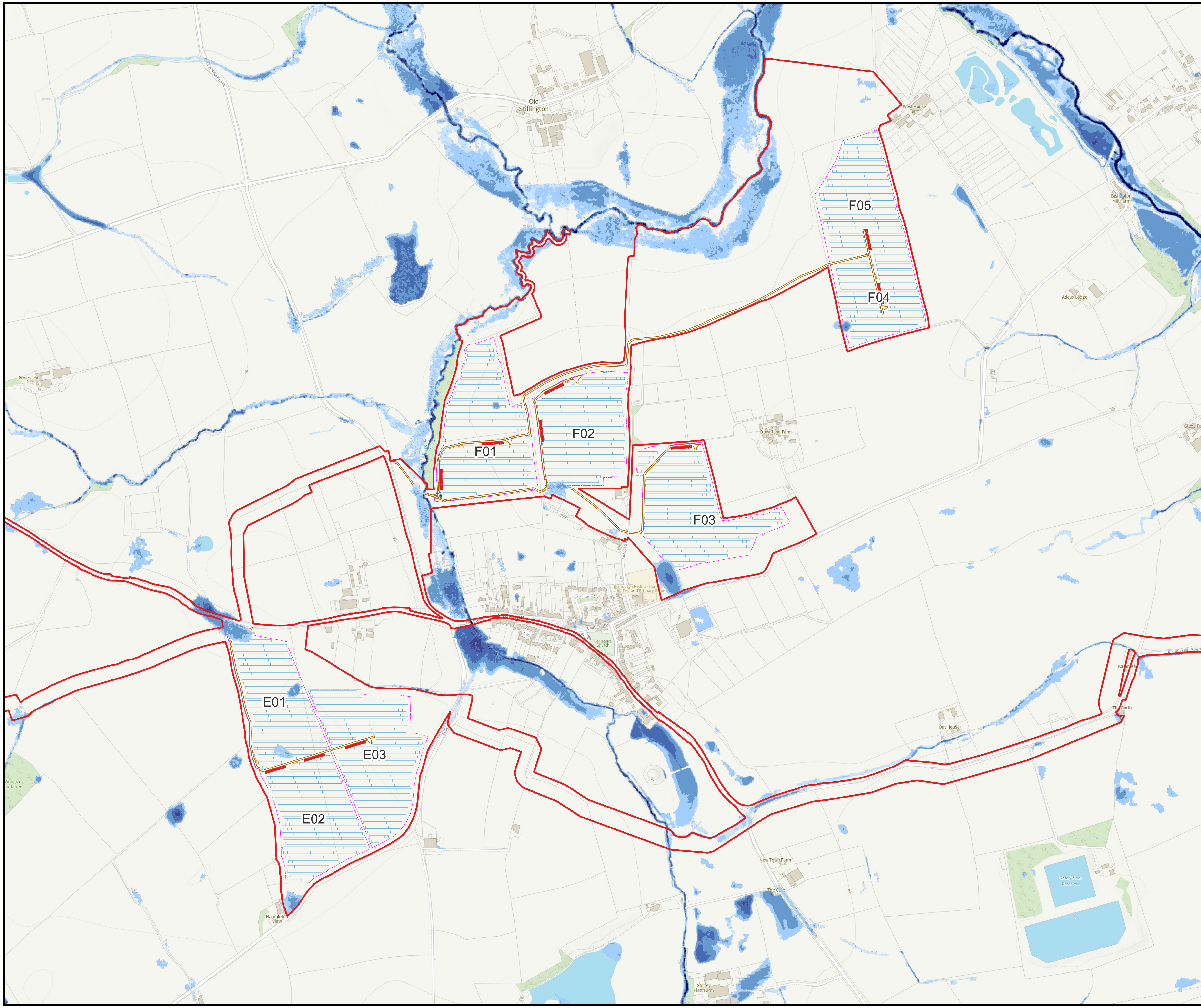
Suitability

Environmental Statement

Project Number	Rev
286386-00	**P03.01**

Drawing Number

BGS-ES10-00021



A3

Legend

1.0% Annual Exceedance Probability Surface Water Flood Depths

- Below 150mm
- 150-300mm
- 300-600mm
- 600-900mm
- 900-1200mm
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

P03	08/01/24	SP	PB	PB	PB
Rev	Date	By	Chkd	Appd	Authd

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 4.3
1.0% AEP Surface Water Flood Risk Depths (3 of 4)

Scale at A3
1:10,000

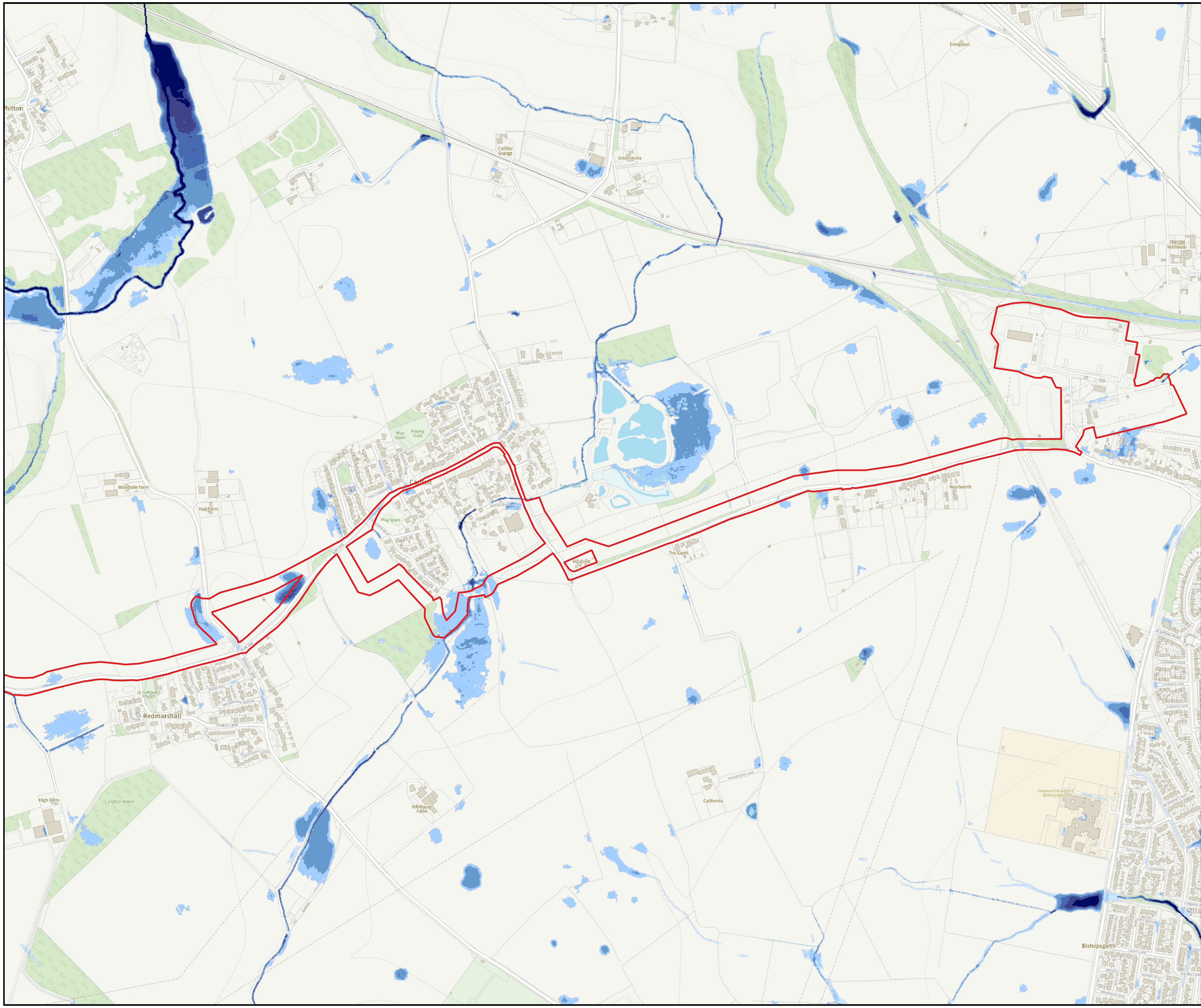
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00022



A3

Legend

1.0% Annual Exceedance Probability Surface Water Flood Depths

- Below 150mm
- 150-300mm
- 300-600mm
- 600-900mm
- 900-1200mm
- Order Limits
- Inverters
- Hybrid Inverters
- Spares
- Switchgears
- Substation footprint
- Solar PV Modules
- Perimeter Fence
- Access Track

Coordinate System: British National Grid

0 0.25 0.5 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 4.4
1.0% AEP Surface Water Flood Risk Depths (4 of 4)

Scale at A3
1:10,000

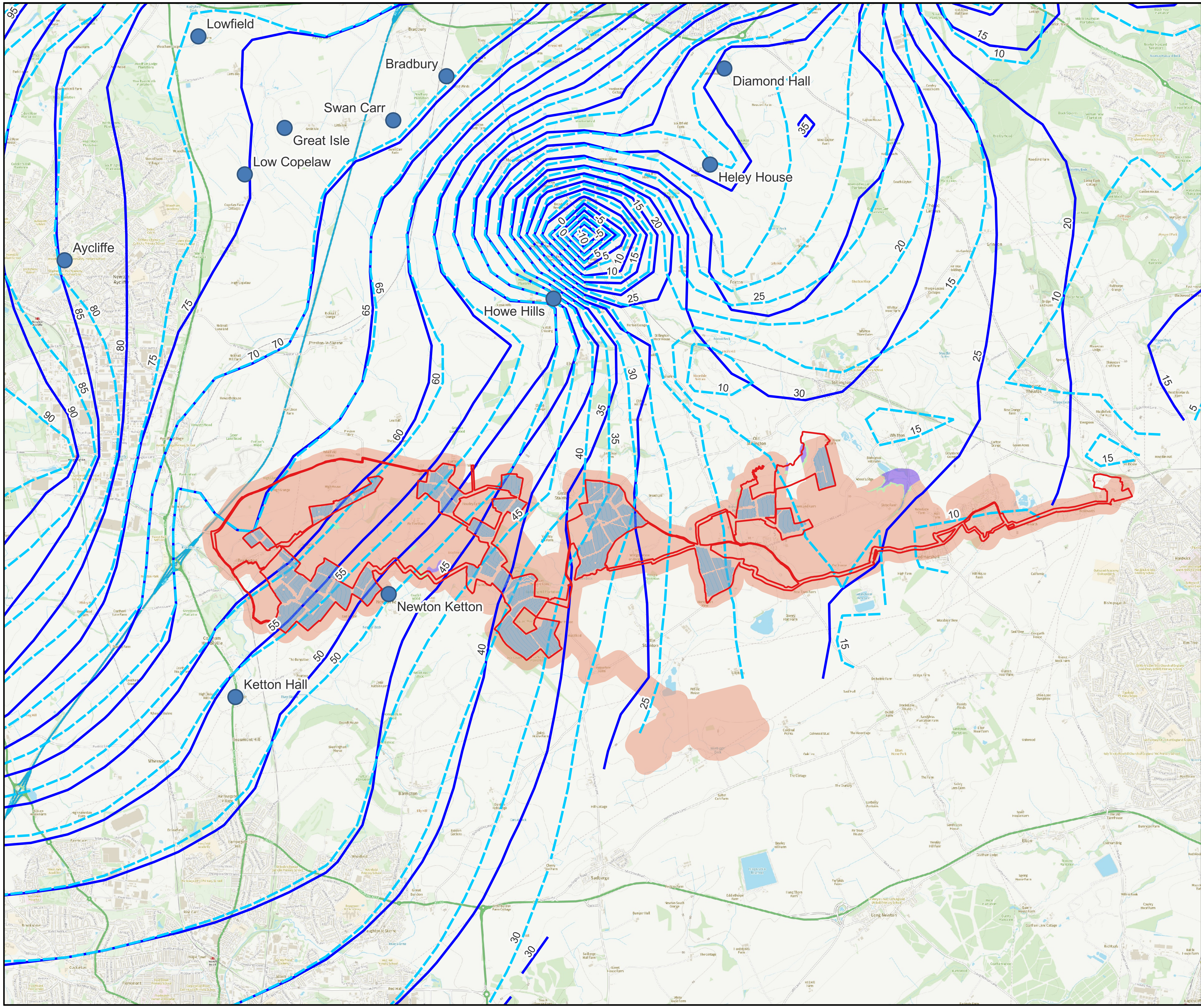
Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00023



A3

Legend

- Order Limits
- Solar PV Modules
- EA 2023 Groundwater Level (High) Contour Lines*
- EA 2023 Groundwater Level (Low) Contour Lines*
- Groundwater Stations

GeoSmart Groundwater Flood Risk Map

- Low
- Moderate
- Negligible

* Environment Agency, "Northumbrian Magnesian Limestone Aquifer Hydrogeological Conceptual Model Report Reference: 6886 R2," by ESI for the Environment Agency, April 2009.

Coordinate System: British National Grid

0 1 2 km

Rev	Date	By	Chkd	Appd	Authd
P03	08/01/24	SP	PB	PB	PB

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 5.1
Groundwater Contours

Scale at A3
1:50,000

Role
Issue

Suitability
Environmental Statement

Project Number
286386-00

Rev
P03.01

Drawing Number
BGS-ES10-00024