

Cottam Solar Project

Environmental Statement Appendix 10.1: Annex F – 10.1.5 Flood Risk Assessment and Drainage Strategy – Cottam 2

Prepared by: Delta-Simons
January 2023

PINS Ref: EN010133
Document reference: APP/C6.3.10.6
APFP Regulation 5(2)(e)





Flood Risk Assessment and Drainage Strategy

Annex F - Cottam 2

Presented to: **Cottam Solar Energy Farm Limited**

Issued: December 2022

Delta-Simons Project No: 21-1088.03

Table of Contents

1.0	SITE DESCRIPTION	1
2.0	ASSESSMENT OF FLOOD RISK.....	4
2.1	Tidal Flood Risk.....	4
2.2	Fluvial Flood Risk.....	4
2.3	Surface Water Flood Risk.....	5
2.4	Groundwater Flood Risk.....	7
2.5	Artificial Sources Flood Risk	7
2.6	Summary of Flood Risk	7
2.7	Mitigation	7
2.8	Residual Risks.....	8
2.9	Impact on Off-Site Flood Risk.....	8
3.0	CONCLUSIONS AND RECOMMENDATIONS	9
3.1	Conclusions.....	9
3.2	Recommendations	9

Annexes

ANNEX A - LIMITATIONS

ANNEX B - LIDAR PLAN

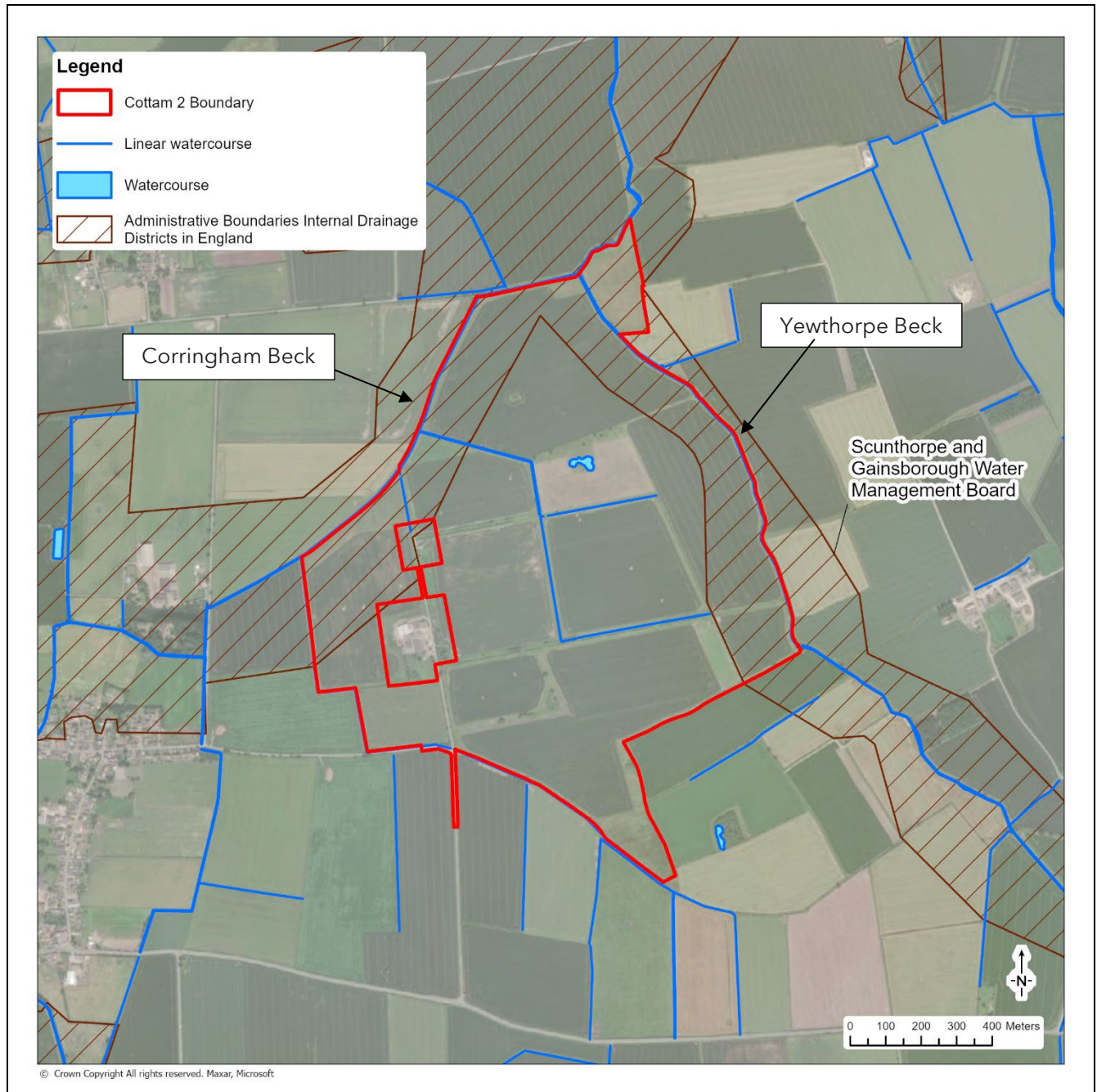
ANNEX C - EAU FROM SOURCE TO NORTHORPE BECK CATCHMENT EA WATER BODY CLASSIFICATION

ANNEX D - ILLUSTRATIVE LAYOUT PLAN

ANNEX E - 0.1% ANNUAL PROBABILITY EVENT SURFACE WATER PROXY MAP

1.0 Site Description

1.1.1 The aim of this section of the report is to outline key environmental information associated with the baseline environment.



Site Location Plan

Co-ordinates	Centred approximately at National Grid Reference 488333, 392155.
Site Location	The Cottam 2 site is located within a rural setting and comprises multiple parcels of agricultural fields, approximately 500 m north-east of the village of Corringham.

<p>Existing Site Conditions</p>	<p>Online mapping (including Google Maps / Google Streetview imagery accessed May 2022) shows that the Site is greenfield comprising agricultural / arable fields.</p>
<p>Topography</p>	<p>Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 1 m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM).</p> <p>A review of LiDAR ground elevation data shows that the Site slopes from approximately 16 - 18 m AOD in centre of the Site to approximately 13 - 16 m AOD in the east and west perimeters where the two watercourses are situated. Given the size of the site the gradients are shallow and the Site is considered to be relatively flat.</p> <p>A LiDAR extract is included in Annex B.</p>
<p>Hydrology</p>	<p>The nearest watercourse is an unnamed land drain which is located in the centre of the Site. Other watercourse in the area include Yewthorpe Beck which runs down the eastern extent of the Site and Corringham beck which runs down the western extent to the Site. All watercourses mentioned are the responsibility of the Lead Local Flood Authority (LLFA) to maintain.</p>
<p>Water Framework Directive Status</p>	<p>The Site is located in the Eau from Source to Northorpe Beck Catchment which has a Cycle 3 2019 Ecological status of Moderate and a Failing Chemical status.</p> <p>A summary of the Water Body Classification for the catchment is included as Annex C.</p>
<p>Geology</p>	<p>Reference to the British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the majority of the Site is underlain by superficial deposits of Till, Mid Pleistocene generally comprising of Diamicton. Around Yewthorpe beck the superficial deposits consist of Alluvium comprising Clay, Silt, Sand And Gravel The superficial deposits are identified as being underlain by Scunthorpe Mudstone Formation consisting of interbedded Limestone and Mudstone.</p> <p>The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a Site-specific basis.</p>
<p>Hydrogeology</p>	<p>According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mapping [accessed May 2022], the Till is classified as a Secondary Undifferentiated Aquifer. Secondary Undifferentiated Aquifers are assigned in 'cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.</p> <p>The Alluvium is classified as a Secondary A Aquifer. Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers';</p> <p>The underlying Scunthorpe Mudstone Formation is described as a Secondary B Aquifer. Secondary B Aquifers are 'predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers'.</p> <p>The EA's 'Source Protection Zones' data, obtained from MAGIC Map's online mapping [accessed May 2022], indicates that the Site is not located within a Groundwater Source Protection Zone.</p>

Proposed Site Conditions	The proposed development at Cottam 2 is for a ground mounted solar photovoltaic plant and associated power stations and access road. An Illustrative Layout Plan is included in Annex D.
---------------------------------	--

2.0 Assessment of Flood Risk

2.1 Tidal Flood Risk

2.1.1 The Site is situated inland at a minimum elevation of 13 m AOD. Therefore, the risk from tidal flooding is considered to be **Negligible**.

2.2 Fluvial Flood Risk

EA Online Flood Maps

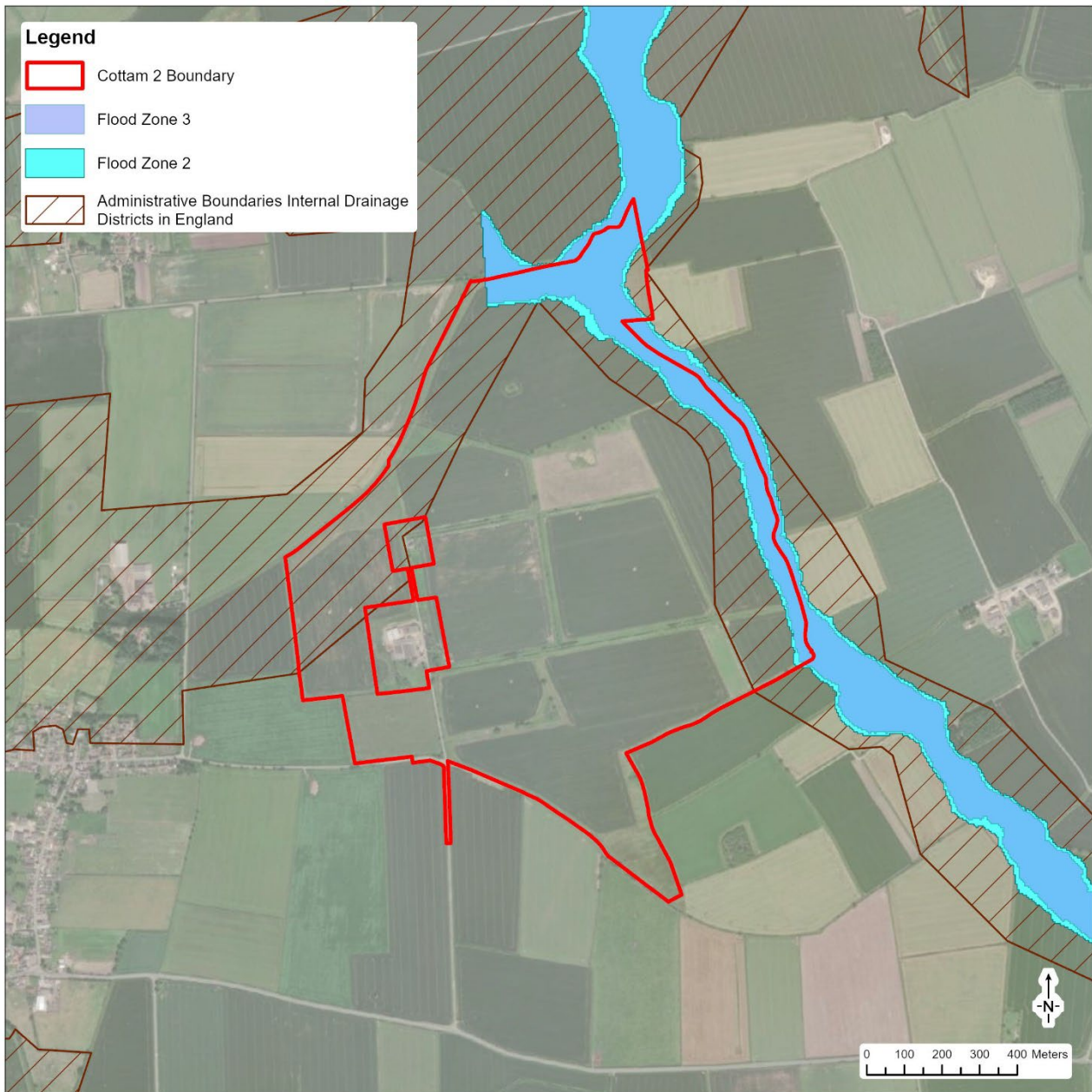


Figure 1: EA's Flood Map for Planning

EA Product Data / Consultation

- 2.2.1 The EA were consulted to obtain site-specific flood data for the Site. In their response, the EA stated, 'we don't hold modelled data for Yewthorpe Beck since it is an ordinary watercourse'. Lincolnshire County Council as the Lead Local Flood Authority and Scunthorpe and Gainsborough Water Management Board as the Internal Drainage Board were subsequently consulted, however neither authority held any flood data relating to the watercourse.
- 2.2.2 In the absence of modelled flood data, the 0.1% annual probability surface water flood scenario can be used as a proxy for the 1% AEP + CC fluvial event. A map depicting flood depths associated with the 0.1% annual probability scenario is included as Annex E. The majority of the flooding along the eastern Site boundary is shown to be between 0.3 - 0.6 m. Two portions of flooding with depths between 0.6 - 0.9 m are shown in the north-eastern corner of the Site.

Summary

- 2.2.3 It can therefore be concluded that the Site is at **Low** risk of fluvial flooding, the proposed solar panels will be raised above surrounding ground levels with associated power infrastructure appropriately waterproofed. Embedded mitigation measures are considered in 3.2 of the covering report and in section 2.7 of this annex.

2.3 Surface Water Flood Risk

- 2.3.1 The EA's Long-Term Flood Risk Map (Figure 2) indicates that surface water flooding with a High Risk (>3.3% Annual Probability) of occurrence is present across the boundaries of the Site, predominantly surrounding the north, east and west. The Site shows little surface water risk within the boundaries, aside from a small parcel within the centre of the site which is shown to be a Medium Risk (1% - 3.3%).



Figure 2: EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)

- 2.3.2 The surface water extents shown on the EA's Long-Term Flood Risk Map largely concur with the Flood outlines shown on the EA Flood Map for Planning associated with the Ordinary Watercourses that runs to the east and west of the Site; Yewthorpe Beck and Corringham Beck. The risk is not likely to impact the main extents of the Site, as the topography ranges from 16 - 18 m AOD within the Site's boundaries, as opposed to 13 - 16 m AOD where the watercourses are situated.
- 2.3.3 Based on the above and considering the embedded mitigation as part of the inherent design of the solar panels, the overall risk of surface water flooding is considered to be **Low**. The proposed solar panels will be raised above surrounding ground levels and will be appropriately waterproofed thereby reducing the potential to be impacted in the event of surface water flooding.
- 2.3.4 The impact of the development on surface water risk is covered in covered in Section 5.0 of the Covering Report to ensure that surface water risk is not exacerbated through appropriate SuDS measures

2.4 Groundwater Flood Risk

- 2.4.1 There is no information within relevant third party reports to suggest that the Site has experienced historical groundwater flooding.
- 2.4.2 No buildings other than the supporting unstaffed infrastructure and no basement levels are identified on plans which may otherwise be at increased risk from groundwater seepage.
- 2.4.3 It can therefore be concluded that the risk of groundwater flooding is **Low** and no specific mitigation measures are required.

2.5 Artificial Sources Flood Risk

Sewer Flooding

- 2.5.1 No site-specific incidents of sewer flooding have been identified from relevant third party reports.
- 2.5.2 On the basis of the Site's rural setting, the presence of sewerage infrastructure is unlikely.
- 2.5.3 It can therefore be concluded that the risk of sewer flooding is **Low**.

Reservoir and Canal Flooding

- 2.5.4 There are no canals within the vicinity of the Site. Therefore, the risk from canal flooding is considered to be **Negligible**.
- 2.5.5 The EA 'Flood Risk from Reservoirs' map shows that the Site is not within the extents of a reservoir breach. The EA states within their Preliminary Flood Risk Assessment for England (dated October 2018) that 'reservoir flooding is extremely unlikely to happen'. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the EA ensure that reservoirs are inspected regularly, and essential safety work is carried out. It can therefore be concluded that the risk from reservoir flooding is considered to be **Negligible**.

2.6 Summary of Flood Risk

- 2.6.1 It can be concluded that the risk to the Site from all sources of flooding is **Negligible to Low**, and therefore mitigation is not required in this instance. However, protective measures are proposed to be incorporated as part of the Scheme, which are set out below

2.7 Embedded Mitigation

- 2.7.1 8m easements have been established around all watercourses, including Main Rivers and Ordinary Watercourses and 9 m from IDB assets.
- 2.7.2 Either fixed or tracker panels will be utilised throughout the Sites.
- 2.7.3 The minimum height of the lowest part of the fixed solar panel units will be 0.6 m above ground level.
- 2.7.4 The tracker solar panel units will be mounted on raised frames (usually raised a minimum of 0.4 m) when on maximum rotation angle) and will therefore be raised above surrounding ground levels and fitted with a tracking system. During times of flooding, solar panels may be stowed by the tracking system algorithm onto a horizontal plane, to the minimum post height of 2.3 m above ground level. This ensures that all sensitive and electrical equipment on the solar panel is raised to a minimum of 2.3 m above ground level in the horizontal position.
- 2.7.5 Fixed panels should be located within areas of the Site which are located in Flood Zone 1 whereas tracker panels can be located in areas that are within Flood Zones 2 and 3 on the basis of the additional flood protection offered by their potential to be stowed horizontally.

- 2.7.6 Electrical infrastructure associated with the panels can be adequately waterproofed to withstand the effect of flooding. Where possible the sensitive electrical equipment has been located in parts of the Site that are within Flood Zone 1. Where this hasn't been possible, equipment will be raised 0.6 m above the 0.1% AEP flood level or where this is not possible as high as practicable.

Flood Warnings and Evacuation

- 2.7.7 Flood Warnings / Flood Alerts do not cover this area. However, access to the Site will be required relatively infrequently, typically by technicians for maintenance and inspection works or Site management. Such works can be scheduled as to avoid the site during times of flood.

2.8 Residual Risks

- 2.8.1 A residual risk is an exceedance event, such as the 1 in 1000 year (0.1% AEP) flood event that would overtop Yewthorpe Beck and Corringham Beck and potentially impact the Site. As the probability of a 1 in 1000 year flood event occurring is 0.1% in any given year, the probability is low and, therefore, no further mitigation beyond what is proposed is required.
- 2.8.2 In the event of the defences failing or an exceedance event occurring, the residual risk to people working within the Site can be managed through the implementation of an appropriate Site management plan, which recognises the residual risks and details what action is to be taken by staff in the event of a flood to put occupants in a place of safety.

2.9 Impact on Off-Site Flood Risk

- 2.9.1 The solar panels will be mounted on frames and raised above ground level allowing flood water to flow freely underneath. Therefore, there will be no loss of floodplain volume as a result of the proposed development and no increased in flood risk elsewhere.
- 2.9.2 The supporting infrastructure will be insignificant in size and should not increase flood risk elsewhere.
- 2.9.3 Surface water management has been considered in Section 5.0 of the Covering Report.

3.0 Conclusions and Recommendations

3.1 Conclusions

3.1.1 The proposed development is for a ground mounted solar farm and associated infrastructure and access roads.

Flood Risk

3.1.2 The EA's Flood Risk Map for Planning indicates that the north and eastern boundary of the Site are enriched by Flood Zone 3. The remainder of the Site is of Low Risk in Flood Zone 1.

3.1.3 The risk of flooding from all sources has been assessed and the flood risk to the Site is considered to be **Negligible to Low** and therefore does not require Site-specific mitigation measures.

3.1.4 The solar panels will be mounted on raised frames and therefore raised above surrounding ground level allowing flood water to flow freely underneath. Therefore, there will be no loss of floodplain volume as a result of the proposed development.

Drainage Strategy

3.1.5 The proposed development is free draining through perimeter gaps around all panels, allowing for infiltration as existing within the grassland/vegetation surrounding and beneath the panels. There will be minimal increase in impermeable area meaning the proposals will not increase surface water flood risk elsewhere.

3.1.6 Any surface water exceeding the infiltration capacity of the surrounding strata will naturally drain to the surrounding Land Drains in line with the existing scenario.

3.1.7 The heavily managed agricultural land will be replaced with grassland. This will help to reduce run off rates by increasing the roughness of the ground, help to increase infiltration by reducing compaction, and improve water quality by reducing erosion and mobilisation of pollutants. As a result, runoff rates may be reduced following development when compared to the existing greenfield scenario.

3.2 Recommendations

3.2.1 The recommendations below have been considered in the design of the Illustrative Site Layout:

- 8m easements have been established around all watercourses, including Main Rivers and Ordinary Watercourses and 9 m from IDB assets
- All service cabling should be designed and installed to be flood resilient / water compatible. This should be achieved in accordance with appropriate design standards and best practise guidance; and
- Locate sensitive electrical equipment in parts of the Site at very low risk of surface water flooding

Annex A - Limitations

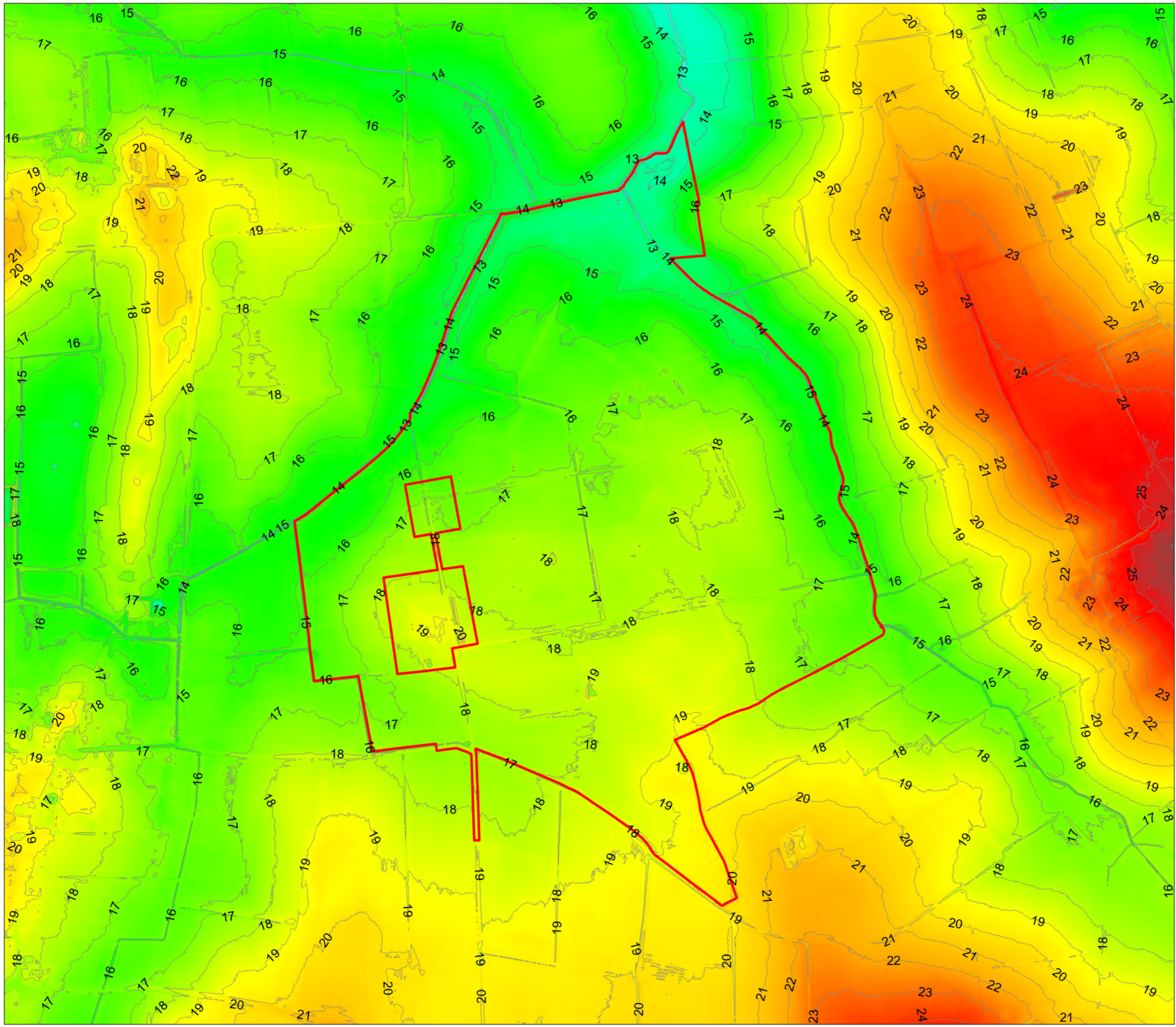
Limitations

The recommendations contained in this Report represent Delta-Simons professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons conclusions, opinions and recommendations has been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Annex B - LiDAR Plan



Legend

- Cottam 2 Boundary
- Contours

LIDAR

29.45

2.21

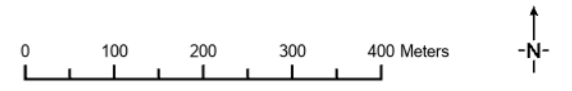


Figure LIDAR & Contours			
Job Cottam 2			
Client Island Green Power			
Appendix B	Revision A	Date	03/11/2022
Drawn BB	Checked EB	Scale	1:8,500 @ A3
Job No.	21-1088.01	Central GR	488402E 392147N

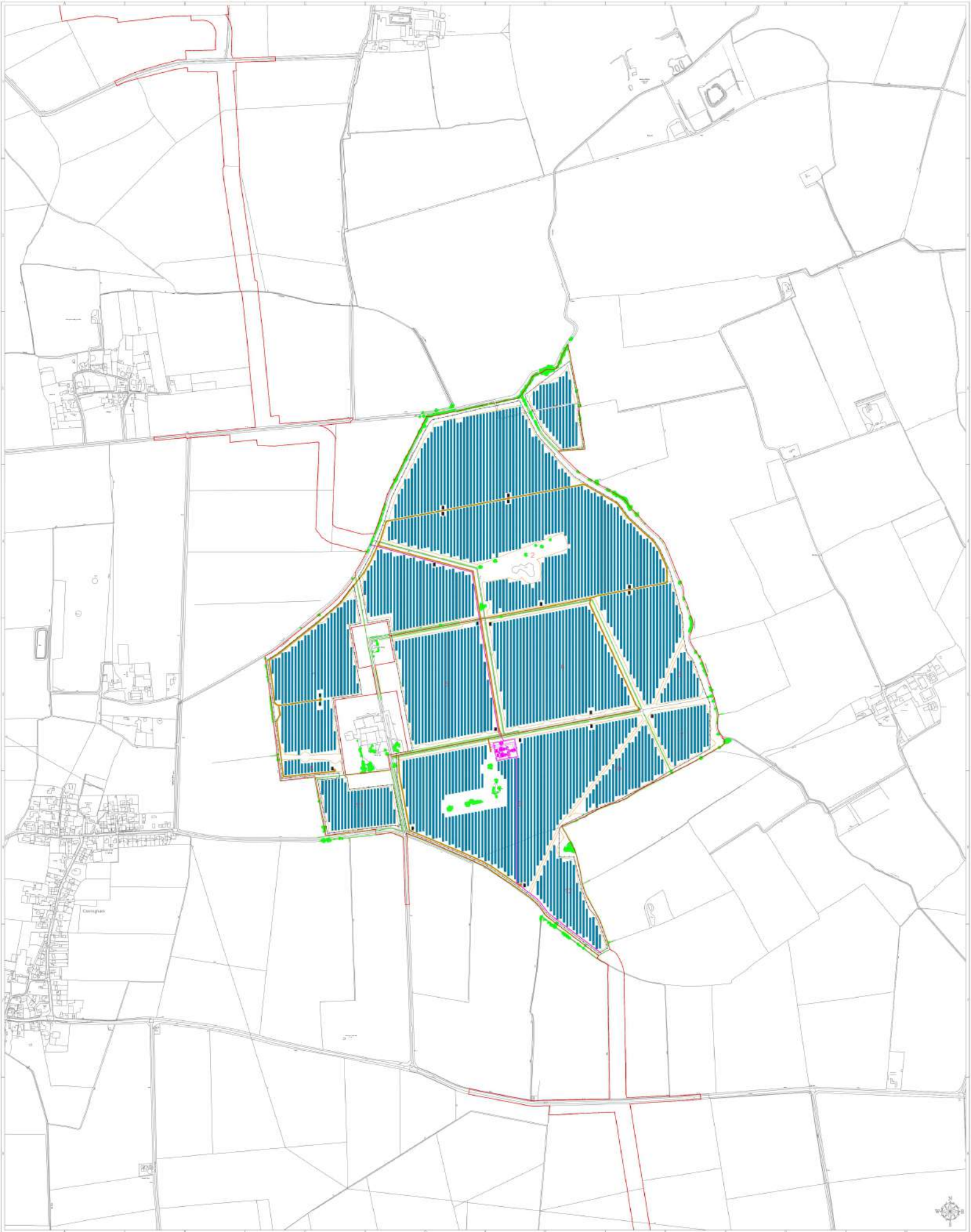


Annex C - Eau from Source to Northorpe Beck Catchment EA Water Body Classification

Classification Item	Cycle 2 2016 Classification	Cycle 3 2019 Classification	Cycle 3 Objectives		
Ecological	Moderate	Moderate	Good	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Biological quality elements	Good	Moderate	Good	2015	
Invertebrates	Good	Good	Good	2015	
Macrophytes and Phytobenthos Combined	Good	Moderate	Good	2015	
Physico-chemical quality elements	Moderate	Moderate	Good	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Ammonia (Phys-Chem)	High	Good	Good	2015	
Dissolved oxygen	High	High	Good	2015	
Phosphate	Poor	Poor	Good	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Temperature	High	High	Good	2015	
pH	High	High	Good	2015	
Hydromorphological Supporting Elements	Supports good	Supports good	Supports good	2015	
Hydrological Regime	High	High	Supports good	2015	
Supporting elements (Surface Water)	N/A		Not assessed	2015	
Specific pollutants	N/A		Not assessed	2015	
Chemical	Good	Fail	Good	2063	Natural conditions: Chemical status recovery time
Priority hazardous substances	Does not require assessment	Fail	Good	2063	Natural conditions: Chemical status recovery time
Benzo(a)pyrene		Good	Good	2015	
Dioxins and dioxin-like compounds		Good	Good	2015	
Heptachlor and cis-Heptachlor epoxide		Good	Good	2015	
Hexabromocyclododecane (HBCDD)		Good	Good	2015	
Hexachlorobenzene		Good	Good	2015	

Hexachlorobutadiene		Good	Good	2015	
Mercury and Its Compounds		Fail	Good	2040	Natural conditions: Chemical status recovery time
Perfluorooctane sulphonate (PFOS)		Good	Good	2015	
Polybrominated diphenyl ethers (PBDE)		Fail	Good	2063	Natural conditions: Chemical status recovery time
Priority substances	Does not require assessment	Good	Good	2015	
Cypermethrin (Priority)		Good	Good	2015	
Fluoranthene		Good	Good	2015	
Other Pollutants	Does not require assessment	Does not require assessment	Does not require assessment	2015	

Annex D - Illustrative Layout Plan



General Legend

	Application Boundary		Tree Canopy
	Fence		Highway
	Development Area		
	Mounting Structure		
	Power Station		
	Electrical Substation		
	High Voltage Electricity Cable		
	Maintenance Track		
	Cable		
	Accessible Pathway		
	CCTV		

Project	Coltarn 2 Solar Project
Project Location	Level of Cottingham, Cottingham, by Lincolnshire OAD (S10)
Project Description	Coltarn Solar Project (M)
Document Title	Restrictive Layout

Scale: 1:500

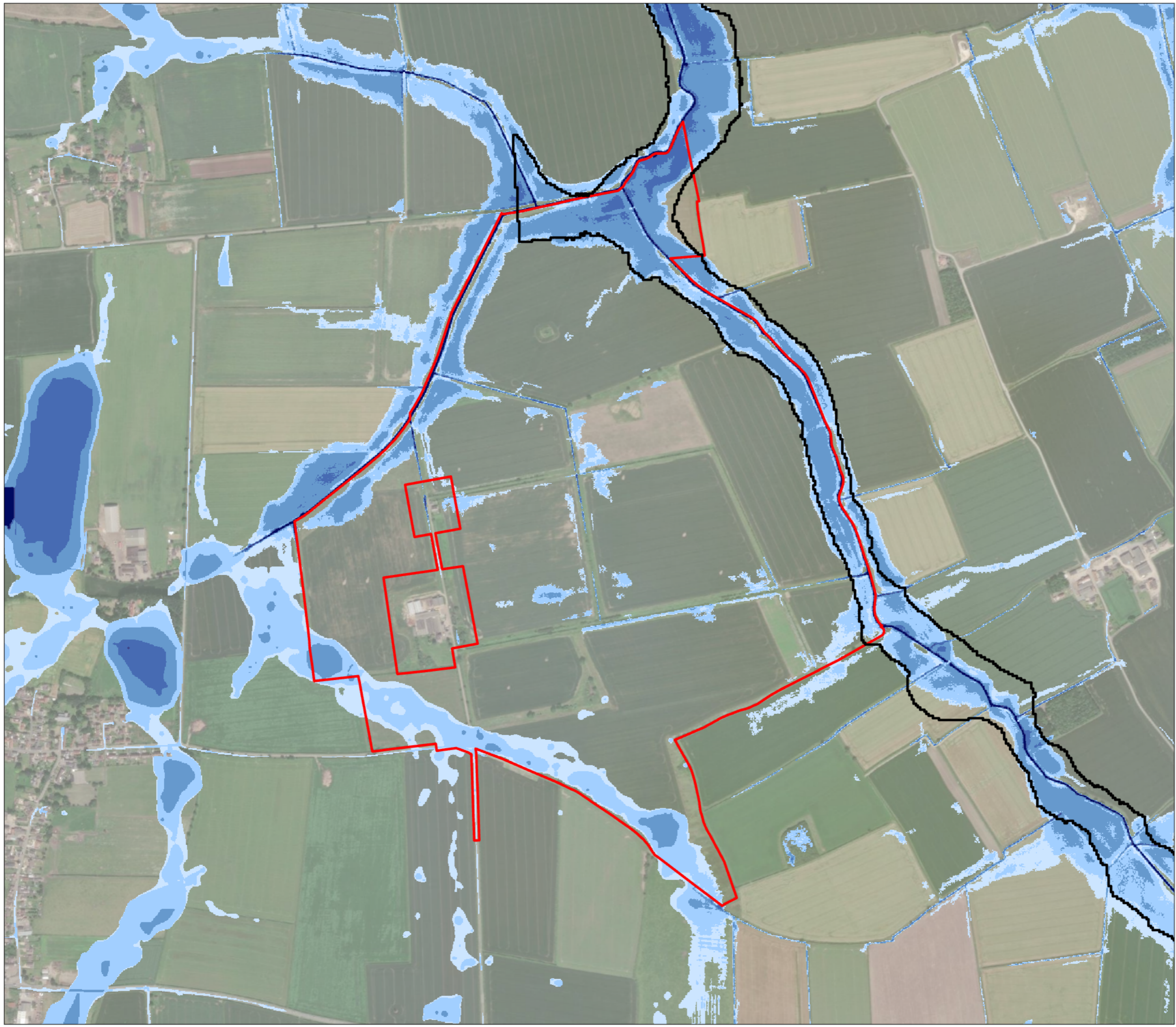
Client: All Well Energy

Company: **POWER** Brand Green Power UK Limited
 1st Floor, 100, Eton Square
 188 Mansel Road, London SW6 6AW

Document History:

Version	Date	Author	Comments
V.01	18/05/2022	A.S.	Updated Layout
V.02	18/05/2022	A.S.	Updated Layout
V.03	14/09/2022	A.S.	Final Restrictive Layout
V.04	14/09/2022	A.S.	Final Restrictive Layout

Annex E - 0.1% Annual Probability Event Surface Water Proxy Map



- Legend**
- Cottam 2 Boundary
 - Flood Zone 2
- Risk of Flooding from Surface Water (Depth 1 in 1000)
- Below 150mm
 - 150-300mm
 - 300-600mm
 - 600-900mm
 - 900-1200mm
 - Over 1200mm

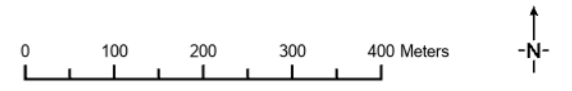


Figure				0.1% Surface Water Map	
Job				Cottam 2	
Client				Island Green Power	
Appendix	E	Revision	A	Date	03/11/2022
Drawn	BB	Checked	EB	Scale	1:8,500 @ A3
Job No.	21-1088.01			Central GR	488402E 392147N

