HELIOS RENEWABLE ENERGY PROJECT

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Flood Risk Assessment

April 2025

HELIOS RENEWABLE ENERGY PROJECT

FLOOD RISK ASSESSMENT

ENSO GREEN HOLDINGS D LIMITED

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EXECUTIVE SUMMARY

I. The Proposed Development is a solar farm with a modelled operational lifespan of 40 years on land at Camblesforth, south of Selby, North Yorkshire (the 'Site'). The Site is approximately 475 hectares in area, and the current use comprises agricultural land situated between the villages of Burn and Camblesforth. The Site is bounded by railway lines on the north western and south eastern edges with Selby Road to the north east and Hirst Road to the south west. The Underground Cable Corridor for the Proposed Development extends to the east of Drax Power Station.

II. The majority of the Site falls within Flood Zone 3a meaning it has a high risk of flooding. This is due to the Rivers Ouse to the north and River Aire to the south which converge to the east of the Site. A solar farm is compatible in areas of Flood Zone 2 and 3a.

III. The pre-development baseline potential flood risk to the Site from overwhelmed sewers and artificial sources is considered to be 'low' to 'very low'. There are areas of elevated risk ('high' – 'medium') associated with the combined risk of flooding from watercourse and tidal sources due to the proximity of the Site to the River Aire and River Ouse, low points where surface waters could collect and the likely presence of shallow groundwaters in underlying superficial and bedrock deposits. The main source of risk is therefore fluvial.

IV. The sequential test is a risk-based approach used to locate development to the lowest risk areas available. The Sequential Test is considered to be satisfied on the basis that no alternative reasonably available sites within the identified search area suitable for the Proposed Development, taking into account other material planning considerations and land availability, with a lower risk of flooding have been identified. A solar farm is classed as essential infrastructure and so the Exception Test is passed owing to the fact that the wider sustainability benefits provided by the solar farm outweigh the flood risks and the measures proposed in this Flood Risk Assessment ('FRA') would make the development safe for its users without increasing flood risk elsewhere.

V. Environment Agency ('EA') maintained flood defences are present in the vicinity of the Site on both the River Ouse and River Aire. The flood defences provide a level of protection which could be overwhelmed in the fluvial 'design flood' and actions are required to ensure the standard of protection can be maintained to mitigate the effect of climate change. A site-specific flood model for the Site has been produced to determine the fluvial and tidal 'design floods' and provide a 'credible maximum scenario sensitivity test'. The site-specific flood model was approved by the EA in July 2024. The EA approved site-specific flood model will inform the detailed design of the flood mitigation and adaptation measures based on the principles established in this FRA.

VI. The Site layout has been devised using a sequential approach to locate sensitive equipment in areas of lowest flood risk where possible, taking into account other material planning considerations and operational requirements. For the Proposed Development in areas of elevated flood risk, flood resilience and resistance measures have been considered to manage the residual flood risk to the Proposed Development. The following design flood mitigation and adaptation measures are proposed:

- A flood warning and evacuation plan for the relevant phase of the Proposed Development would be contained in the detailed Construction Environmental Management Plan ('CEMP'), Operation Environmental Management Plan ('OEMP') or Decommissioning Environmental Management Plan ('DEMP') and the construction contractor and operating staff would register to receive flood alerts / warnings from the EA and follow site evacuation procedures during periods of elevated flood risk;

- During times of elevated tidal and fluvial flood risk the solar arrays within the areas of elevated flood risk would be rotated to the horizontal stow position which would be a minimum of a 0.3m above the fluvial 'design flood' level or the stow position set above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater;
- Panel supports and security fencing in flood risk areas would be securely piled into the ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event;
- Security fencing mesh size in flood risk areas (fluvial 'design flood') would be increased to 0.15m square to minimise the risk of it collecting debris;
- Ancillary control equipment would be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.
- The Substation and Battery Energy Storage System ('BESS') Compound would be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood';
- Finished floor levels of any ancillary control equipment in the Solar Farm Zone, including Invertor Station, and in Substation and BESS Compound will be raised at least +0.3m above the fluvial 'design flood' level, and would be above the fluvial 'credible maximum scenario sensitivity test' flood level. The equipment would be at least +0.3m (and up to +0.6m) above existing ground level.'
- As an adaptation measure, the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect the equipment from inundation;
- As an adaptation measure, a level for level and volume floodplain compensation scheme would be implemented to mitigate the effect of the earth flood defence bund on the potential fluvial flood risk at the end of the decommissioning period (the fluvial 'credible maximum scenario sensitivity test' flood). A preliminary floodplain compensation scheme within the DCO limits has been shown to be feasible.
- A detailed Flood Management Strategy, containing details of the flood defence bund and floodplain compensation scheme adaptation measures based on the outputs of the EA approved site-specific flood model, would be secured by a suitably worded DCO Requirement;
- Onsite watercourses are retained and existing watercourse crossings are utilised where possible within the Proposed Development;
- Where possible, all development (including security fencing) would be at least 7m from the onsite ordinary watercourses in accordance with Selby Area Internal Drainage Board ('IDB') byelaws. Additional consents may be required for watercourse crossings (site access or services) and landscape planting where this is not achieved.

VII. These flood mitigation and adaptation measures would ensure that the Proposed Development would remain operational and safe in times of the fluvial 'design flood', result in no significant loss of floodplain storage, and would not significantly impede water flows or increase flood risk elsewhere. These flood mitigation and adaptation measures would also ensure that the Proposed Development would remain resilient to the effects of the fluvial 'credible maximum scenario sensitivity test' flood event. The flood mitigation and adaptation measures can be secured by a suitably worded Development Consent Order ('DCO') Requirement requiring the submission of details to be submitted to and approved by the Local Planning Authority.

VIII. With respect to surface water runoff, the solar panels are raised above the existing ground allowing grass sward to be maintained underneath the panels. Rainfall falling onto the photovoltaic panels would runoff directly to the ground beneath the panels and infiltrate into the ground at the same rate as it does in the Site's existing greenfield state. Access tracks would be permeable in nature. The extent of impermeable cover as a result of the Solar Farm amounts to only 0.1% of the Solar Farm Zone (the area of the Site where solar panels and associated infrastructure is proposed). The effect on the Mean Annual Flood (Q_{BAR}) is minimal and only equates to a 0.23% increase compared with the greenfield runoff.

IX. A sustainable drainage strategy, involving the implementation of SuDS in the form of interception swales, is proposed for managing surface water runoff on the development Site. Interception swales are proposed at the low points of the Solar Farm Zone to intercept extreme flows, which may already run offsite and provide runoff pathway management. The volume of storage provided within the proposed interception swales (398m^3) is greater than the additional runoff generated as a result of the extreme 1 in 100 year storm event, including an allowance for climate change (289.5m^3). The interception swales are therefore an appropriate form of mitigation given the 'temporary' nature of the Solar Farm, and a proportionate mitigation measure given the negligible hydrological effect of a Solar Farm and are a practical implementation of NFM.

X. A sustainable drainage strategy (SuDS) is proposed for managing the disposal of surface water runoff from the BESS Compound (including a 132kv Substation). It is proposed that runoff from the BESS Compound would be collected by perimeter filter drains. The filter drains would convey the runoff to three shallow attenuation basins (Attenuation Basins 1, 2 and 3). Runoff would be discharged at a controlled rate into the onsite drainage ditches at a combined rate no greater than 1.4 l/s/ha (3.6 l/s) in accordance with Selby Area IDB requirements. Flow controls would be utilised to restrict runoff at each outfall. The proposed drainage strategy would ensure that surface water arising from the BESS Compound would be managed in a sustainable manner to mimic the surface water flows arising from the Site prior to the Proposed Development, while reducing the flood risk to the Site itself and elsewhere, taking climate change into account.

XI. Existing drainage features would be retained, and the Site would remain vegetated throughout construction and operation of the Solar Farm to prevent soil erosion. The proposed interception swales would lead to an overall reduction in surface water flow rates from the Site and mitigate any increase in run-off due to the minor reduction in the overall permeable area of the Site. On this basis the Proposed Development would not increase flood risk onsite or elsewhere and would preserve the Site's natural drainage regime.

XII. The main purpose of this FRA is to provide sufficient flood risk information to support the DCO application. The FRA has been updated to collate additional submissions made to the EA within the Examination period.

XIII. The overall conclusions drawn from this FRA are that future users of the Proposed Development would remain appropriately safe throughout the lifetime of the Proposed Development and that, subject to a DCO Requirement requiring the drainage arrangements as indicated on plans E216/88 Rev D and E216/90-106 Rev C to be implemented and maintained in accordance with the procedures set out at **Table O** of this FRA and a Check Sheet attached as **Appendix 31**, the Proposed Development would not increase flood risk elsewhere and would reduce flood risk overall.

1. INTRODUCTION

1.1. This FRA has been prepared on behalf of Enso Green Holdings D Limited in connection with proposals for the development of a Solar Photovoltaic Farm, and Energy Storage on land to the south west of the village of Camblesforth, North Yorkshire known as the Helios Renewable Energy Project (the 'Proposed Development'). This FRA supports an application for a DCO.

1.2. The overall Site comprises around 475 hectares and encompasses a number of inter connected parcels of predominantly agricultural land, consisting of fields used for grazing and arable cropping. A site location plan is contained in **Appendix 1.** The main part of the Site where solar panels and associated infrastructure is proposed (referred to as the 'Solar Farm Zone') is situated to the south west of the village of Camblesforth, to the north of the village of Hirst Courtney and Hirst Road, to the south of the A1041 and to the east of the Selby Branch of the East Coast Mainline railway. The Site is located within the administrative area of North Yorkshire Council. The Underground Cable Corridor for the Proposed Development extends to the east of Drax Power Station. The location of the Site is shown on **Figure 1** below and a more detailed Site Location Plan is provided in **Appendix 1**.

1.3. The Proposed Development comprises the construction of a solar farm consisting of ground mounted photovoltaic ('PV') modules mounted on metal frames, with associated site infrastructure, ancillary control equipment, energy storage and an underground connection to the local electricity grid. The parameter plan and field boundaries plan are reproduced in **Appendix 2** and an extract from the parameter plan is shown on **Figure 2** below. The modelled operational lifespan of the solar farm is 40 years.

1.4. The main purpose of this FRA is to provide sufficient flood risk information to support the DCO application. The FRA has been updated following comments received from statutory consultees in relation to the Preliminary Environmental Information Report ('PEIR') stage of the DCO application and results of the site-specific flood modelling. A further update has been completed to collate additional submissions made to the EA within the Examination period.

1.5. This FRA demonstrates that the Proposed Development would be appropriately safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where practicable, would reduce flood risk overall.

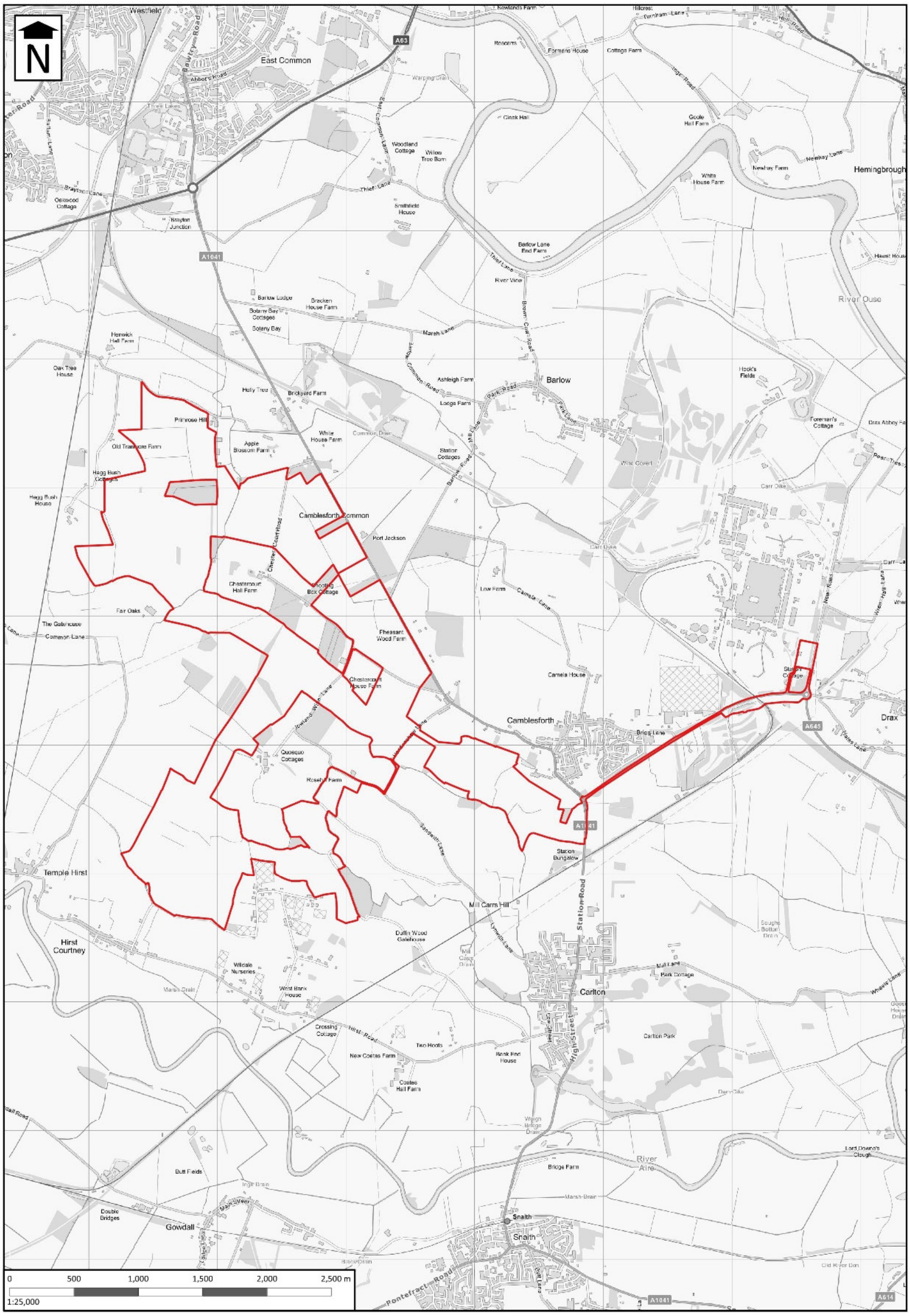

Figure 1: Site Location Plan

Contains OS data © Crown copyright [OS VectorMap® District] [2023]

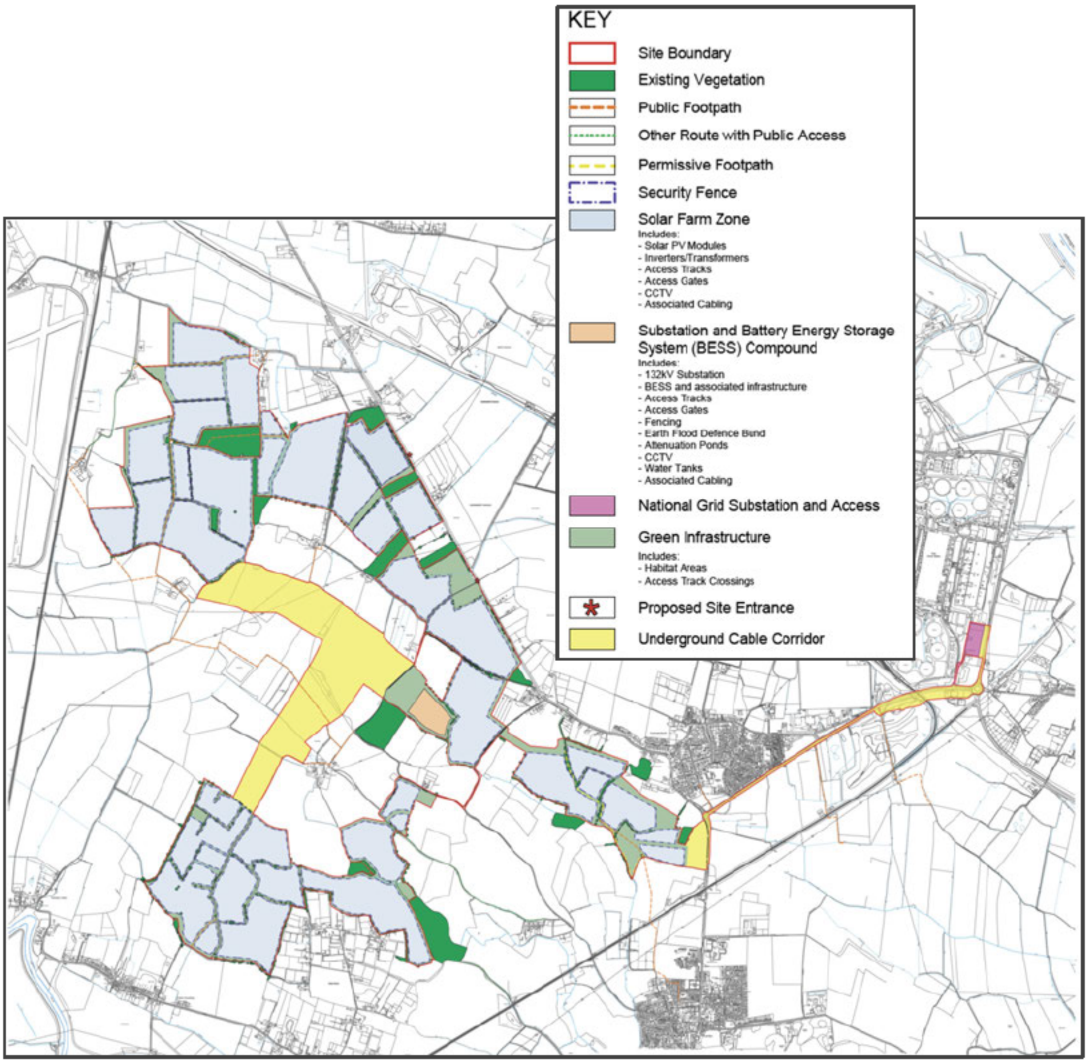

Figure 2: Extract from Parameter Plan (Drawing No. DX-01-P02 Rev 11)

2. SCOPE OF THE ASSESSMENT

National Planning Policy

National Policy Statements

2.1. The Proposed Development has an expected energy generating capacity in excess of the 50MW threshold for onshore generating stations in England and therefore constitutes a Nationally Significant Infrastructure Project (‘NSIP’) and the National Policy Statements (NPS) therefore apply to the DCO application.

2.2. National Policy Statements are produced by Government. There are six NPSs setting out government policy on different types of nationally significant energy infrastructure projects. The 2023 revised NPSs (EN-1 to EN-5) were adopted on 17 January 2024.

2.3. The Overarching NPS for Energy (EN-1)[1] notes that the policy on climate change adaptation in Section 4.10 applies. Paragraph 4.10.11 states:

> **‘Applicants should demonstrate that proposals have a high level of climate resilience built-in from the outset and should also demonstrate how proposals can be adapted over their predicted lifetimes to remain resilient to a credible maximum climate change scenario.’**

2.4. The climate change scenarios set out in the latest EA’s guidance are described in Section 3 below and require the assessment of the maximum credible climate change scenario.

2.5. The Overarching NPS for Energy (EN-1) recognises the need for applications to be supported by a FRA in accordance with the guidance contained in the Planning Practice Guidance Flood Risk and Coastal Change section[2] which accompanies the National Planning Policy Framework[3] (‘NPPF’) and the requirement for appropriate arrangements to manage surface water including appropriate use of Sustainable Drainage Systems (‘SuDS’). It confirms that the Sequential and Exception Tests need to be satisfied for developments in accordance with the NPPF and its Guidance. In general terms with respect to flood risk paragraph 5.8.12 states:

> **‘Development should be designed to ensure there is no increase in flood risk elsewhere, accounting for the predicted impacts of climate change throughout the lifetime of the development. There should be no net loss of floodplain storage and any deflection or constriction of flood flow routes should be safely managed within the site. Mitigation measures should make as much use as possible of natural flood management techniques.’**

2.6. The NPS for Renewable Energy Infrastructure (EN-3)[4] sets out policy on solar PV schemes >50 MW in England. EN-3 identifies indicative impacts of solar schemes which could require assessment by the application. With respect to flood risk and drainage paragraphs 2.10.84 – 2.10.88 state:

> **‘Where a Flood Risk Assessment has been carried out this must be submitted alongside the applicant's ES. This will need to consider the impact of drainage. As solar PV panels will drain to the existing ground, the impact will not, in general, be significant.**

[1] Department for Energy Security and Net Zero (2023) Overarching NPS for Energy (EN-1)
[2] Department for Levelling Up, Housing and Communities (2022) Guidance Flood risk and coastal change. Available from: https://www.gov.uk/guidance/flood-risk-and-coastal-change (Accessed on 22.05.23).
[3] Department for Levelling Up, Housing and Communities (2024) National Planning Policy Framework. Available from: https://www.gov.uk/guidance/national-planning-policy-framework (Accessed on 18.02.25).
[4] Department for Energy Security and Net Zero (2023) National Policy Statement for Renewable Energy Infrastructure (EN-3)

Where access tracks need to be provided, permeable tracks should be used, and localised Sustainable Drainage Systems (SuDS), such as swales and infiltration trenches, should be used to control any run-off where recommended.

Given the temporary nature of solar PV farms, sites should be configured or selected to avoid the need to impact on existing drainage systems and watercourses.

Culverting existing watercourses/drainage ditches should be avoided.

Where culverting for access is unavoidable, applicants should demonstrate that no reasonable alternatives exist and where necessary it will only be in place temporarily for the construction period.'

2.7. EN-3 sets out matters that could be relevant for the Secretary of State decision making. With respect to flood risk and drainage paragraph 2.10.154 states:

'Water management is a critical component of site design for ground mount solar plants. Where previous management of the site has involved intensive agricultural practice, solar sites can deliver significant ecosystem services value in the form of drainage, flood attenuation, natural wetland habitat, and water quality management.'

NPPF

2.8. The NPPF sets out the Government's planning policies for England and how these should be applied. Policy on planning and flood risk in the NPPF is dealt with at paragraphs 170-182 in chapter 14 'Meeting the challenge of climate change, flooding and coastal change'. Chapter 14 was first published on 27 March 2012 and last updated on 12 December 2024.

2.9. The national planning practice guidance (PPG) to the NPPF was launched as a web-based resource in March 2014. The category dealing with flooding is contained in Flood Risk and Coastal Change (Reference ID: 7) and last updated on 25 August 2022.

2.10. Paragraph 170 of the NPPF states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future), but where development is necessary, the development should be made safe for its lifetime without increasing flood risk elsewhere.

2.11. Paragraph 171 states that strategic policies should be informed by a strategic flood risk assessment ('SFRA'), and should manage flood risk from all sources.

2.12. A Level 1 SFRA[5] was prepared by AECOM on behalf of the former Selby District Council (now North Yorkshire Council), in August 2022, to support the development of their new Local Plan. The SFRA provides an overview of flood risk from all sources including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

[5] AECOM (2022) Selby District Level 1 Strategic Flood Risk Assessment.

2.13. As set out in paragraph 172 of the NPPF, all plans should apply a sequential, risk-based approach to the location of development - taking into account the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by applying the sequential test and then, if necessary, the exception test.

2.14. Paragraph 174 states that the aim of the sequential test is to steer new development to areas with the lowest probability of flooding from any source. The strategic flood risk assessment will provide the basis for applying the test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

2.15. Paragraph 181 identifies that where appropriate; applications should be supported by a site-specific flood-risk assessment. Footnote 63 of the NPPF states that a site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more.

2.16. Paragraph 181 of the NPPF states:

> **'When determining any planning applications, local planning authorities should ensure flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:**
>
> **a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;**
>
> **b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;**
>
> **c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;**
>
> **d) any residual risk can be safely managed; and**
>
> **e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.'**

Flood Zones

2.17. A copy of the EA's Flood Map for Planning, obtained from the GOV.UK website, which shows the Flood Zones in the vicinity of the Site, is reproduced as **Figure 3** below.

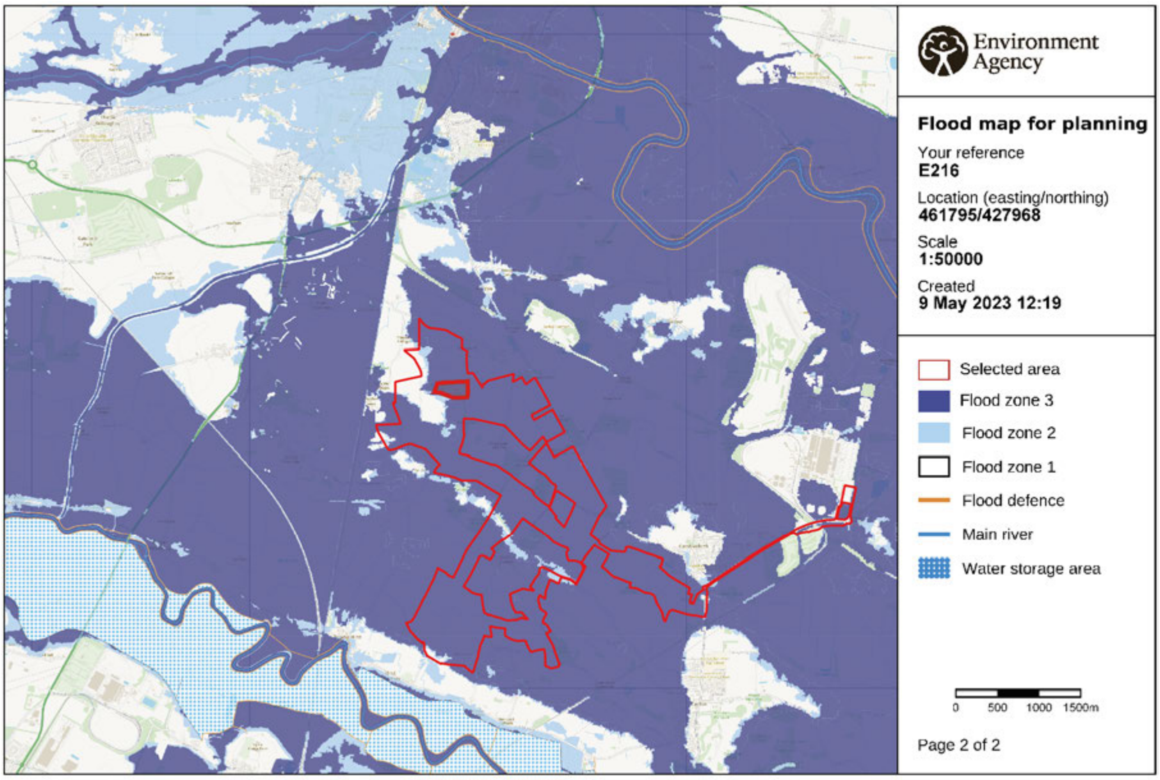

Figure 3: Flood Map for Planning

2.18. The EA's Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. The EA's Flood Map for Planning shows the area that could be affected by flooding, either from rivers or the sea, coloured dark blue corresponding to Flood Zone 3. The light blue area is Flood Zone 2 and shows the additional extent of an extreme flood from rivers or the sea. These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Where there is no blue shading, this shows the area where flooding from rivers and the sea is very unlikely corresponding to Flood Zone 1.

2.19. The orange lines on the Flood Map for Planning show flood defences that have been built to protect against flooding from rivers and the sea. The defences shown on the Flood Map for Planning provide different levels of flood protection and do not remove the risk of flooding and could be overtopped or fail. The effectiveness of the flood defences in protecting the Site from fluvial and tidal flooding are assessed in Section 4 below.

2.20. The red line Site boundary has been added to the EA's Flood Map for Planning on **Figure 3.** From an inspection of the Flood Map it can be seen that the majority of the Site falls within Flood Zone 3 with smaller areas of Flood Zone 2 and Flood Zone 1.

2.21. The probability of flooding of the different flood zones is summarised below:

- Flood Zone 1 defined as land with a low probability of flooding, having a less than 0.1% (1 in 1000) annual probability of river or sea flooding.
- Flood Zone 2 Medium Probability is defined as land having between a 1% (1 in 100) and 0.1% (1 in 1000) annual probability of river flooding; or between a 0.5% (1 in 200) and 0.1% (1 in 1000) annual probability of sea flooding.

- Table 1 of the government's flood risk and coastal change guidance divides Flood Zone 3 into Zone 3a High Probability and Zone 3b The Functional Floodplain.
  - Flood Zone 3a is defined as a 'high probability' zone assessed as having a 1% (1 in 100) or greater annual probability of river flooding (>1%) in any year or having a 0.5% (1 in 200) or greater annual probability of sea flooding.
  - Flood Zone 3b is defined as where water from rivers or the sea has to flow or be stored in times of flood and is not separately distinguished from Zone 3a on the Flood Map for Planning and is identified in the SFRA.

2.22. The Level 1 SFRA defines Flood Zone 3b as the land area which would naturally flood during the 5% Annual Exceedance Probability ('AEP') (1 in 20 Return Period ('RP')) event or greater in any year and identifying land which is designed to flood (such as a flood attenuation scheme, washland or flood storage area). It should be noted that areas which would naturally flood during a 5% AEP (1 in 20 RP) event or greater but are prevented from doing so by existing infrastructure will not be defined as functional floodplain and this approach has been agreed by the EA. The extents of Flood Zone 3b on the Site are shown on Appendix A Figure 8 within the Level 1 SFRA and an extract of this mapping with the red line is reproduced in **Appendix 3**. Inspection of this mapping indicates that due to the presence of flood defences along the River Aire and River Ouse the areas of Flood Zone 3 on the Site are defined as Flood Zone 3a.

Flood Risk Assessment Planning Practice Guidance

2.23. For the purposes of applying the NPPF, paragraph 20 in the Flood Risk and Coastal Change PPG advises that a site-specific FRA is carried out to assess the flood risk to and from a development site. The objectives of a site-specific flood risk assessment are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable.

2.24. Paragraph 1 of the PPG states "flood risk" is a combination of the probability and the potential consequences of flooding. Areas at risk of flooding are those at risk of flooding from any source, now or in the future. Sources of flood risk include rivers and the sea, direct rainfall on the ground surface, rising groundwater, overwhelmed sewers and drainage systems, reservoirs, canals and lakes and other artificial sources. Flood risk also accounts for the interactions between these different sources.

2.25. Paragraph 21 in the PPG advises that the information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should be proportionate to the degree of flood risk and make optimum use of information already available, including information in a SFRA for the area, and the interactive flood risk maps. A flood risk assessment should also be appropriate to the scale, nature, and location of development.

2.26. The PPG provides a model checklist for a site-specific FRA.

2.27. With regard to what further advice is available on the preparation of a site-specific FRA, guidance from the Department for Environment, Food & Rural Affairs ('DEFRA') and the EA, published on the Government's GOV.UK website, includes guidance on how to carry out a flood risk assessment entitled: 'Flood risk assessment in flood zones 2 and 3'[6]. This guidance provides information on the range of factors that need to be considered when assessing flood risk.

Local Planning Policy

2.28. The Proposed Development is located within the administrative areas of North Yorkshire Council.

2.29. It should be noted that as of 1st April 2023, North Yorkshire County Council and seven district councils, including Selby District Council, comprise a new unitary authority known as North Yorkshire Council. Local planning policy still makes reference to the former Selby District Council.

Adopted Local Planning Policy

2.30. There are a number of adopted local plans that form the development plan for the former Selby district which include the Selby District Core Strategy Local Plan (2013)[7] and Selby District Local Plan (2005)[8].

2.31. The Selby District Core Strategy Local Plan was adopted in October 2013 and contains Policy SP15 'Sustainable Development and Climate Change' relevant to the Proposed Development.

2.32. Policy SP15 'Sustainable Development and Climate Change' states:

> **'A. Promoting Sustainable Development**
>
> **In preparing its Site Allocations and Development Management Local Plans, to achieve sustainable development, the Council will: …**
>
> > **d) Ensure that development in areas of flood risk is avoided wherever possible through the application of the sequential test and exception test; and ensure that where development must be located within areas of flood risk that it can be made safe without increasing flood risk elsewhere;**
> >
> > **e) Support sustainable flood management measures such as water storage areas and schemes promoted through local surface water management plans to provide protection from flooding; and biodiversity and amenity improvements. …**
>
> **B. Design and Layout of Development**
>
> **In order to ensure development contributes toward reducing carbon emissions and are resilient to the effects of climate change, schemes should where necessary or appropriate: …**
>
> > **c) Incorporate water-efficient design and sustainable drainage systems which promote groundwater recharge; … '**

[6] EA and Department for Environment, Food & Rural Affairs (2017) Guidance: flood risk assessment in flood zones 2 and 3. Available from: https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zones-2-and-3 (accessed on 25.05.23).
[7] Selby District Council (2013) Selby District Core Strategy Local Plan
[8] Selby District Council (2005) Selby District Local Plan

2.33. The Selby District Local Plan was adopted in February 2005 and contains 'saved' policies relevant to this assessment. Policies ENV5 'Development in Flood Risk Areas', and ENV12 'River and Stream Corridors' are relevant to this assessment.

2.34. Policy ENV5 'Development in Flood Risk Areas' states:

> **'In areas with a high risk of flooding proposals for new development will only be permitted where:**
>
> > **1) Exceptionally, within functional flood plain areas, it relates to essential transport or utilities infrastructure which cannot be located in a lower risk area, and which is designed to remain operational even in times of flood.**
> >
> > **2) Within or adjacent to existing settlements, an appropriate standard of flood defence can be maintained or provided for the lifetime of the development, and proposals incorporate appropriate flood management and mitigation measures, including flood resistant construction, the provision of flood warning and evacuation procedures, laying out development to ensure that non-critical area flood first, and the incorporation of sustainable urban drainage systems.**
> >
> > **3) Elsewhere within undeveloped flood plains, proposals relate to agriculture, essential transport and utilities infrastructure, job related residential accommodation, or exceptionally, non-residential development with particular locational requirements for which an alternative lower risk location is not available, and for which associated compensatory flood storage measures are provided.**
>
> **Development proposals which impede the functional flood plain and flood flows, adversely affect the stability and continuity of or access to flood defences, or which materially increase the risk of flooding elsewhere will not be permitted.**
>
> **All proposals in areas subject to a risk of flooding must be accompanied by a flood risk assessment appropriate to the scale and nature of the development, prepared in consultation with the EA.'**

2.35. Policy ENV12 'River and Stream Corridors' states:

> **'Proposals for development likely to harm the natural features of or access to river, stream and canal corridors will not be permitted unless the importance of the development outweighs these interests, and adequate compensatory measures are provided.'**

Emerging Local Planning Policy

2.36. NYC are currently consulting on the Draft Selby District Council Local Plan (Consultation Version 2024)[9]. The latest stage of the process was the publication of proposed submission documents for public consultation which was concluded in April 2024. The Draft Selby District Council Local Plan (Consultation Version 2024) contains emerging Policy SG9 'Design' and Policy SG11 'Flood Risk' which are relevant to this assessment.

[9] North Yorkshire Council (2024) Selby Local Plan Revised Publication 2024.

2.37. Emerging Policy SG9 'Design' states:

'… B. Development should where appropriate seek to: …

9. Incorporate multi-functional green infrastructure within sites to provide carbon storage and Sustainable Drainage Systems (SuDS); …'

2.38. Emerging Policy SG11 'Flood Risk' states:

'A. To enable communities to manage, be resilient and adapt to flood risk, development will only be supported where it can be demonstrated that:

1. The site falls within areas of lowest flood risk as set out in the most up-to-date EA flood risk maps and/ or Selby District's Strategic Flood Risk Assessment (SFRA) maps; or

2. The development is of a type that is exempt from the Sequential and Exceptions Tests, as determined by national policy; or

3. The site has passed through a Sequential Test as set out by the Local Planning Authority; or

4. Where there are no sequentially-preferable sites, the site has been assessed through the application of the Exception Test as set out in the National Planning Policy Framework; and

5. The proposal does not increase the risk of flooding off-site;

6. A scheme that has to be located in Flood Zone 3b (functional floodplain), involving essential infrastructure that has passed the Exception Test, or water-compatible uses, will be designed and constructed to:

i. remain operational and safe for users in times of flood;

ii. result in no net loss of floodplain storage;

iii. not impede water flows and not increase flood risk elsewhere.

B. If a site has passed the Sequential and Exception Tests the following criteria will need to be applied where viable and feasible to make it acceptable in detail:

1. Where the development is located in areas of flood risk such as Flood Zone 2 (or higher) and does not constitute Minor Development or a change of use the development layout within the site will be subject to the sequential approach, with the highest vulnerability development located in areas at lowest flood risk within the site;

2. Relevant flood resilience construction methods identified through an up to date site-specific Flood Risk Assessment (FRA) should be implemented to reduce the impact and likelihood of a flood event;

3. Where the development has existing trees, woodland and/or hedgerows these should be retained where the risk of flooding from surface water has been identified and it is possible, and if not retained the developer must agree a tree

planting scheme in line with Policy NE6 where determined to be the best option to help reduce identified flood risk from surface water;

4. The features that manage surface water are commensurate with the design of the development in terms of size, form and materials and make a positive contribution to reducing flood risk. More specific development control guidance should incorporate comments from the Lead Local Flood Authority;

5. Sustainable Drainage Systems (SuDS) where appropriate are incorporated in accordance with the National Planning Policy Framework and the non-statutory technical standards, but taking advice from those organisations that provide input through the planning process including the Lead Local Flood Authority, and in relevant areas the Internal Drainage Boards;

6. Wastewater and effluent should be disposed to dedicated treatment plants wherever possible and make the best use of existing sewerage networks, in line with Policy IC4 (Water supply, Wastewater Treatment and Drainage Infrastructure). Infrastructure for new development should ensure that surface water is always drained and managed separately from foul water. It is considered that combined sewer systems, which carry both foul and surface water, have limited capacity and are more likely to lead to foul flooding and are therefore not supported for new development;

7. Hard surfaces on developments should be permeable where practicable in line with highways guidance from the Local Highways Authority unless proven not to be possible by site investigation;

8. Proposals involving building over existing culverts, or the culverting or canalisation of watercourses will not be permitted unless it can be demonstrated to be in the interests of public safety or to provide essential infrastructure and that there will be no detrimental effect on flood risk and biodiversity. Where feasible, development proposals should incorporate re-opening of culverts, modification of canalised watercourses and consideration of mitigation measures to achieve a more natural state;

9. In terms of mitigation, sites should follow the relevant guidance detailed within the Strategic Flood Risk Assessment(s), including:

i. Setting of finished floor levels;
ii. Management of residual depths, hazards, etc.; and
iii. Consideration to the design flood event;
iv. Access and egress requirements.

10. In some developments (for example, commercial/industrial), raising floor levels may not be possible due to operational requirements. In these instances alternative measures should be considered and agreed with the EA before implementation.

C. Where required by the National Planning Policy Framework (NPPF) and set out in Planning Practice Guidance, proposals for development should be accompanied by a site-specific Flood Risk Assessment (FRA). The need for a FRA is described in the NPPF, however

Footnote 59 of the NPPF (2023) also refers to the need for the SFRA to provide guiding details for sites where a FRA will be necessary; and not just relying on the EA flood zones.

D. Development allocated will not be subject to the Sequential/Exception Tests identified in part A as it is already been determined through the Local Plan process that they have passed the Sequential Test.'

Summary of Scope

2.39. The scope of this Flood Risk Assessment is therefore to provide sufficient information to satisfy the relevant requirements of the designated NPSs, the NPPF and its associated guidance, local planning policy and guidance from the Department for Environment, Food & Rural Affairs and EA.

3. DEVELOPMENT SITE CONTEXT

The Development Proposals

3.1. The Proposed Development comprises the construction, operation and decommissioning of ground mounted solar arrays, energy storage and associated development comprising grid connection infrastructure and other infrastructure. The Proposed Development has an expected energy generating capacity in excess of the 50MW.

3.2. The exact details of all elements of the design of the Proposed Development will evolve through the tendering and detailed design stages. To allow for flexibility to accommodate changes in technological advancements which would influence the details of the design and layout, this assessment adopts a parameter plan approach based on the principle of the 'Rochdale Envelope'. The parameter ranges, including details of size, technology and locations of different elements of the Proposed Development are specified and this assessment is based on a reasonable worst-case of the proposed equipment.

3.3. Arrays of solar panels would be situated in rows running on a north to south axis with a minimum separation distance of 2m between lines of panels. The technology utilised would change the angle of the solar panels along a central axis by approximately 60° degrees from the horizontal to track the movement of the sun and maximise energy generation potential. The rows of PV panels are separated by a horizontal 'rainwater' gaps. These gaps and movement of the panels allows rainwater to drain freely to the ground beneath and between the PV panels, replicating the existing greenfield scenario. The lower edge of the panels would be up to 0.9m above ground level at the maximum rotation and the horizontal stow position would be approximately 2m above ground level. Grass would continue to grow underneath the panels and between rows which would continue to delay surface water runoff and prevent soil erosion. **Figure 4** shows a typical cross section of the proposed solar array.

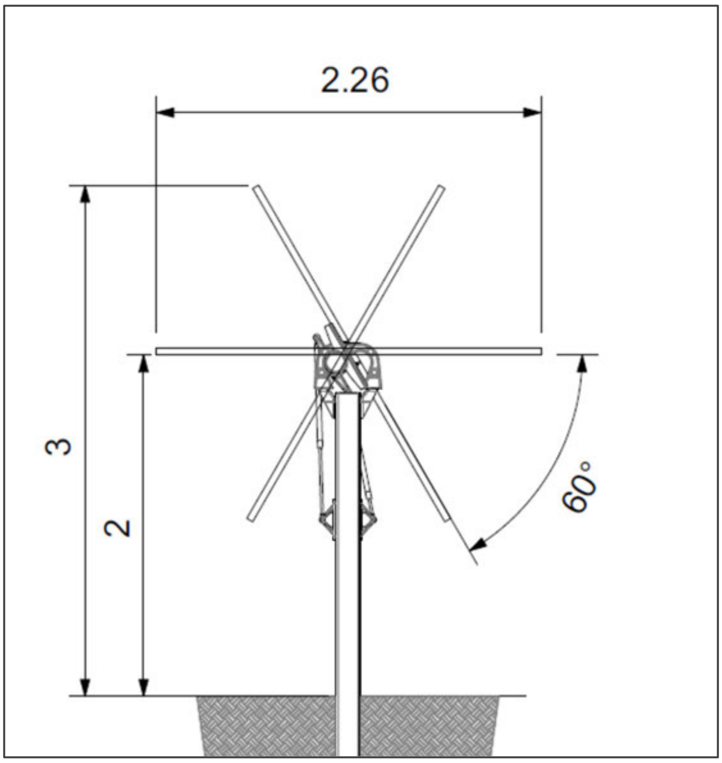

Figure 4: Rotational Solar Panel (Extract from Figure 3.4 [6.2.3.4])

3.4. The supporting frames have a minimal cross-sectional area and would be 'pile driven' or 'screw anchored' into the ground to a typical depth of 1.5 to a maximum of 2.5m below ground level, depending on ground condition surveys to be completed prior to construction activities commencing.

3.5. The piling for the solar arrays has the potential to damage historical agricultural land drains and detailed site design should take their presence into account and/or the land drains should be reinstated on decommissioning of the development (unless agreed otherwise with the landowner).

3.6. Archaeologically sensitive areas are identified on the Site and to mitigate disturbance of below ground features alternative foundation types are to be used in these areas. Concrete ballast foundations (2.5m x 0.5m) are proposed at these discrete locations.

3.7. If string inverters are chosen at detailed design stage, string inverter boxes for combining multiple strings of solar panels would be located underneath or adjacent to the tracker structures and elevated above ground level.

3.8. The Proposed Development does not involve any change in ground levels other than the provision of an earth flood defence bund and associated compensatory floodplain storage discussed in Section 4 and the provision of interception swales discussed in Section 5 of this report.

3.9. The majority of the Site would be converted to grassland underneath the solar panels with existing arable land within perimeter fence seeded with Emorsgate grazing mixture EG27, or similar, and maintained by sheep grazing or mowing during the operational lifespan of the Proposed Development.

3.10. Any access tracks would be formed using permeable materials (unbound open graded stone) so as to avoid creating impermeable areas across the Site. A typical detail of the internal access road is reproduced as **Figure 5** below. The aggregate specification of 40/80 complies with the definition of a permeable material with a low fines content and would allow rainwater to pass through the track and infiltrate into the underlying ground as it would in the pre-development baseline situation.

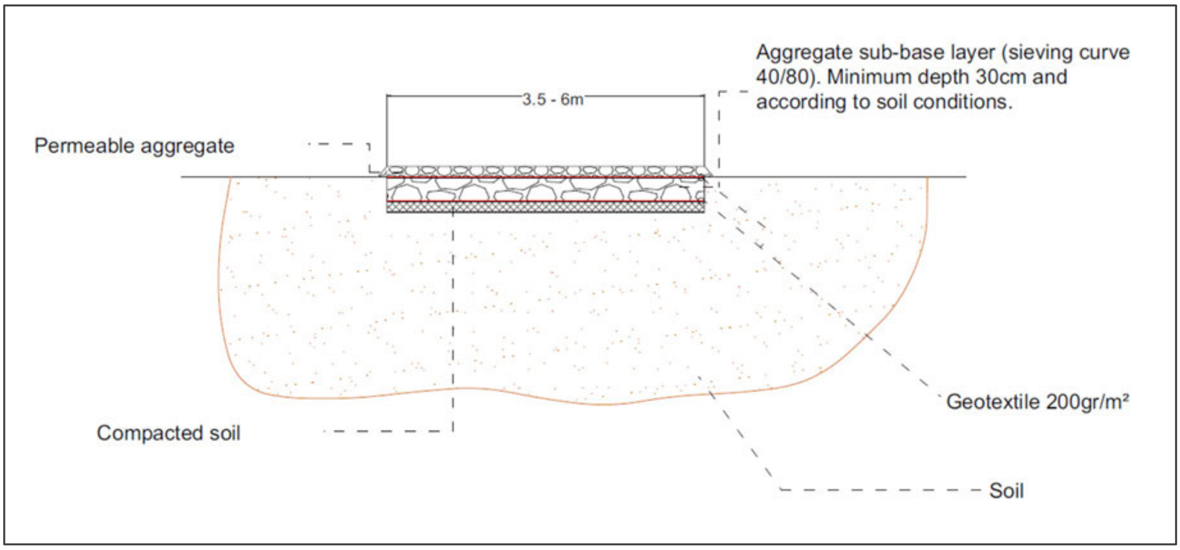

Figure 5: Internal Access Road Detail (Extract from Drawing No. DX-01-P05)

3.11. Ancillary equipment would be contained in small buildings, typically container units distributed across the Site. Ancillary equipment includes Inverter Stations which contain an Inverter, Transformers and associated switch gear, a separate Control Room, and a Sub-substation.

3.12. Alternatively, the use of string invertors mounted to the mounting structures underneath the solar PV infrastructure could be utilised and may be considered at the tender / detailed design stage. If string invertors are utilised, this would reduce the size of onsite container units. For the purposes of this assessment the use of Inverter Stations has been assessed which is a worst case from a flood risk and drainage perspective.

3.13. Due to their small size and remote rural locations it is proposed that roof water from these buildings would discharge directly onto the surrounding ground. Minimum floor levels for buildings and all sensitive control equipment on the Site would be set on concrete supports at least 300mm (and up to up to 600mm) above ground level to prevent the ingress of water.

3.14. The proposals also include provisions for energy storage, such as batteries, to reinforce the power generation of the solar PV panels. The battery energy storage system ('BESS') compound comprises shipping containers or similar, with each unit measuring up to 12.2m x 2.4m x 3.5m on concrete supports up to 600mm in height, above a 300mm deep gravel sub-base within a defined energy storage area.

3.15. Electrical cabling is required to connect the rows of PV panels to the Inverter Stations and to the sub-station and the grid connection. These cables would be installed underground in trenches and ducts. The dimensions of the trenches will vary depending on the amount of cabling they contain and would be typically up to a depth of 1.5m. The cable routes are below ground and due to their nature would be waterproofed and resistant to all sources of flooding. The below ground cabling has minimal flood risk or drainage implications.

3.16. Cable trenches have the potential to act as land drains and convey any water falling on the Site which infiltrates into the ground to the lower parts of the Site (particularly on sloping sites). To prevent this occurring, clay 'stanks' should be provided at intervals within the cable trenches. The entry point of any cable or ducting into chambers should also be sealed to prevent water ingress.

3.17. The Proposed Development includes an on-site substation and grid connection cabling with a maximum voltage of 132 kilovolts ('kV'). The 132kV Substation compound would be crushed stone which is considered to be permeable.

3.18. Any electrical plant which contains oil would be designed to be suitably bunded in accordance with the Control of Pollution (Oil Storage) (England) Regulations 2001 and the EA and Department for Environment, Food & Rural Affairs guidance entitled 'Oil storage regulations for businesses'[10].

Site Description

On-site Watercourses and Existing Drainage Arrangements

3.19. The Ordnance Survey map of the area shows geographical features including watercourses and other bodies of water.

[10] EA (2023) Oil storage regulations for businesses. Available from: https://www.gov.uk/guidance/storing-oil-at-a-home-or-business (Accessed on 25.05.23).

3.20. The Site lies predominately within the catchment of the River Aire. The River Aire runs to the south of the Site, to the south of Hirst Road and the villages of Temple Hirst and Hirst Courtney, and flows predominately from west to east. At its closest point the River Aire is located approximately 0.75km south of the area of the Site where solar panels and associated infrastructure is proposed (the 'Solar Farm Zone'). The River Aire is a tributary of the River Ouse and flows into the River Ouse approximately 7.5km to the east of the Solar Farm Zone.

3.21. The northern part of the Solar Farm Zone (to the north of Fair Oaks) lies within the wider catchment of the River Ouse. At its closest point the River Ouse is located 2.2km northeast of the Solar Farm Zone and flows predominately from the north west to the south east.

3.22. Due to the Site's position in the lower catchment of the River Ouse there are a number of tributaries in the vicinity of the Site that are relevant to this assessment. The River Derwent joins the River Ouse approximately 4.5km to the north east of the Solar Farm Zone and to the north east of Drax Power Station. The Dutch River flows into the River Ouse to the south of Goole approximately 10.4km to the south east of the Solar Farm Zone . The last major tributary of the River Ouse in the vicinity of the Site is the River Trent which flows into the river approximately 21.6 km to the south east of the Solar Farm Zone . At this location the River Ouse becomes the River Humber / Humber Estuary and flows into the North Sea.

3.23. The River Aire and River Ouse are tidally influenced in the vicinity of the Site. The River Ouse tidal limit is located at Naburn Weir significantly upstream of the Site and the River Aire tidal limit is the lock and weir at Chapel Haddlesey, west of the Site.

3.24. The River Ouse, River Aire, River Derwent, Dutch River, and River Trent are all classified as 'Main Rivers'.

3.25. Numerous drainage ditches cross the Site which drain ultimately into the River Aire or River Ouse. The drainage ditches are located within the boundary of the existing fields and are classified as 'ordinary watercourses'.

3.26. The Site falls within the area administered by the Selby Area Internal Drainage Board ('IDB'). The Selby Area IDB's purpose is to manage water levels within the low-lying catchments of the River Aire and River Ouse with the aim of protecting people and their property. A number of the 'ordinary watercourses' which cross the Site are managed by the IDB and their byelaws apply, controlling activities along these watercourses. The locations of these watercourses are shown on **Figure 6** below. The ordinary watercourses drain into the River Aire and River Ouse via a gravity outfalls or pumping stations.

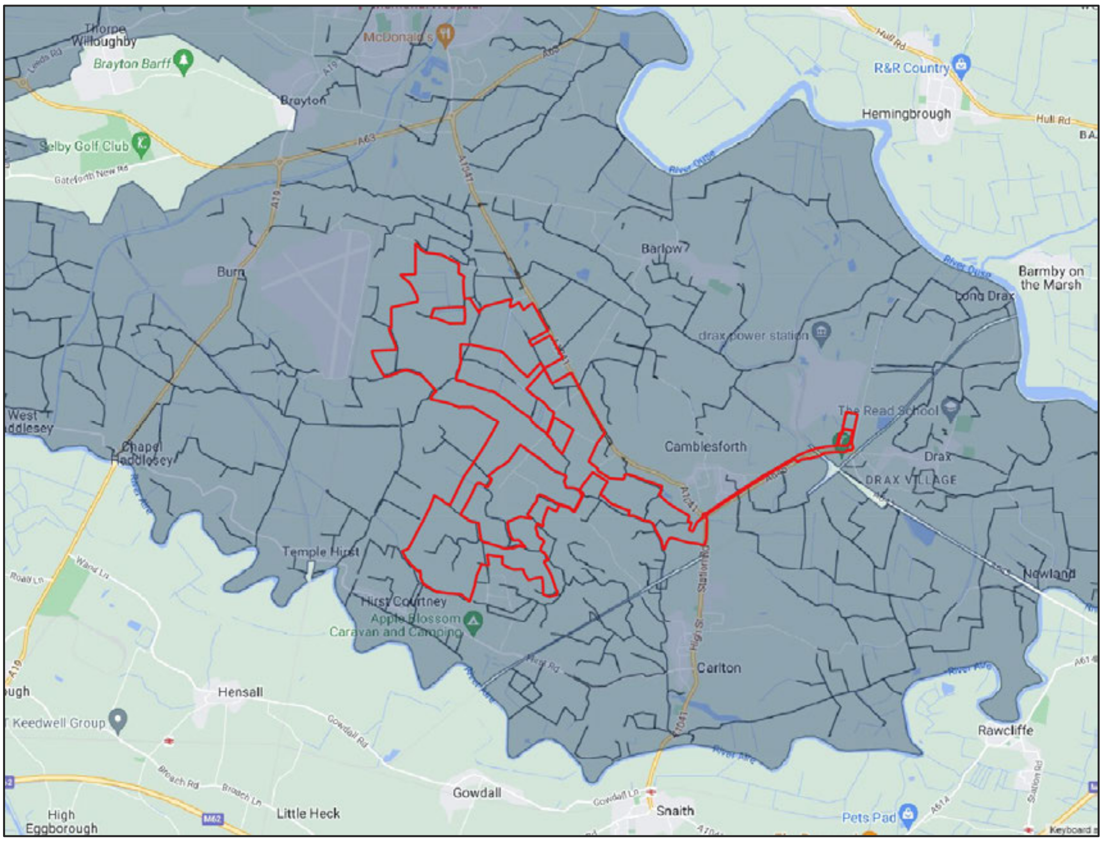

Figure 6: Extent of Selby Area IDB Area and managed Ordinary Watercourses (extract from Selby Area IDB website[11])

3.27. The existing surface water drainage arrangements, including locations of watercourses, are indicated on Drawing No. E216/107-127 copies of which are included in **Appendix 4**. Potential existing overland flow routes have been identified based on the Site's topography.

3.28. The geophysical survey [6.3.6.3] has identified extensive agricultural land drains through large parts of the Solar Farm Zone. The extent of the Solar Farm Zone is shown on the Parameters Plan reproduced in **Appendix 2** and **Figure 2**. These systems are likely to consist of mole drains or tile drains (clay or plastic perforated pipes) installed to improve the agricultural quality of the land and reduce waterlogging.

3.29. Currently the Site naturally drains by a combination of overland flow towards the low points and the ordinary watercourses/ drainage ditches which cross the Site and infiltration into the underlying ground.

Site Levels

3.30. The topography across the Solar Farm Zone is relatively flat and low lying. Site levels range between approximately 3m Above Ordnance Datum ('AOD') to 6m AOD. The western area of the Solar Farm Zone and along the southernmost boundary are at the highest elevation where levels fall predominately towards the northeast boundary. The lowest part of the Solar Farm Zone is the easternmost area. The general elevation across the Site is presented on **Figure 7** below.

[11] Selby Area IDB (2023) Selby Area IDB. Available from: https://www.shiregroup-idbs.gov.uk/idbs/selby/ (Accessed on 25.05.23).

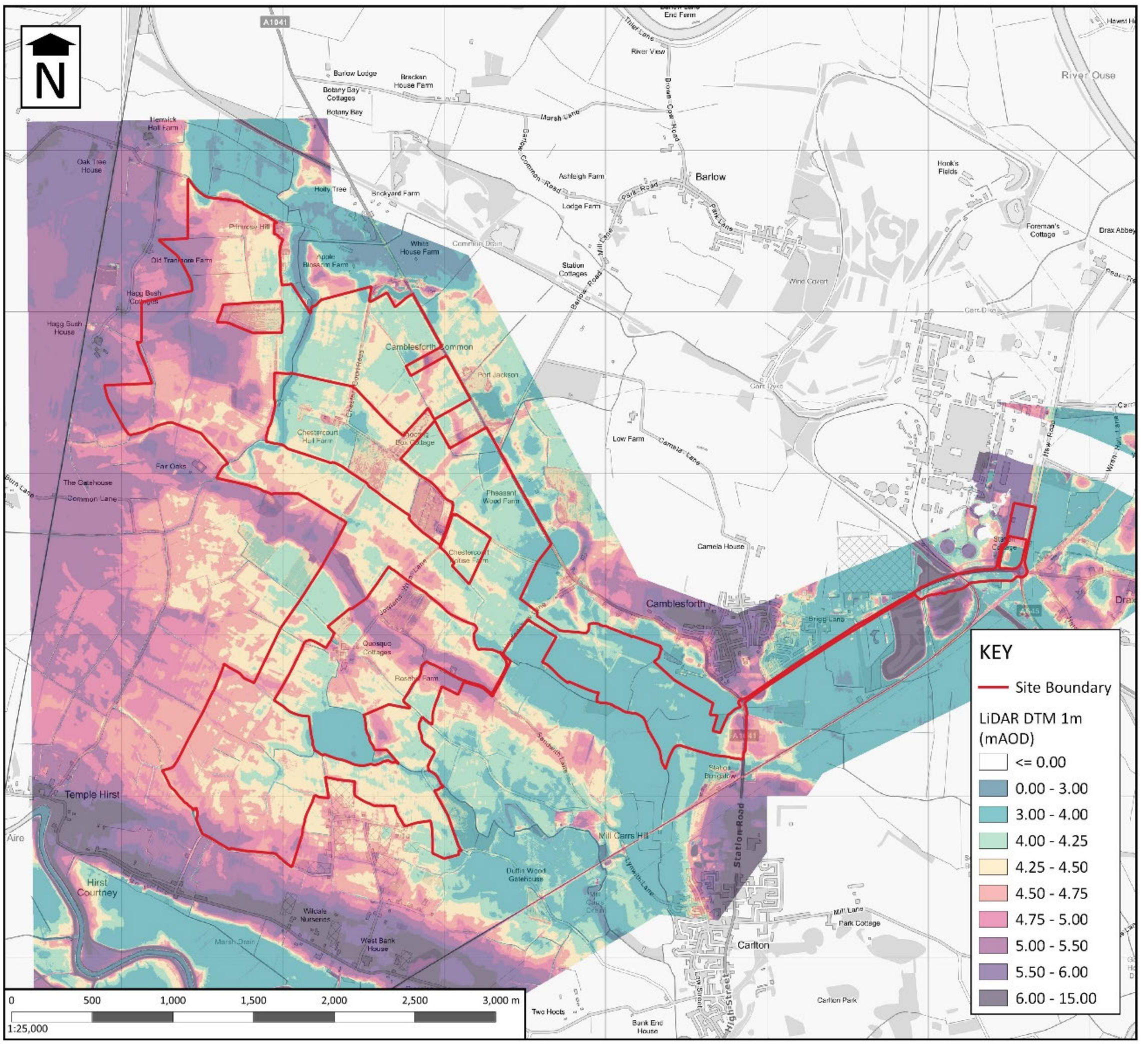

Figure 7: LiDAR

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3.31. The gradient across the Solar Farm Zone varies and typically ranges between 1 in 100 to 1 in 150. The area with the steepest gradients is located in the north western area and along the southern boundary; gradients typically range between 1 in 20 and 1 in 50. The area with the shallowest gradients is located in the eastern area where gradients are typically 1 in 200.

3.32. A copy of the Topographical Survey, conducted by Above Surveying Ltd. in May 2022. Drawing reference: 'Drax Linework ("CAD") Rev 1.0' is reproduced in **Appendix 5**.

Ground Conditions

3.33. The British Geological Survey© NERC (2023) online geological mapping[12] indicates that the Site is wholly underlain by Sherwood Sandstone Group (Sandstone) bedrock.

[12] British Geological Survey (2023) Geology Viewer. Available from: geologyviewer.bgs.ac.uk. (Accessed on 25.05.23)

3.34. Superficial deposits are present across the Site and are shown on **Figure 8** below. Hemingbrough Glaciolacustrine Formation (clay, silty) deposits are found towards the south-western and eastern parts of the Solar Farm Zone. Breighton Sand Formation (sand) deposits are found through the central and northern areas of the Solar Farm Zone. Small isolated areas of Alluvium (clay, silt, sand and gravel) deposits are present along watercourse corridors bisecting the northern and southern areas of the Solar Farm Zone where solar panels and associated infrastructure is proposed.

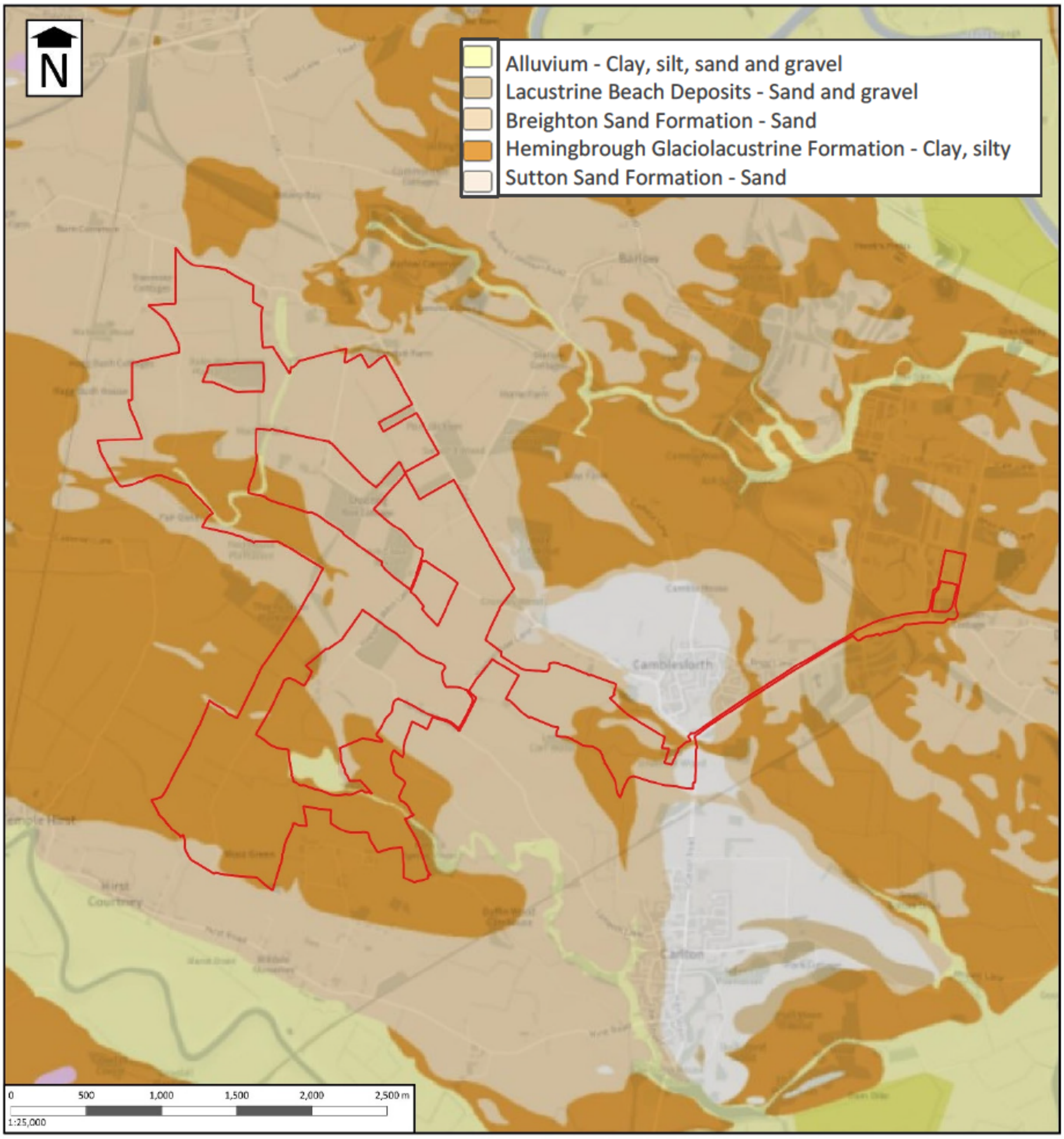

Figure 8: Superficial Deposits
Contains British Geological Survey materials ©NERC [2023]

3.35. From an inspection of the EA's Aquifer Designation Map dataset held on Natural England's MAGIC website[13] the Site's Sherwood Sandstone Group (Sandstone) bedrock is classified as a Principal Aquifer. The extent of bedrock aquifers in the vicinity of the Site is shown on **Figure 9** below. A 'Principal' Aquifer is classified as layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

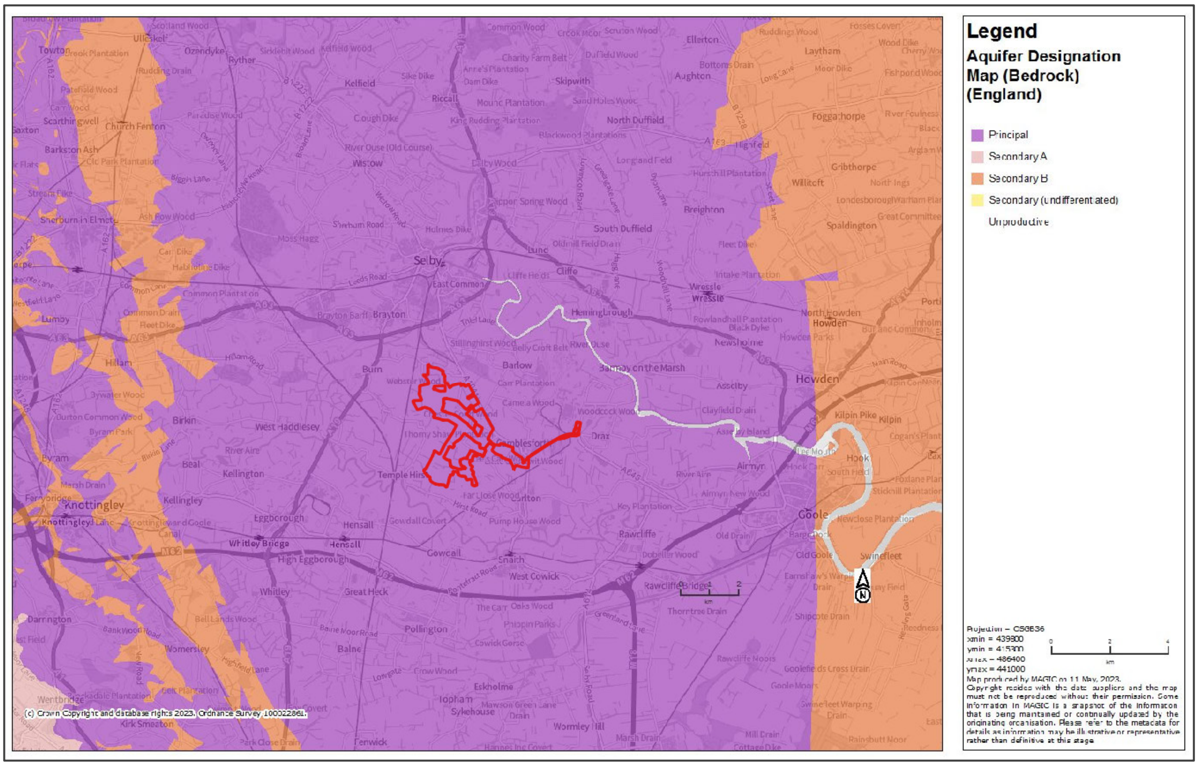

Figure 9: EA's Aquifer Designation Map (Bedrock)

3.36. The Breighton Sand Formation (sand) superficial deposits are classified as a Secondary A aquifer. A 'Secondary A' Aquifer is classified as 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. The other superficial deposits are classified as unproductive strata. The extent of superficial aquifers in the vicinity of the Site is shown on **Figure 10** below.

[13] Natural England (2023) MAGIC Map. Available from: https://magic.defra.gov.uk/MagicMap.aspx (accessed on 25.05.23)

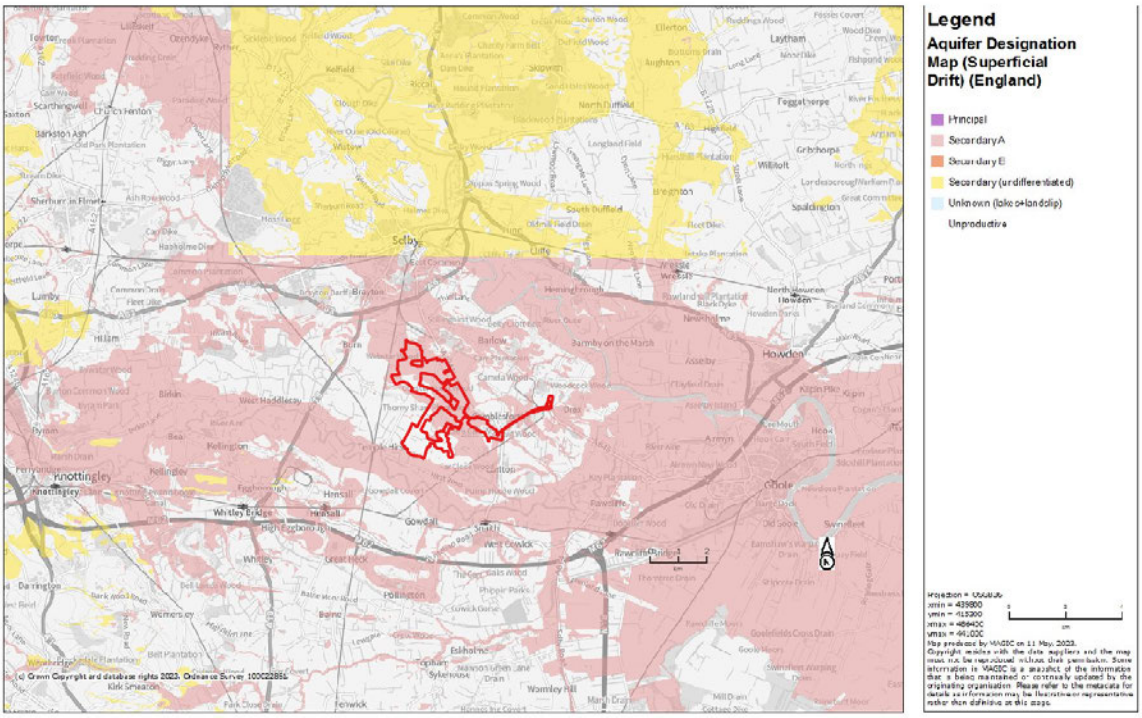

Figure 10: EA's Aquifer Designation Map (Superficial Drift)

3.37. Based on the Flood Studies Report ('FSR') Winter Rainfall Acceptance Potential ('WRAP') Map, as shown on Drawing No. E216/82 reproduced in **Appendix 6**, the Site is located in a 'Soil Index Class 2' area. Soil Index Class 2 has the second highest Winter Rainfall Acceptance Potential and therefore the second lowest standard percentage runoff. This suggests the underlying soil has relatively good permeability.

3.38. The Cranfield Soil and AgriFood Institute ('CSAI'), incorporating the National Soil Resources Institute (NSRI,) at Cranfield University maintains soil reports and maps for England and Wales. The Soilscapes dataset map[14] is shown on **Figure 11** below and is reproduced from the MAGIC website. Inspection of Figure 11 indicates that soils in the soils in the central and northern area of the Solar Farm Zone are classified as 'Naturally wet very acid sandy and loamy soils' and are described as naturally wet. Naturally wet soils are permeable soils in low lying areas often affected by high ground water that has drained from the surrounding landscape. The central and southern area of the Solar Farm Zone is underlain by soils described as 'Loamy soils with naturally high groundwater' and are naturally wet.

3.39. A small band of 'Freely draining slightly acid loamy soils' is present running along the southern edge of the Site near the village of Hirst Courtney. Freely draining soils absorb rainfall readily and allow it to drain through to underlying layers. The easternmost area of the Solar Farm Zone is underlain by 'Freely draining slightly acid sandy soils'.

3.40. The area of the 'Underground Cable Corridor' in the vicinity of Drax power station crosses areas underlain by 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' which are described as having impeded drainage. Soils with impeded drainage refer to soils with a tight, compact deep subsoil that impedes downward water movement; after heavy rainfall, particularly during the winter, the subsoil becomes waterlogged and can result in very wet ground conditions.

[14] Cranfield University (2023) Soilscapes Map. Available from: https://www.landis.org.uk/soilscapes/ (accessed on 25.05.23).

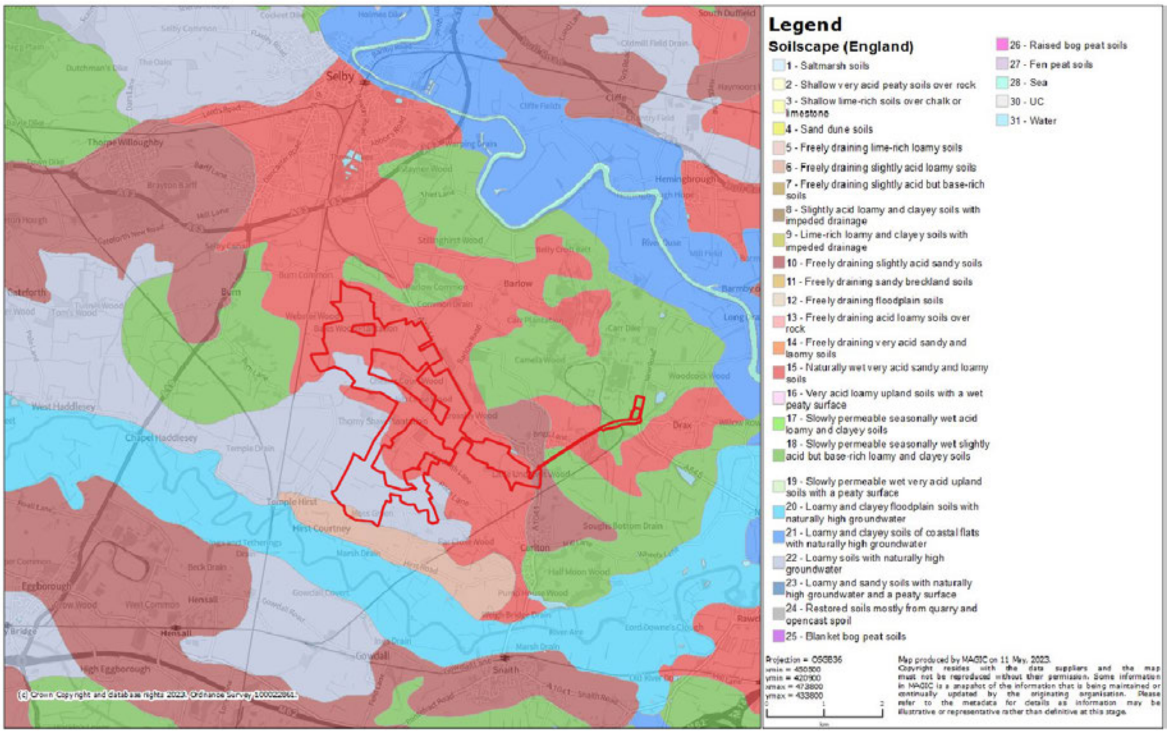

Figure 11: Soilscapes Dataset

3.41. Based on the available information the underlying ground conditions appear to have variable permeability. However, due to the low-lying nature of the Site and presence of superficial and principal aquifers high groundwater is likely to be present.

Groundwater Source Protection

3.42. From an inspection of the EA's Source Protection Zones dataset the Site lies within a Groundwater Source Protection Zone. A copy of the EA's Groundwater Source Protection Zone Map is reproduced in **Figure 12** below.

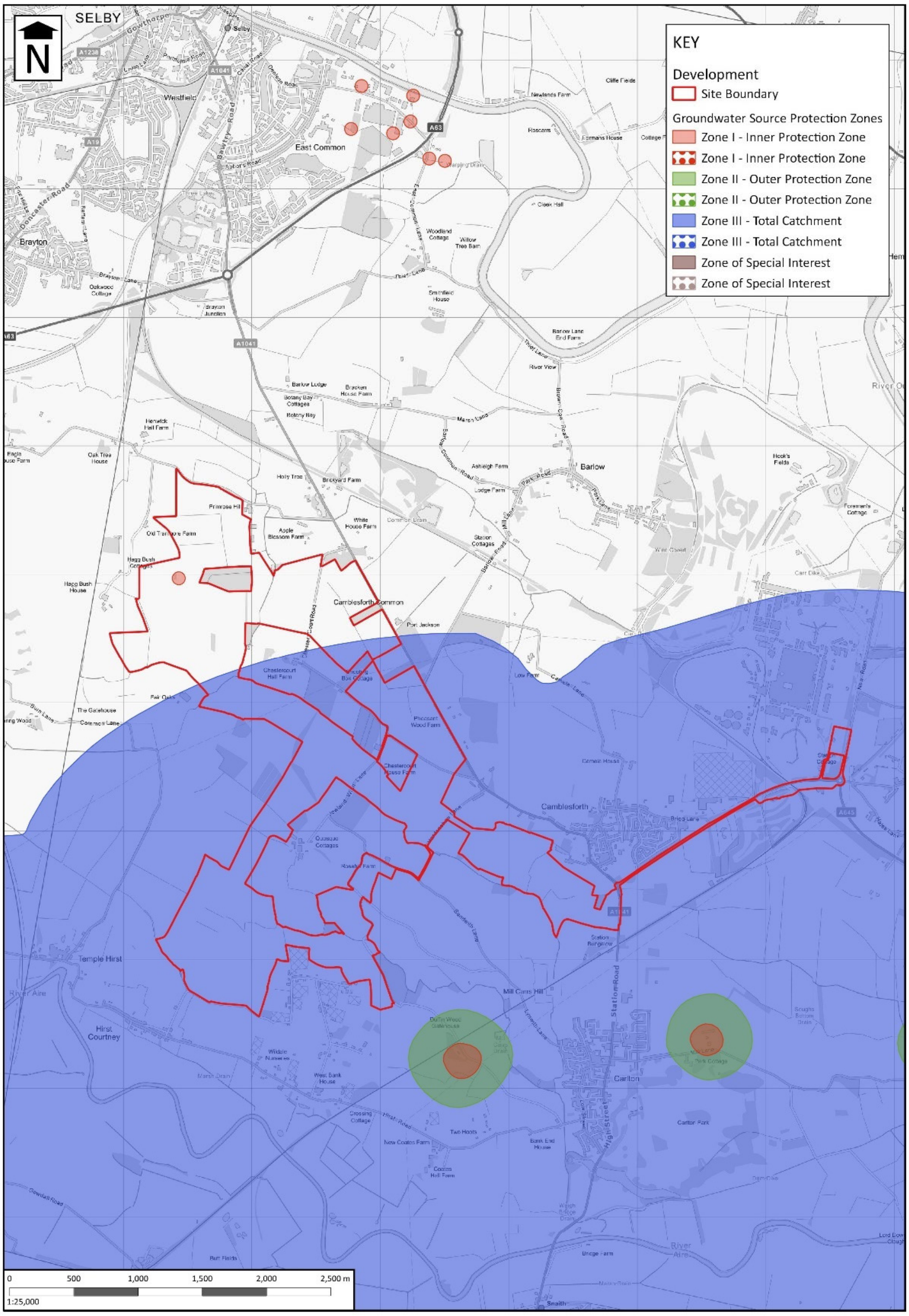

Figure 12: Groundwater Source Protection Zone

Contains OS data © Crown copyright [OS VectorMap® District] [2023]

3.43. The southern, central, and western areas of the Solar Farm Zone and areas of the Underground Cable Corridor fall within a Groundwater Source Protection Zone – Zone III Total Catchment ('SPZ3'). The northern area of the Solar Farm Zone falls predominately outside of a Groundwater Source Protection Zone. However, a small isolated Groundwater Source Protection Zone – Zone I Inner Protection Zone ('SPZ1') is present in the northern area of the Solar Farm Zone approximately 100m to the west of Bales Wood and approximately 400m to the east of Hagg Bush Cottages.

3.44. The Environment Agency defines SPZ1 and SPZ3 as follows[15]:-

'Inner zone – SPZ1

'A groundwater SPZ1 is the area immediately around an abstraction point for domestic supply or for food production purposes. Groundwater in a SPZ1 is most vulnerable to pollution given the close proximity of the abstraction point and the water's intended use for human consumption. It is defined within the Environmental Permitting (England and Wales) Regulations 2016 as one of the following.

1. **The area within 50 metres of a point where the groundwater is abstracted for domestic supply or food production purposes.**
2. **The area where it takes groundwater that is intended to be used to supply water for domestic or food production purposes up to 50 days to travel to the groundwater abstraction point.**

'For any given abstraction point, whichever area is largest applies.'

'Total catchment – SPZ3

'This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.'

3.45. The small area of SPZ1 onsite is associated with abstraction for 'general agricultural use' (Licence Nos. 2/27/24/300/R01 & 2/27/24/300/R01). The descriptions attached to the abstraction licence references 'general farming & domestic' use and 'spray irrigation – direct' use and that the borehole abstracts from the Sherwood Sandstone Bedrock.

3.46. The EA's Groundwater Vulnerability Maps dataset is held on Natural England's MAGIC website and reproduced as **Figure 13** below. The dataset shows the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties within $1km^2$. Inspection of this dataset shows areas of 'medium-high' vulnerability are present associated with the area of Breighton Sand Formation (sand) superficial deposits. Areas of 'low' vulnerability are associated with the Hemingbrough Glaciolacustrine Formation (clay, silty) superficial deposits which would act as barrier to the bedrock aquifer below. The 'Underground Cable Corridor crosses areas of 'medium-high', 'medium', 'medium-low' and 'low' vulnerability.

[15] EA (2024) Guidance: Groundwater source protection zones (SPZs). Available from: https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#how-we-defined-the-zones (accessed on 17.02.25).

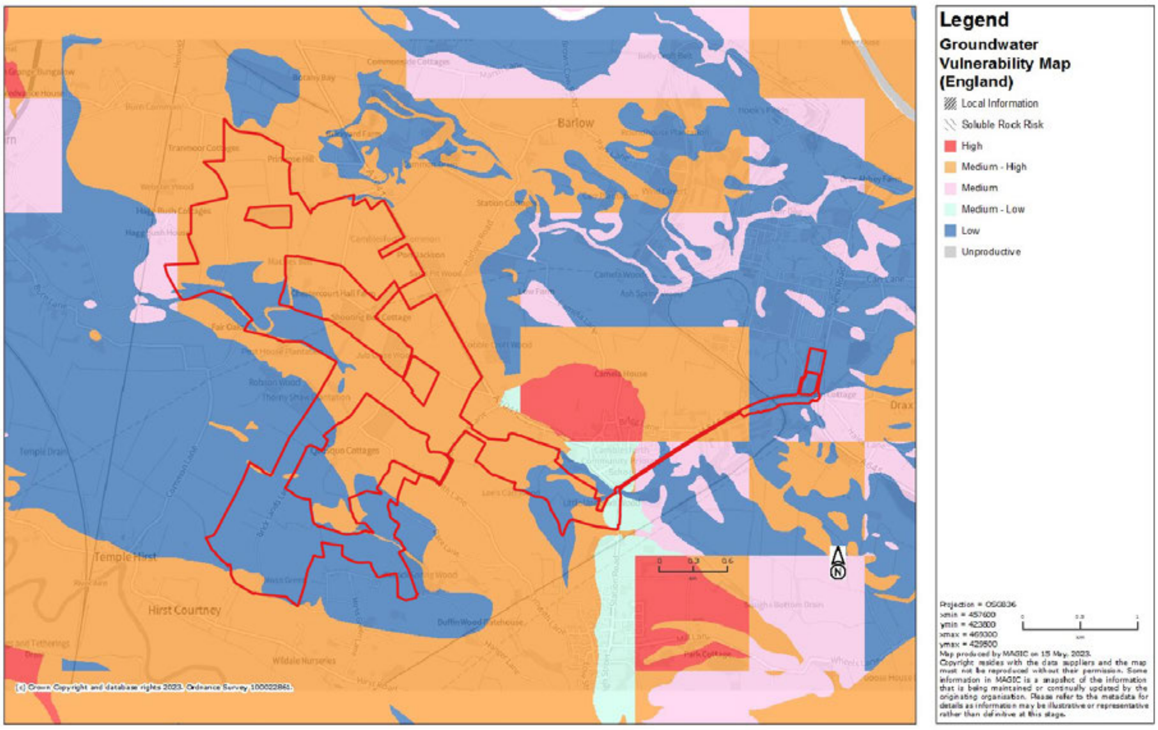

Figure 13: Groundwater Vulnerability Map

3.47. The 'EA Approach to Groundwater Protection' (February 2018) offers guidance on designing an appropriate surface water discharge system within a source protection zone. The relevant section of this document is Section G: 'Discharge of Liquid effluents into the ground' which applies to sewage effluent, surface water run-off, and industrial effluent and waste waters.

3.48. It should be noted that no discharge of sewage effluent or trade effluent is proposed as part of the development proposal. No deep excavation (>3m) is anticipated on the development which could create a pathway to groundwater.

3.49. Rainwater falling on panels or associated control equipment will be clean and remain uncontaminated by the presence of the solar farm. As such position statements G12 and G13 apply. The approach to surface water management is set out in Section 5 below.

3.50. Only solar arrays and security fencing extend into SPZ1 (approximately 0.212 Ha of the Site). The supporting frames have a minimal cross-sectional area and would be 'pile driven' or 'screw anchored' into the ground to a typical depth of 1.5-2.5m below ground level, depending on ground condition surveys to be completed prior to construction activities commencing. At the detailed design stage, the risk of piling causing physical disturbance or creating a potential pathway for contamination to the underling aquifer or SPZ1 would be assessed. If required, a Piling Risk Assessment and/or Foundation Works Risk Assessment ('FWRA') can be secured by DCO requirement requiring details to be submitted to and approved by the Local Planning Authority.

3.51. The detailed site design would ensure that no fluid filled cables pass through the small area of SPZ1 on the Site. Position statement C5 refers to fluid filled cables in SPZ1 and SPZ2. The areas of the Site where high voltage fluid filled cables could be used would be classified as SPZ3 and therefore acceptable in this location subject to standard pollution control measures.

3.52. The underground cable connecting the Proposed Development to the national grid would need to cross under the railway line to the east of the Site. It is proposed that the utility crossing would use trenchless methods. The design and implementation of the trenchless method utility crossing of the railway will be supported by a Hydrogeological Risk Assessment which will consider the implications of the proposals on physical disturbance of the aquifer and on groundwater levels or flow. Where necessary, additional mitigation measures will be identified to mitigate the effect of the trenchless method utility crossing of the railway on sensitive receptors (SPZ3 and Principal Bedrock Aquifer). The Hydrogeological Risk Assessment (‘HyRA’) for the trenchless method utility crossing of the railway will be secured by a suitably worded DCO requirement requiring details to be submitted to and approved by the Local Planning Authority.

3.53. It is recognised that a risk of spillages during the construction and decommissioning phases of the development could occur, however these are sufficiently mitigated through the application of construction best practice guidance and good site management as set out in the outline Construction Environmental Management Plan (‘oCEMP’) [6.3.5.1]. The oCEMP [6.3.5.1] will be further developed once the appointment of the Contractor(s) for the project has been confirmed and a detailed construction programme has been developed. Submission and approval of the final Construction Environmental Management Plan (‘CEMP’) will be secured by DCO requirement requiring details to be submitted to and approved by the Local Planning Authority.

3.54. Due to the nature of the Proposed Development, measures proposed in the oCEMP [6.3.5.1] and detailed site design it is considered that no new pathways would be created for pollutants to groundwater during the operation, construction or decommissioning of the Proposed Development. The Proposed Development would not pose a significant risk to groundwater resources and groundwater quality and complies with the terms of the EA’s Groundwater Protection Policy.

Climate Change Allowances

3.55. The NPPF and its guidance requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.

3.56. Guidance on the lifetime of development is provided at paragraph 6 in the Flood Risk and Coastal Change PPG. The lifetime of a non-residential development depends on the characteristics of that development.

3.57. The modelled operational lifespan of the solar farm is 40 years, after which the infrastructure would be removed and the Site returned to arable agricultural use. The modelled operational lifespan of the Proposed Development would be secured through the DCO Requirements.

3.58. For the purposes of this assessment, it is presumed that a decision will be made in 2025, procurement and construction will commence from 2027 and be concluded no later than 2029. The 40-year modelled operational lifespan will run to 2069 and energy generation will cease and decommissioning will commence. Decommissioning and handback of the land will be concluded in 2070.

3.59. Under heading 4 in the Site-Specific FRA Checklist in the Flood Risk and Coastal Change PPG, it asks how flood risk at the Site is likely to be affected by climate change, and states that further advice on how to take account of climate change in flood risk assessments is available from the EA. Guidance published by the EA, entitled 'Flood risk assessments: climate change allowances'[16], sets out the climate change allowances to be used for peak river flow, peak rainfall intensity, sea level rise, offshore wind speed and extreme wave height. This guidance was last updated on 27 May 2022.

3.60. There are a range of climate change allowances for each river basin district and epoch for sea level rise which are expressed as percentiles. A percentile describes the proportion of possible scenarios that fall below an allowance level. The higher central allowance is based on the 70th percentile (only 30% of projections would exceed this allowance) whereas the upper end allowance is based on the 95th percentile (only 5% of projections would exceed this allowance).

Maximum Credible Climate Change Scenario

3.61. The EA's climate change guidance[17] states:

> **'if you develop NSIPs you may need to assess the flood risk from a credible maximum climate change scenario. Check the relevant national policy statement.'**

3.62. The purpose of the assessment of the credible maximum climate change scenario is to understand the sensitivity of the Proposed Development and inform the approach to climate change adaptation over its lifetime.

3.63. Paragraph 4.10.11 of the Overarching NPS for Energy (EN-1) identifies the need to demonstrate how proposals can be adapted over their predicted lifetimes to remain resilient to a credible maximum climate change scenario.

3.64. Paragraph 4.10.12 of the Overarching NPS for Energy (EN-1) states:

> **'Where energy infrastructure has safety critical elements, the applicant should apply a credible maximum climate change scenario. It is appropriate to take a risk-averse approach with elements of infrastructure which are critical to the safety of its operation.'**

3.65. The EA's climate change guidance[18] recommends this is a 'sensitivity test' and goes on to recommend an 'adaptative approach' to allow for additional or revised mitigation measures over the lifetime of the development. In relation to the 'adaptive approach' the guidance[19] notes that *'some measures to manage flood risk are not necessary now but may be in the future'*.

3.66. With respect to climate change adaptation Overarching NPS for Energy (EN-1) paragraph 4.10.15 notes that in respect to the design of new energy infrastructure critical to its operation necessary action can be taken to ensure the operation of the infrastructure over its estimated lifetime to adapt to '*more radical changes to the climate'* (the credible maximum climate change scenario).

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[16] EA (2022) Guidance: Flood risk assessments: climate change allowances. Available from: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (accessed on 25.05.23).
[17] EA (2022) Guidance: Flood risk assessments: climate change allowances. Available from: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (accessed on 25.05.23).
[18] EA (2022) Guidance: Flood risk assessments: climate change allowances. Available from: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (accessed on 25.05.23).
[19] EA (2022) Guidance: Flood risk assessments: climate change allowances. Available from: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (accessed on 25.05.23).

3.67. In addition, Overarching NPS for Energy (EN-1) paragraph 4.10.16 notes:

> **'If any adaptation measures give rise to consequential impacts (for example on flooding, water resources or coastal change) the Secretary of State should consider the impact of the latter in relation to the application as a whole …'**

3.68. Furthermore, in respect to adaptation measures Overarching NPS for Energy (EN-1) paragraph 4.10.19 goes on to state:

> **'Adaptation measures should be required to be implemented at the time of construction where necessary and appropriate to do so. However, where they are necessary to deal with the impact of climate change, and that measure would have an adverse effect on other aspects of the project and/or surrounding environment (for example coastal processes), the Secretary of State may consider requiring the applicant to keep the need for the adaptation measure under review, and ensure that the measure could be implemented should the need arise, rather than at the outset of the development (for example increasing height of existing, or requiring new, sea walls).'**

3.69. The tidal and fluvial flood risk credible maximum climate change scenario sensitivity tests applicable over the 40-year operational lifespan for the Proposed Development for are discussed in the sections below.

3.70. The approach to adaptation in the credible maximum climate change scenario is considered in the Flood Risk Mitigation Measures section of the report.

Peak River Flow Allowance

3.71. Peak river flow allowances are based on management catchments rather than river basin districts, and the appropriate allowance to use depends on the flood zone and the flood risk vulnerability classification of the development.

3.72. The higher central allowance should be used for essential infrastructure in Flood Zone 3a. The 2050s epoch covers the period 2040 to 2069 which covers the modelled operational lifespan of the Proposed Development.

3.73. The Site lies across two management catchments, the Aire and Calder Management Catchment to the south and the Wharfe and Lower Ouse Management Catchment to the north. The Proposed Development falls into the 'Essential Infrastructure' flood risk vulnerability classification. Based on the flood zone and flood risk vulnerability classification of the development, the higher central allowance needs to be used when assessing peak river flows.

3.74. The high central allowance should be used to assess safe access, escape routes and places of refuge; off-site impacts; and calculate floodplain storage compensation for essential infrastructure.

3.75. The upper end allowance should be used when assessing the 'credible maximum scenario' sensitivity test (as discussed above).

3.76. **Table A** below summarises the different peak river flow allowances for the different Management Catchments.

Table A: Summary of Peak River Flow Allowances

Management Catchment	Higher Central 'Design Flood'	Upper End 'Sensitivity Test'
	2050s Epoch	2050s Epoch
Wharfe and Lower Ouse (Northern area of the Site)	18%	29%
Aire and Calder (Southern area of the Site)	18%	31%

Note: 2050s Epoch = 2040-2069

3.77. The operational lifespan of the Proposed Development extends until 2069 with decommissioning being concluded in 2070. The decommissioning period only extends one year into the 2080s epoch (2070 – 2125). The 2080s epoch is not appropriate to assess for the 'Design Flood' for the operational lifespan of the development. It is proposed to use the 2050s epoch Upper End 'Sensitivity Test' as a precautionary assessment of the potential fluvial flood risk at the end of the decommissioning period.

Peak Rainfall Intensity Allowances

3.78. With respect to the peak rainfall intensity allowance, once again the Site lies across the two management catchments; the Aire and Calder Management Catchment to the south and the Wharfe and Lower Ouse Management Catchment to the north.

3.79. The EA's climate change guidance[20] states:

> **'For flood risk assessments and strategic flood risk assessments assess the upper end allowances. You must do this for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 to 2125).**
>
> **Design your development so that for the upper end allowance in the 1% annual exceedance probability event:**
>
> - **there is no increase in flood risk elsewhere**
> - **your development will be safe from surface water flooding'**

3.80. The EA's climate change guidance[21] states:

> **'For development with a lifetime between 2061 and 2100 take the same approach but use the central allowance for the 2070s epoch (2061 to 2125).'**

3.81. The total potential change anticipated for 2070s epoch (2061 to 2125) is +30% for the central allowance in the 1% AEP rainfall event in both management catchments.

Sea Level Allowances

3.82. For sea level allowances, Table 1 of 'Flood risk assessments: climate change allowances' gives a range of allowances for each river basin district and epoch for sea level rise. Table 2 gives the offshore wind speed and extreme wave height allowances.

[20] EA (2022) Guidance: Flood risk assessments: climate change allowances. Available from: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (accessed on 25.05.23).

[21] EA (2022) Guidance: Flood risk assessments: climate change allowances. Available from: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (accessed on 25.05.23).

3.83. The Site lies within the Humber river basin district and as such the 'Humber' sea level rise allowances apply. For flood risk assessments it is necessary to assess both the higher central and upper end allowances. Table 1 of the guidance is replicated below as **Table B**.

Table B: Sea Level Allowances for Humber River Basin District for each epoch in mm for each year (based on a 1981 to 2000 baseline) – the total sea level rise for each epoch is in brackets

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Humber	Higher central	5.5 (193)	8.4 (252)	11.1 (333)	12.4 (372)	1.15
Humber	Upper end	6.7 (235)	11.0 (330)	15.3 (459)	17.6 (528)	1.55

3.84. The cumulative rise from 2000 to the end of 2070 will be between +0.501m (Higher Central) and +0.642m (Upper end) which covers the 40-year modelled operational lifespan of the development.

3.85. The guidance states that where it is appropriate to apply a credible maximum scenario, use the H++ allowance. For the change to relative mean sea level use the H++ scenario of 1.9m for the total sea level rise to 2100. It is appropriate to utilise a scaled H++ scenario to cover the finite 40 year modelled operational lifespan of the development.

3.86. The H++ scenario is derived from UKCP09 and the UKCP18 Factsheet: Sea level rise and storm surge[22] co-published by the EA in 2018 notes the H++ scenario is still a reasonable plausible high-end scenario based on our current interpretation of the evidence. The EA's guidance entitled 'adapting to climate change: advice for flood and coastal erosion risk management authorities'[23] (dated 2016) reproduces H++ scenario sea level rise allowances based on UKCP09. This information (Table 5) is reproduced in **Table C** below.

Table C: H++ Scenario Sea Level Allowance (compared to 1990 baseline, includes land movements)

Change to relative mean sea level	Sea level rise (mm/yr)				
	1990 to 2025	2026 to 2050	2051 to 2080	2081 to 2125	Cumulative rise 1990 to 2100 (metres)
H++ scenario	6	12.5	24	33	1.9

3.87. Based on **Table C**, the H++ Scenario sea level allowance up to 2070 would be +1002.5mm / +1.0m compared with 1990 levels.

[22] Met Office, EA, DEFRA & DBEIS (2018) UKCP18 Factsheet: Sea level rise and storm surge.
[23] EA (2016) Adapting to climate change: advice for flood and coastal erosion risk management authorities.

3.88. The Humber Extreme Water Levels[24] ('HEWL') (2020) strategic flood model was produced by the EA to inform wider flood risk management work around the Humber estuary and on its tidal tributaries. The HEWL dataset includes an assessment of the H++ Scenario between the years 2021 – 2121. The outputs of the HEWL allow for a scaled H++ Scenario up to 2070 to be accounted for in the site-specific flood model. The site-specific flood model and associated outputs are discussed in more detail in the sections below.

3.89. The EA guidance also covers offshore wind speed and extreme wave height. Wave heights may change because of increased water depths and changes to the frequency, duration and severity of storms. The guidance states:

> **'If your development lifetime is beyond 2056, use the allowance for the 2056 to 2125 epoch. The allowances are not cumulative across the epochs.'**
>
> **'Use the sensitivity test allowances in addition to the offshore wind speed and extreme wave height allowances for assessments where it is appropriate to apply a credible maximum scenario.'**

3.90. The offshore wind speed and extreme wave height allowance allowances are summarised in **Table D** below.

Table D: Offshore Wind Speed and Extreme Wave Height Allowance (based on a 1990 baseline)

Applies all around the English coast	2056 to 2125
Offshore wind speed allowance	10%
Offshore wind speed sensitivity test	10%
Extreme wave height allowance	10%
Extreme wave height sensitivity test	10%

Standard of Protection

3.91. In terms of providing an acceptable standard of protection against flooding for new development, where development is necessary in flood risk areas the development should be made safe for its lifetime without increasing flood risk elsewhere. The site-specific FRA checklist makes reference to the assessment of the 'design flood'.

3.92. Paragraph 2 in the Flood Risk and Coastal Change PPG defines a "design flood" as follows:

> **'This is a flood event of a given annual probability, which is generally taken as:**
>
> - **river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or**
> - **tidal flooding with a 0.5% annual probability (1 in 200 chance each year); or**
> - **surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year),**
>
> **plus an appropriate allowance for climate change.'**

[24] Jacobs (2020) Humber 2100+ Extreme Water Levels.

3.93. Therefore, in terms of providing an acceptable standard of protection against flooding for new development, the development should be appropriately safe without increasing flood risk elsewhere in the 'design flood'.

3.94. The Government published its 'Non-statutory technical standards for sustainable drainage systems'[25] in March 2015. They should be used in conjunction with the NPPF and planning practice guidance. Standard S7 states that the drainage system must be designed so that flooding does not occur on any part of the Site for a 1 in 30 year rainfall event. Standard S8 goes on to state that the drainage system must be designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building (including a basement); or in any utility plant susceptible to water within the development.

[25] DEFRA (2015) Non-statutory technical standards for sustainable drainage systems

4. FLOOD RISK ASSESSMENT

4.1. In addition to flooding from rivers and the sea it is also necessary to consider the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

Sources of Information

4.2. A Level 1 SFRA was produced by AECOM Limited on behalf of Selby District Council in August 2022. This provides an overview of flood risk from all sources including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

4.3. The Government's GOV.UK website contains 'Long Term Flood Risk Information'[26] which includes interactive maps showing 'Flood risk from rivers or the sea' and 'Flood risk from surface water'. These maps show the chance of flooding in one of four risk categories: High risk means that each year this area has a chance of flooding of greater than 3.3% (1 in 30); Medium risk between 1% and 3.3% (1 in 100 and 1 in 30); Low risk between 0.1% and 1% (1 in 1000 and 1 in 100); and Very low-risk less than 0.1% (1 in 1000). The 'Flood risk from surface water' map indicates the extent, depth and velocity of water for High, Medium and Low risk scenarios. The Long Term Flood Risk Information also includes a 'Flood risk from reservoirs' map.

4.4. Enquiries have been made to the EA to obtain: the detailed Flood Map of the area; the latest available modelled flood levels for the watercourses in the vicinity of the Site; the modelled flood extents; flood defence locations; details of historic flood events; and local flood history data from all sources of flooding. A copy of the initial EA consultation response is contained in **Appendix 7**.

Baseline Site Specific Flood Risk

Flooding from Watercourses and Tidal Sources

4.5. The tidal estuary and the rivers flowing into it, including the Rivers Aire and Ouse, are the primary sources of flood risk in the vicinity of the Site.

4.6. The effect of a high astronomical tide combined with a fluvial event and or storm surge could pose a flood risk to the surrounding land resulting in exceedance of the capacity of the channel of the River Ouse and Rive Aire and overtopping of flood defences.

4.7. Accordingly, the Level 1 SFRA states:

> **'The main source of fluvial flood risk in the District arises from the tributaries of the Rivers Aire and Ouse, in the southeast of the District around the areas of Burn, Camblesforth and Drax. The majority of these areas are defined as Flood Zone 3a, though they are also areas which have been identified as benefitting from flood defences.'**

Flood Zones

4.8. As stated in paragraphs 2.20 - 2.22 of this FRA, the majority of the Site falls within Flood Zone 3a with smaller areas of Flood Zone 2 and Flood Zone 1. The EA's Flood Zones do not take into account the presence of flood defences.

[26] EA (2023) Check your long term flood risk. Available from: https://check-long-term-flood-risk.service.gov.uk/map (accessed on 25.05.23)

Flood Defences

4.9. The Asset Map contained in **Appendix 7** shows the location of flood defences on the River Aire and River Ouse in the vicinity of the Site. Inspection of this plan indicates the presence of embankments along the northern bank of the River Aire and southern bank of the River Ouse which would provide some protection to the Site.

4.10. With respect to flood defences the Level 1 SFRA states:

> **'The flood defences around the River Aire benefit the areas to the north of the river, from Birkin eastwards towards Burn, Camblesforth and Newland, close to the boundary of the District. The flood defences around the River Ouse benefit areas south of the river, along the upper Humber Estuary from Drax, northwest to Wistow.'**

4.11. The EA has published its Spatial Flood defences layer as open data. An extract from this dataset showing the design standard of protection ('SoP') for the flood defences in the vicinity of the Site is shown on Drawing No. E216/84 Rev C contained in **Appendix 8**. A design SoP has not been attributed to the flood defences along the River Ouse; the design SoP for the embankments along the River Aire are predominately 1 in 50 on the land south of the Site increasing to 1 in 200 on land to the east near Newland.

4.12. The EA conducts regular inspections of the flood defences that it is responsible for maintaining (typically every six months). The EA attribute a grade to assess the flood defence condition as follows:

- 1: Very Good –Cosmetic defects that will have no effect on performance
- 2: Good – Minor defects that will not reduce the overall performance of the asset
- 3: Fair – Defects that could reduce the performance of the asset.
- 4: Poor – Defects that would significantly reduce the performance of the asset. Further investigation required.
- 5: Very Poor - Severe defects resulting in complete performance failure.

4.13. The EA's flood risk information request consultation response contained in **Appendix 7** states that its aim is to improve all assets below '3: Fair' to an acceptable standard.

4.14. Review of the EA's Spatial Flood defences layer indicates that the current condition of the flood defences along the southern bank of the River Ouse, to the north of the Site, range between '2: Good' and '4: Poor'. The current condition of the flood defences along the northern bank of the River Aire, to the south of the Site, range between '2: Good' and '3: Fair' although large sections have not been attributed a condition grade.

4.15. The presence of the embankments along the River Aire and River Ouse disconnect the rivers from their natural floodplain. The Ouse Catchment Flood Management Plan[27] ('CFMP') was published by the EA in December 2010. The CFMP is a strategic planning document providing an overview of the main sources of flood risk (inland flooding, from rivers, ground water, surface water and tidal flooding) and how they can be managed over the next 50 – 100 years. The Site falls into 'Sub-area 6: Tidal Ouse and Wharfe' of the River Ouse CFMP. It is noted that flooding comes from both fluvial/tidal combinations and surface water and that extensive defences and pumping are used to reduce the risk of flooding in this area.

[27] EA (2010) Ouse Catchment Flood Management Plan Summary Report December 2010.

4.16. Policy Option 4 from the River Ouse CFMP has been selected as the most appropriate approach to managing flood risk for Sub-area 6 where the Site is located. Policy Option 4: 'take action to sustain the current scale of flood risk to the future' states:

> **'Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.**
>
> **This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.'**

4.17. The CFMP notes the need to locally upgrade current defences and review the pumping regime to keep pace with future increases in fluvial flows.

4.18. The Aire Catchment Flood Management plan[28] was also published by the EA in December 2010. The relevant catchment area of the River Aire CFMP is Sub-area 8: Lower Aire. This section states that the sources of flooding are the River Aire, the Aire and Calder Navigation and tidal influences of the Humber Estuary in addition to surface water and sewers.

4.19. The selected policy for the Lower Aire sub-area within the River Aire CFMP is Policy 6: 'take action with others to store water or manage runoff in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment' and states:

> **'Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.**
>
> **This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.'**

4.20. The use of the washlands as flood storage areas is important within the River Aire Catchment. Flood defences maintained by the EA are present in the vicinity of the Site on both the River Ouse and River Aire. The flood defences provide a level of protection which could be overwhelmed in the design flood and actions are required to ensure the standard of protection can be maintained to mitigate the effect of climate change. Having regard to the policies contained in the CFMPs, the strategic flood defences are likely to be maintained and improved over the 40 year operational lifetime of the Proposed Development.

[28] EA (2010) Aire Catchment Flood Management Plan Summary Report December 2010

Strategic Flood Models

4.21. The EA has provided details of three strategic flood models for the vicinity of the Site. These are the 2016 Upper Humber Study[29], 2017 Lower Aire Model[30] and 2020 Humber Extreme Water Levels[31] ('HEWL') dataset.

4.22. The area of assessment covered by the 2017 Lower Aire Model[32] extends to the railway line in the vicinity of Temple Hirst. This is upstream of the Proposed Development and as such model outputs are not relevant to this assessment.

4.23. The 2016 Upper Humber Study[33] was published by JBA Consulting in July 2018 on behalf of the EA. The model includes the upper Humber Estuary and its major tributaries where flood risk is influenced by fluvial and tidal conditions and considers both defended and undefended conditions and a joint probability assessment. The tributaries models include the Rivers Ouse, Aire, Don and Trent and the model extents extend to the railway bridges in Selby and Temple Hirst. The combined upstream catchments of these watercourses is approximately 14% of mainland England. The 2016 Upper Humber Study is therefore the most relevant strategic flood model.

4.24. The Upper Humber Study identified that the tidally influenced reaches are located downstream of Goole and the fluvial dominated reaches are upstream of Selby. The reaches of the River Aire and River Ouse in the vicinity of the Site are at most at risk from a combined fluvial and tidal event. As such the implications of joint probability need to be considered.

4.25. The Upper Humber Study identified that the impact of climate change increasing flows and tidal levels (sea level rise) will increase flood extents across the wider floodplain.

4.26. The Humber Extreme Water Levels[34] ('HEWL') (2020) is the third EA strategic flood model in the vicinity of the Site. The HEWL provides additional assessment of the joint probability of tidal and fluvial conditions and maximum water levels are produced at identified locations. It should be noted that the HEWL model is 1D only so that no maximum flood extents are available from the modelling outputs. As such the Level 1 SFRA states:

> **'Downstream of Temple Hirst rail bridge and the Selby A63 road bridge the Upper Humber (2016) should be used in the Selby LLFA at present to define flood extents.'**

4.27. **Table E** below compares the climate change allowances in the Upper Humber Study strategic flood model to the latest EA climate change allowances. It should be noted that the joint probability assessment contained in the Upper Humber Study strategic flood model did not allow for climate change on the tidal or fluvial elements.

[29] JBA Consulting (2018) Upper Humber Flood Risk Mapping Study Final Report
[30] JBA Consulting (2017) Northern Forecasting Package: Lower Aire Model Final Report V1.0
[31] Jacobs (2020) Humber 2100+ Extreme Water Levels.
[32] JBA Consulting (2017) Northern Forecasting Package: Lower Aire Model Final Report V1.0
[33] JBA Consulting (2018) Upper Humber Flood Risk Mapping Study Final Report
[34] Jacobs (2020) Humber 2100+ Extreme Water Levels.

Table E: Comparison of Climate Change Allowances

Climate Change Scenario	Site-Specific Flood Model		Upper Humber Study
	Design Flood	Credible Maximum Scenario Sensitivity Test	
Peak River Flow Wharfe and Lower Ouse (Northern area of the Site)	+18%	+29%	20%
Peak River Flow Aire and Calder (Southern area of the Site)	+18%	+30%	
Sea Level Rise	+0.501m (Higher Central) +0.642m (Upper end)	Approx. +1.00m	+0.610m

Notes: Assumed the 40 year modelled operational lifespan (including consenting, construction, operation and decommissioning) extends to 2069/70 as a precaution.

4.28. Inspection of **Table E** above shows that the climate change allowances in the Upper Humber Study differ from those that require assessment under the current EA guidance.

4.29. To comprehensively assess the latest climate change allowances (including the Credible Maximum Scenario Sensitivity Test) and improve the assessment of flood risk of the Site from the effect of floodwaters overtopping flood defences and floodwaters spilling onto the floodplain, a site-specific flood model has been produced combining the three EA strategic flood models. The outputs from the Upper Humber Study strategic flood model would be the most relevant strategic flood model to utilise to compare with the results of the site-specific flood model.

Site-Specific Flood Model

4.30. The site-specific flood modelling has been conducted by Aegaea. The project team has engaged with the EA over the course of the project. The EA concluded their 'non-real time hydraulic model review' of the site-specific flood model in July 2024 and the site-specific flood model has been approved. The summary of the development of the site-specific flood model is set out below.

4.31. The scope of the site-specific flood model was updated to take account of comments received from the EA in its response dated 16th May 2023 which are set out in the JBA 'Method Statement Review'. A copy of the 'Revised Scoping Document' prepared by Aegaea and 'Method Statement Review' prepared by JBA are contained in **Appendix 9**.

4.32. Following initial EA feedback in 2023 the site-specific flood model was progressed by Aegaea and submitted to the EA for review in January 2024. The EA provided its first set of 'non-real time hydraulic model review' comments in April 2024. Virtual meetings were held with the EA on 13th March 2024 and 19th April 2024 with follow up email dialogue. The site-specific flood model was amended to address the 'non-real time hydraulic model review' comments and matters raised as part of the engagement. The site-specific flood model was resubmitted to the EA for review in June 2024. This FRA is based on the June 2024 site-specific flood model which was approved by the EA in July 2024. Details of the June 2024 site-specific flood model are set out in the 'Hydraulic Model Technical Note' contained in **Appendix 10**. The results from the EA approved site-specific flood model are discussed in the sections below.

4.33. The results of the EA approved site-specific flood model will inform the detailed design of the design flood risk mitigation measures based on the principles set out in the sections below.

Undefended Scenario

4.34. Due to the low-lying nature of the Site and tidal levels, large areas of the surrounding land, including the majority of the Site, would be affected in undefended flood scenarios.

4.35. It is considered that the undefended scenario is unlikely to be a true representation of residual risk having regard to the EA's ongoing responsibility for maintaining flood defences over the 40 year modelled operational lifespan of the Proposed Development.

4.36. In the response to the preliminary scope for the site-specific flood model prepared by Aegaea, JBA Consulting's response on behalf of the EA contained in Appendix 9 agreed with this approach stating '*it is exceptionally unlikely that all flood defences along the subject rivers would fail simultaneously*'.

4.37. This assessment therefore focuses on the defended scenario which is considered to be representative of the flood risk to the Site. The residual risk of defence failure is assessed in the sections below.

4.38. Although the combined effect of fluvial and tidal sources is the predominate flood hazard to the Site it is important to consider the effects of either a dominate tidal or dominate fluvial scenario to more comprehensively understand the flood mechanisms and the sensitivity of the Site to the different flood sources.

Defended Tidal

4.39. The risk of a tidal storm surge increasing water levels and resulting in overtopping of flood defences has been assessed as part of the site-specific flood model. The flood extents and depths behind the raised defences is determined by the volume of water overtopping the defences.

4.40. The site-specific model considered the 0.5% AEP plus higher central climate change scenario (1 in 200 RP) tidal flood event. This is considered the tidal 'design flood' and modelled flood depths are presented on Drawing No. E216/150 contained in **Appendix 11**.

4.41. The site-specific model considered the 0.5% AEP plus H++ climate change (scaled to 2070) scenario (1 in 200 RP) tidal flood event. This is considered the tidal 'credible maximum scenario sensitivity test' and modelled flood depths are presented on Drawing No. E216/151 contained in **Appendix 12**.

4.42. Both tidal model runs discussed above include an allowance for 3.33% AEP (1 in 30 RP) fluvial inflows to account for the joint probability of a extreme high tide coinciding with elevate fluvial flows.

4.43. Inspection of Drawing No. E216/150 and Drawing No. E216/151 show that the Site is unaffected by tidally dominated flooding in both scenarios. The flood extents are restricted to the areas behind the flood defences on the River Ouse and River Aire in both events.

4.44. The outputs from the site-specific flood modelling are consistent with the 0.5% AEP plus climate change (1 in 200 RP) tidal flood event outputs contained in the 2016 Upper Humber Study EA strategic flood model.

4.45. On the basis of the site-specific flood modelling the Site is at 'very low' risk of flooding from tidal sources in both the 'design flood' and 'credible maximum scenario sensitivity test' taking into account the presence of flood defences along the River Aire and River Ouse.

Defended Fluvial

4.46. The River Aire and River Ouse have large upstream catchments which extend as far as the Yorkshire Dales. High peak river flows as a result of rainfall over the wider upstream hydrological catchment can result in overtopping of flood defences and has been assessed as part of the site-specific flood model.

4.47. The site-specific model considered the 3.33% AEP (1 in 30 RP) fluvial flood event. This can be used to update the extents of the functional floodplain within the vicinity of the Site and the modelled flood depths are presented on Drawing No. E216/152 contained in **Appendix 13**. Inspection of Drawing No. E216/152 show the Site is unaffected by the fluvial functional floodplain. The fluvial functional floodplain is restricted to the areas behind the flood defences on the River Aire broadly extending to Hirst Road approximately 0.38km to the south of the Site. In addition, the fluvial functional floodplain is restricted to the areas behind the flood defences on the River Ouse on land north of the village of Barlow approximately 1.5km to the north of the Site.

4.48. The site-specific model considered the 1% AEP plus higher central climate change (1 in 100 RP) fluvial flood event. This is considered the fluvial 'design flood' and modelled flood depths are presented on Drawing No. E216/153 contained in **Appendix 14**.

4.49. Inspection of Drawing No. E216/153 shows that the majority of the Site is flood free during the fluvial 'design flood'. The flood defences along the River Ouse to the north are overtopped but the flood extents are restricted to the areas behind the flood defences on the River Ouse on land north of the village of Barlow approximately 1.5km to the north of the Site and do not affect the Site. Southern areas of the Site are affected from overtopping of flood defences along the River Aire and flood waters spreading out over the low-lying areas crossing both Hirst Road and railway line to the east of the Site which serves Drax Power Station affecting Field Numbers 35 – 43 north of Moss Green Lane and at the southern extent of Brick Lands Lane. The Field Numbers are set out in the plan contained in **Appendix 2**. The modelled flood depths across large areas are predominately shallow and less than 0.1m with areas of greater depth up to 0.3m deep affecting the low-lying areas in these parcels. Areas of greater flood depths are limited to low spots associated with the channels of onsite ordinary watercourses.

4.50. The site-specific model considered the 1% AEP plus upper end climate change (1 in 100 RP) fluvial flood event. This is considered the fluvial 'credible maximum scenario sensitivity test' and modelled flood depths are presented on Drawing No. E216/154 contained in **Appendix 15**.

4.51. Inspection of Drawing No. E216/154 shows that extensive areas of the Site are affected by flooding in the fluvial 'credible maximum scenario sensitivity test' as a result of flood waters overtopping of flood defences along the River Aire and flood waters spreading out over the low lying areas. Due to the large size of the upstream catchment, the flood hydrograph is likely to be prolonged resulting in a significant volume of flood water overtopping flood defences. The flood extents and depths behind the raised defences are determined by the volume of water overtopping the defences and the capacity of the floodplain. The flood defences along the River Ouse to the north are overtopped but the flood extents are restricted to the areas behind the flood defences on the River Ouse on land north of the village of Barlow approximately 1.5km to the north of the Site and do not affect the Site.

4.52. During the fluvial 'credible maximum scenario sensitivity test' areas of the Site are affected from overtopping of flood defences along the River Aire and flood waters spreading out over the low-lying areas crossing both Hirst Road and the railway line to the east of the Site which serves Drax Power Station. The flood depths and extent vary across the Site. The Solar Farm Zone on land to the east of Hagg Bush Lane and west of the Bales Wood is shown to be flood free (Field Numbers 1-9). The flood depths in the central southern area and central northern area of the Solar Farm Zone are predominately <0.6m deep (Field Numbers 10 - 16, 34 - 41 and 44). Localised deeper areas of flooding are identified associated with isolated low spots and the channels of onsite ordinary watercourses. Areas of deeper flooding are identified on the eastern area of the Solar Farm Zone to the southwest of Camblesforth and Selby Road (Field Numbers 20 – 25) and adjacent to Stockwith Lane (Field Numbers 42 – 43). Flood depths in this area are predominately <1.1m with areas of deeper flooding up to 1.4m deep in the low-lying areas on the eastern boundary. Areas of deeper flooding in the eastern area of the Solar Farm Zone are associated with isolated low spots and the channels of onsite ordinary watercourses.

4.53. During the fluvial 'credible maximum scenario sensitivity test' Field Number 29 where the Substation and BESS Compound would be located would be affected. The southern area of the Field 29 the flood depths are predominately <0.3m with areas of deeper flooding predominately <0.7m in the low-lying northeastern area of Field Number 29. Areas of deeper flooding associated with isolated low spots and the channels of onsite ordinary watercourses are also present in Field Number 29.

4.54. The fluvial 'credible maximum scenario sensitivity test' indicates that the flood defences along the River Aire are vulnerable to overtopping as a result of the effects of climate change increasing peak flows. This is consistent with the lower SoP provided by the flood defences along the River Aire on the land to the south of the Site.

4.55. Both fluvial model runs discussed above include an allowance for a 50% AEP (1 in 2 RP) tidal boundary to account for the joint probability of a extreme fluvial flows coinciding with a high tide.

4.56. On the Site the outputs from the 'credible maximum scenario sensitivity test' site-specific flood modelling are consistent with the 1% AEP plus climate change (1 in 100 RP) fluvial flood event outputs contained in the 2016 Upper Humber Study EA strategic flood model. The areas around the site show additional areas of the floodplain are utilised compared with the 2016 Upper Humber Study EA strategic flood model. The 'Hydraulic Model Technical Note' contained in Appendix 10 attributes these changes '*to the combination of events used for joint probability modelling, as well as the application of sub grid sampling and updated LiDAR'*.

4.57. On the basis of the site-specific flood modelling the Site is at predominately 'very low' risk of flooding from fluvial sources in the 'design flood' with the southern areas north of Moss Green Lane and at the southern extent of Brick Lands Lane affected by shallow flooding (typically <0.3m). The Site is vulnerable to increased flood depths and extents during the 'credible maximum scenario sensitivity test' as a result of increased peak flows increasing the volume of floodwaters overtopping flood defences along the River Aire which would spread out across the low-lying areas behind the flood defences.

Defended Joint Probability Tidal and Fluvial

4.58. Due to the Site position at the confluence of the River Aire and River Ouse and the vicinity of the River Don, River Trent and wider Humber Estuary it is necessary to consider the combined effect of tidal and fluvial flooding at the location of the Site (or the joint probability).

4.59. Due to the size of the respective watercourse catchments the joint probability of all the watercourses in the vicinity of the Site (River Aire, Ouse, Don and Trent) being affected by the 1% AEP flood event simultaneously at the location of the Site is considered to be incredibly unlikely and not representative of a 1% AEP joint probability fluvial flood scenario at the Site.

4.60. To assess joint probability the appropriate boundary and inflow conditions are utilised in the fluvial and tidal model runs as part of the site-specific flood modelling. For example, the 1% AEP (1 in 100 RP) flood event has been assessed on both the River Ouse and River Aire with a 50% AEP (1 in 2 RP) tidal boundary. Whereas in the tidally dominated situation the 0.5% AEP (1 in 200 RP) allows for 3.33% AEP (1 in 30 RP) fluvial inflows. Both the fluvial flows and tidal boundaries include an appropriate climate change allowance on the effect on peak flows and sea level rise over the lifespan of the Proposed Development.

4.61. It is considered that the assessment of joint probability of fluvial and tidal flood events occurring at the same time is assessed by the site-specific flood model through the appropriate tidal boundary and fluvial inflow conditions (including applying the appropriate climate change allowance).

Breach Event

4.62. There is a risk of a flood event occurring as a result of the structural failure of a raised flood defence. The flow and extent of flooding from a breach event is determined by the head gradient, flood mechanism (tidal cycle) and response (emergency repair).

4.63. The EA's Upper Humber Study contained an assessment of the breach of flood defences. The effect of a 50m breach width for earth embankments and 20m for hard defences over a 72-hour period for the 1% AEP (1 in 100 RP) fluvially dominated water levels and 0.5% (1 in 200 RP) tidally dominated levels was assessed. The Upper Humber Study breach locations 3 and 4 are located on the River Ouse to the north of the Site and the flood extents do not affect the Site.

4.64. Additional breach modelling was conducted on the Upper Humber strategic flood model by JBA Consulting on behalf of the EA published in April 2017[35]. A further 18 locations were considered. Breaches A – C are located in the vicinity of the Site however, the flood extents do not affect the Site.

4.65. No breach events along the River Aire were assessed as part of the Upper Humber Study.

4.66. The Upper Humber Study indicates that during a breach event along the River Ouse the flood extents are localised and restricted to the areas around the breaches. Due to the distance from the Site to the River Ouse it is concluded that the effect of breaches of flood defences on the River Ouse on the Site would be negligible and does not require further assessment.

4.67. It should be noted that the Level 1 SFRA includes additional breach analysis during the 1%+CC (1 in 100 RP) event. Breach 3 in Selby results in a small flood extent extending onto the northern area of the Solar Farm Zone south of Common Lane along the Common Drain. No details of the modelling methodology are provided in the Level 1 SFRA and the extensive areas of flooding suggest it is more precautionary than the assumptions made in the Upper Humber Study.

[35] JBA Consulting (2017) Upper Humber – Additional Breach Modelling.

4.68. Due to the requirement to assess the sensitivity of the Proposed Development to the 'credible maximum scenario' the need for supplementary breach analysis within the site-specific flood modelling is not considered to be required to establish the residual risk to the Site. As discussed above, during the fluvial 'credible maximum scenario sensitivity test' the Site is affected by flooding. The effect of breaches of flood defences along the River Aire in this scenario are likely to be minimised as the flood defences are already overtopped. The effect of a breach increasing the volume of floodwaters spilling onto the floodplain is likely to be minimal in the context of the overtopping volume that would occur during the fluvial 'credible maximum scenario sensitivity test'.

4.69. In addition, the breach analysis contained in the EA Upper Humber Study indicate the Site is not vulnerable to breaches of the flood defences on the River Ouse due to its remoteness from the flood defences.

4.70. Due to the EA's maintenance regime for the flood defences in the vicinity of the Site, the risk of flood defence failure should be minimised and the effect of a breach should be considered a residual risk to the Site.

4.71. By assessing the fluvial 'credible maximum scenario sensitivity test' the need for supplementary breach analysis is not considered required as the effect of any breach would in all likelihood by less than the effect of the fluvial 'credible maximum scenario sensitivity test' on the Site.

Summary of Pre-Development Baseline Flooding from Watercourses and Tidal Sources

4.72. The pre-development baseline risk of flooding from fluvial and tidal sources ranges between 'high' and 'very low' on the Site. Flood defences along the River Aire are overtopped once the effects of climate change on peak river flows are taken into account. Floodwaters spread out over the floodplain and flood depths and extent vary across the Site during the fluvial 'design flood'. The extent and depth of flooding increases on the Site when the fluvial credible maximum climate change scenario 'sensitivity test' is taken into account on peak flows in the River Aire and River Ouse.

Flooding from Surface Water

4.73. The GOV.UK's Flood risk from surface water map indicates where surface water may be expected to flood or pond. Surface water flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead. The GOV.UK website advises that flooding from surface water is difficult to predict as rainfall location and volumes are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding. The information shown is a general indicator of an area's flood risk. A copy of the GOV.UK's Flood risk from surface water map is reproduced in **Figure 14** below.

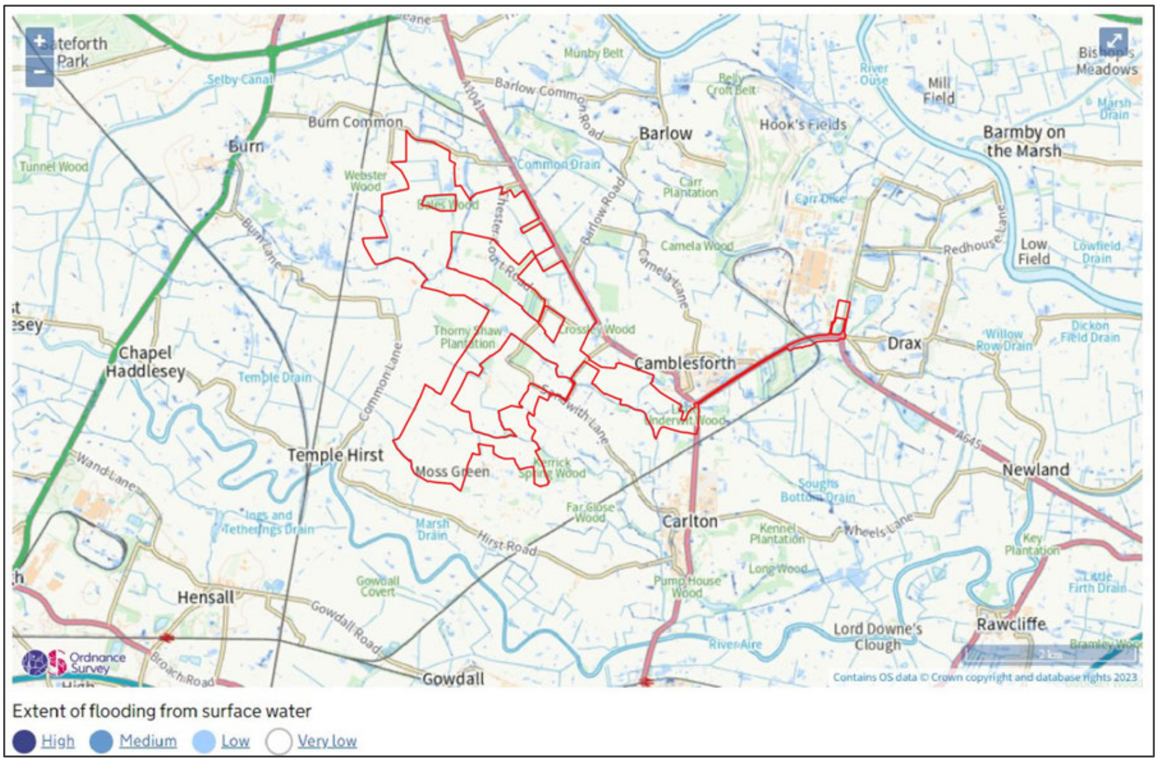


Figure 14: Flood Risk from Surface Water Map

4.74. The GOV.UK's Flood risk from surface water map shows that the majority of the Site is at 'very low' risk (less than 0.1%). Smaller isolated areas of 'low' risk (between 0.1% and 1%), 'medium' risk (between 1% and 3.3%) and 'high' risk (greater than 3.3%) are present. The areas of elevated surface water flooding are associated with low points on the Site where surface water runoff could collect and routes of ordinary watercourses.

4.75. The extent of the low-risk surface water flood event is shown on Drawing No. E216/02 Rev C contained in **Appendix 16**. The flood depths over 600mm deep are restricted to the channels of onsite watercourses. Areas of flooding with depths below 600mm are located at isolated areas throughout the Site. These are associated with lower lying areas of topography. Modelled velocities in the low-risk event in the isolated areas are less 0.25 m/s indicating the surface water flooding is associated with surface waters collecting rather than an overland flow route. Areas with modelled velocities over 0.25 m/s are associated with the routes of ordinary watercourses.

Summary of Pre-Development Baseline Flooding from Surface Water

4.76. The pre-development baseline risk of flooding from surface water is assessed as predominately 'very low' with areas of elevated risk associated with isolated low points and the route of onsite ordinary watercourses where surface water could collect.

Flooding from Groundwater

4.77. Groundwater flooding is most likely to occur in low-lying areas underlain by water-bearing permeable rocks termed aquifers. These may be extensive regional aquifers in chalk or sandstone, or localised sands or river gravels in valley bottoms underlain by less permeable rock. Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas, the water table is usually at shallower depths, so that during very wet periods, the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding which may follow overland flow paths or pond at local topographic depressions. The rate of groundwater emergence depends upon the pressure head on the groundwater body, and the permeability of soils and near surface geology which can be locally variable.

4.78. The Selby District Level 1 SFRA uses the EA's dataset 'Areas Susceptible to Groundwater Flooding' ('AStGWF') which indicates where groundwater may emerge due to geological and hydrogeological conditions. This information is shown as a proportion of 1km grid squares where there is potential for groundwater emergence. The mapping shows that the Site covers a range of groundwater flooding susceptibilities.

4.79. The areas of elevated risk are associated with the areas of the Site where superficial and bedrock aquifers are present. The general pattern for the majority of the Solar Farm Zone is an increasing susceptibility towards groundwater flooding from the south western area of the Site ('<25%') towards the north eastern boundary of the Site aligning with the A1041 ('>=75%'). The exception to this is the very south western corner where the susceptibility level is '>=25% <50%'.

4.80. The Level 1 SFRA notes that groundwater flood risks are highly localised and dependent upon geological interfaces between permeable and impermeable subsoils.

Summary of Pre-Development Baseline Flooding from Groundwater

4.81. The pre-development baseline risk of flooding from groundwater is assessed as 'very low' to 'high' for the Site based on the available information due to the presence of groundwater bearing superficial and bedrock deposits and low-lying nature of the Site increasing its vulnerability to shallow groundwater levels.

Flooding from Overwhelmed Sewers and Drainage Systems

4.82. Flooding from sewers and drainage systems occurs when the sewer or drainage system is overwhelmed as a result of a blockage or excessive flow exceeding its capacity and/or when sewers cannot discharge properly to watercourses due to high water levels.

4.83. Historical incidences of sewer flooding are recorded by water and sewerage companies on the DG5 register which records incidents of internal and external flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding. For confidentiality reasons this data is provided at the postcode level. This data does not identify whether flooding incidences were caused by general exceedance of the sewer system design, or by operational issues such as blockages. This dataset is a snapshot in time and may become outdated following asset improvement works by the water and sewerage company and future rainfall events.

4.84. The Level 1 SFRA makes reference to the DG5 Flood Register. The dataset provides the number of properties affected within a postcode area within the last 10 years. It should be noted that the DG5 register only records those incidences reported to Yorkshire Water Services Limited. In addition, it does not take into account any maintenance or improvement works undertaken by Yorkshire Water Services Limited to resolve flooding issues. The Level 1 SFRA shows 0-2 external sewer flooding records reported within the vicinity of the Site.

Summary of Pre-Development Baseline Flooding from Overwhelmed Sewers and Drainage Systems

4.85. The pre-development baseline risk of flooding from overwhelmed sewers and drainage systems is considered to be 'low' to 'very low' due to the Site's rural location with limited sewerage infrastructure.

Flooding from Artificial Sources

Reservoirs

4.86. Flooding from reservoirs may occur as a result of partial or complete failure of the control structure designed to retain water in the artificial storage area.

4.87. The GOV.UK's Flood risk from reservoirs map indicates the Site would be affected in the event of reservoir failure. The reservoir flood map shows two flooding scenarios known as 'dry-day' and 'wet-day'. The 'dry-day' scenarios predict the extent of flooding that would occur if a dam or reservoir failed when river levels are at normal levels. The 'wet day' scenario predicts how much worse the extent of flooding might be if the river is already experiencing the effects of an extreme flood event. A copy of the Risk of flooding from reservoirs map is reproduced as **Figure 15** below.

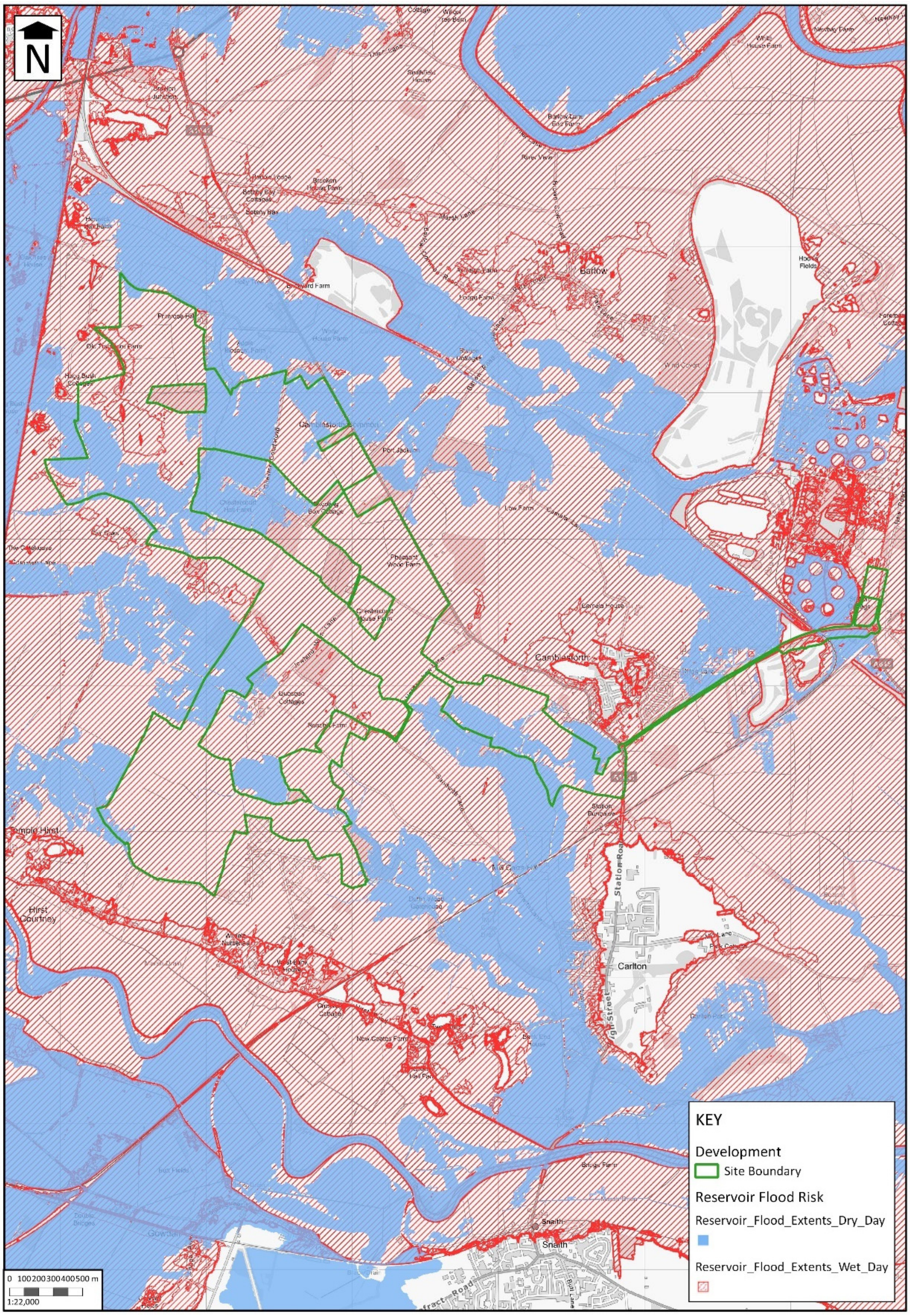


Figure 15: Risk of Flooding from Reservoirs

4.88. When the rivers are at normal levels, the risk of reservoir flooding is present in the north western area of the Solar Farm Zone south and east of Bales Wood, in the northern area of the Site to the southwest of Selby Road and in the south eastern corner to the south west of Camblesforth. Limited areas of risk are present in the southern area of the Solar Farm Zone. The area of the Underground Cable Corridor and Green Infrastructure are also affected. The Selby Branch of the East Coast Mainline railway appears to protect much of the Site in the event of reservoir flooding in the 'dry-day' scenario. In the case of a 'wet-day' scenario flooding occurs across the whole of the Site.

4.89. The GOV.UK website advises that whilst there is a risk in this area, flooding from reservoirs is extremely unlikely. Also, since this is a worst-case scenario, it is unlikely that any actual flood would be this large. Current reservoir regulation has been further enhanced by the Flood and Water Management Act 2010, which amends the Reservoirs Act 1975, and aims to ensure that all reservoirs are properly inspected and supervised by reservoir panel engineers, maintained and monitored in order to detect and repair any problem. Reservoirs therefore present a low but managed risk.

4.90. The Level 1 SFRA notes that to date there have been no recorded incidents of reservoir flooding within Selby District.

Canals

4.91. The Selby Canal runs approximately 1.2km north of the Site at its closest point, flows to the north-east and is located on a small embankment. The Selby canal is formed from the northern branch of the Aire and Calder navigation.

4.92. Canals are regulated waterbodies under the jurisdiction of the Canal and River Trust ('CRT'). As canals are managed waterbodies, they are unlikely to flood unless there is a failure of a raised embankment or a large ingress of water from an adjacent river. Embankment failure can be caused by animal burrowing, culvert collapse, subsidence, overtopping or adjacent works affecting the embankment. The flooding from a breach of a canal embankment is dependent on the canal and adjacent ground levels, embankment construction, nature of the breach and impounded length of canal which determines the volume that can be discharged.

4.93. The Level 1 SFRA records one incident of flooding from the Aire and Calder navigation at Ferrybridge Lock on 26th June 2007. This is located approximately 13km to the south west of the Site in the town of Ferrybridge.

4.94. The Selby Canal is located some distance from the Site and if a breach of the embankment were to occur at the location closest to the Site, ground levels adjacent to the Selby Branch of the East Coast Mainline railway which is located on embankment in the vicinity of the Site would be likely to prevent any floodwaters from extending over a significant distance.

4.95. It is therefore concluded that the chance of flooding from canals is 'very low'.

Summary of Pre-Development Baseline Flooding from Artificial Sources

4.96. The pre-development baseline risk of flooding from artificial sources is considered to be 'low' to 'very low'. Reservoirs are present in the upstream catchment which could pose a risk to the Site. However, due to the management regime of the reservoirs the risk of failure is considered to be extremely unlikely and a managed risk.

Historical Flooding

4.97. The SFRA states that:

> **'There is a long history of flooding within Selby District and several large events have occurred in the last 60 years, with the main sources of flooding being predominantly from fluvial and surface water sources.'**

4.98. The EA's publicly available datasets 'Historic Flood Map' and 'Recorded Flood Outlines' are presented on **Figure 16** below.

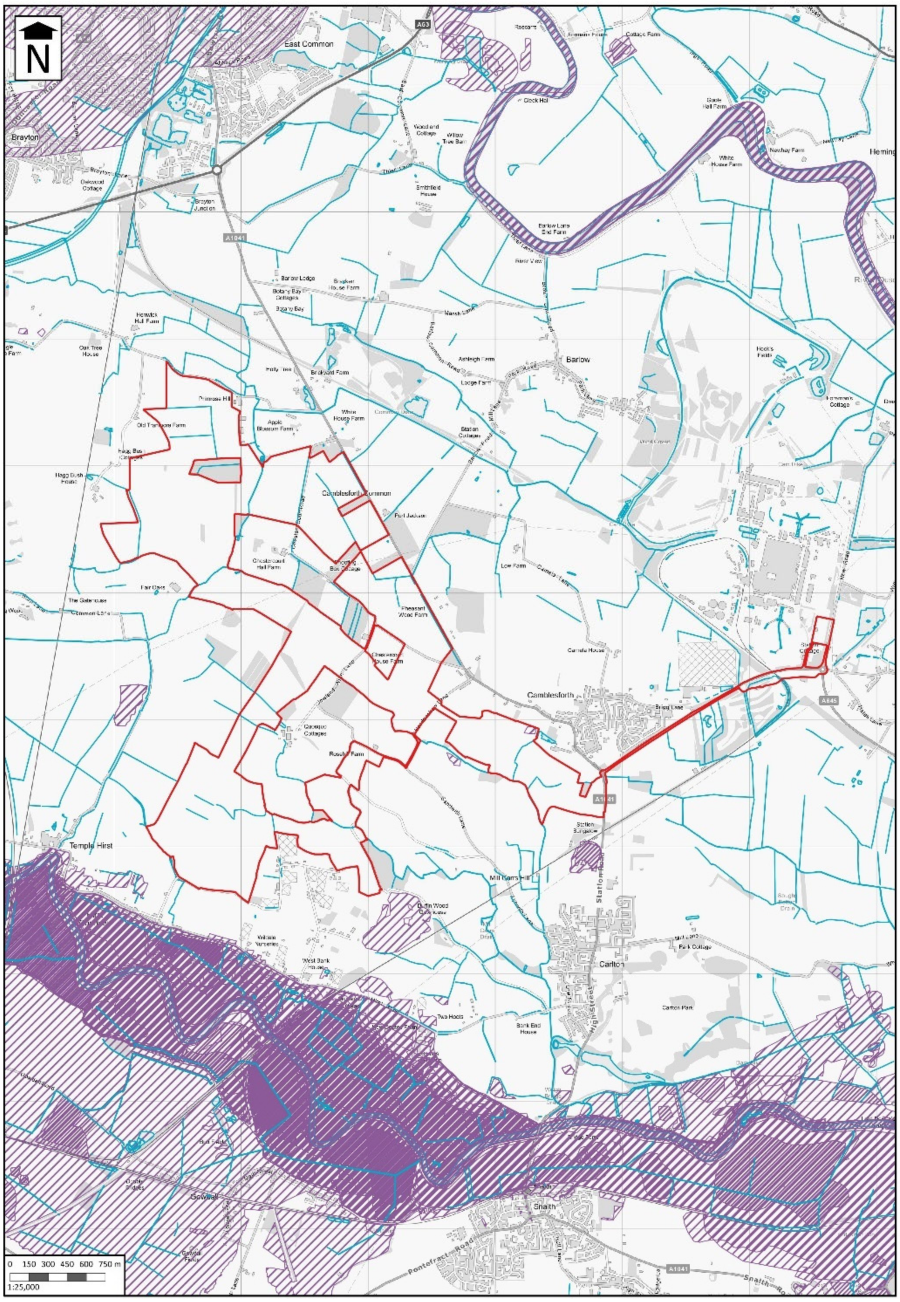


Figure 16: EA's Recorded Flood Outlines

4.99. A small area of historic flooding recorded within the Site boundary is located to the west of Camblesforth. This occurred in February 2020 and is attributed to Storm Dennis.

4.100. A larger area of historic flooding is recorded to the west of Carlton in February 2020 and is associated with Storm Ciara and is located to the south of the Site. Further areas of historic flooding are recorded within 100m of the Site boundary including the capacity exceedance of the River Aire. The flooding events occurred in February 2020 as a result of the combined effect of successive storms (Ciara and Dennis).

4.101. There are further historic records of the River Aire exceeding its channel capacity in December 1978, March 1981, January and March 1982, February 1995, Autumn 2000, June 2007, and December 2015. In these cases, the flood extent is mainly constrained to the washland areas surrounding the River Aire and the historic flood outlines do not extend onto the Site.

4.102. In summary, historical incidences of flooding are recorded in the vicinity of the Site attributed to the combined effect of watercourse and surface water flooding.

Summary of Baseline Flood Risk

4.103. A summary of the potential flood risk from all sources of flooding associated with existing pre-development baseline conditions is shown in **Table F** below.

Table F: Pre-development Baseline Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk	Description
Watercourses & Tidal	High – Very Low	Flood defences along the River Aire are overtopped once the effect of climate change on peak river flows are taken into account in the 1% AEP (1 in 100 RP) plus climate change fluvial flood event. Floodwaters spread out over the floodplain and flood depths and extents vary across the Site.
Surface Water	High - Very Low	The majority of the Site is at very low-risk, with areas of elevated risk associated with isolated low points and the route of onsite ordinary watercourses where surface waters could collect.
Groundwater	High – Very Low	Due to the presence of groundwater bearing superficial and bedrock deposits and the low-lying nature of the Site shallow groundwater may be present.
Overwhelmed Sewers	Low - Very Low	Due to the Site's rural location limited sewerage infrastructure is likely to be present and the Site is located in an area with a low number of historic records.
Artificial Sources	Low – Very Low	Reservoirs are present in the upstream catchment which could pose a risk to the Site. However, due to the management regime for the reservoirs, a failure is considered to be extremely unlikely and a managed risk.

4.104. The pre-development baseline potential flood risk to the Site from overwhelmed sewers and artificial sources is considered to be 'low' to 'very low'. There are areas of elevated risk ('high' – 'medium') associated with the combined risk of flooding from watercourse and tidal sources due to the proximity of the Site to the River Aire and River Ouse, low points where surface waters could collect and the likely presence of shallow groundwaters in underlying superficial and bedrock deposits.

Flood Risk Mitigation Measures

4.105. This section of the report sets out the flood mitigation and adaptation measures required to ensure the Proposed Development is appropriately safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, would reduce flood risk overall.

4.106. The Site layout has been devised using a sequential approach to locate sensitive equipment in areas of lowest flood risk where possible, taking into account other material planning considerations and operational requirements.

4.107. For the Proposed Development in areas of elevated flood risk, flood resilience and resistance measures have been considered to manage the residual flood risk to the Proposed Development. The Proposed Development has been designed to be compatible with the risk of flooding on the Site.

4.108. The flood mitigation and adaptation measures are discussed in more detail below; application of these measures would ensure that the Proposed Development would remain operational and safe for users in times of flood, result in no significant loss of floodplain storage, and would not significantly impede water flows or increase flood risk elsewhere.

4.109. The detailed design of the flood mitigation and adaptation measures would be informed by the EA approved site-specific flood model based on the principles of mitigation set out below.

EA Flood Alerts

4.110. Solar farm developments are not ‘occupied’ and only occasional maintenance visits are required for landscape maintenance and equipment repairs. These maintenance visits can be scheduled to avoid periods of elevated flood risk. The Proposed Development is remotely monitored, and faulty modules can be shut down as required. Through the design mitigation measures outlined below (raising and protecting equipment), the Proposed Development would continue to operate safely during flood conditions with no need for maintenance operatives to be onsite.

4.111. The Site lies within the ‘Flood Alert Area’ of the ‘Tidal River Aire catchment’. The construction contractor and operating staff would register to receive flood alerts from the EA.

4.112. An agreed flood warning and evacuation plan would be put in place for the Proposed Development to be displayed so that users (construction, operation and decommissioning staff) would be fully aware of the procedure to follow. This would include reference to the EA’s available Flood Alerts, and suitable warning notices would be displayed in the Site office/sign in location to inform occupants of the degree of flood risk and the action to be taken in the event of a flood including routes for safe access and egress. Safe access and egress routes would be available for vehicles and pedestrians via the local highway network (Selby Road A1041).

4.113. The proposed flood warning and evacuation plan for the relevant phase of the Proposed Development will be contained in the detailed CEMP, Operational Environmental Management Plan (‘OEMP’) and Decommissioning Environmental Management Plan (‘DEMP’) which will be secured by a suitably worded DCO Requirement requiring details to be submitted to and approved by the Local Planning Authority.

Solar Arrays

4.114. Non-flood sensitive infrastructure (PV solar arrays) has been designed to be resistant and resilient to flood waters in the fluvial and tidal design flood events.

4.115. During times of elevated tidal and fluvial flood risk, and when an EA flood alert is issued, the solar arrays within the areas of elevated flood risk would be rotated to the horizontal position ('the stow position') to ensure the solar panels are raised above the flood level. When an EA flood alert is issued solar arrays in areas of elevated flood risk would return to their stow position as a precaution. This action would be performed remotely and no operatives would be required onsite during periods of elevated flood risk.

4.116. It is proposed to provide a minimum of a 0.3m freeboard between the fluvial 'design flood' level and the stow position of the solar arrays or set the stow position above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater.

4.117. The 0.3m uplift between the design flood level and the stow position is to protect the equipment and avoid displacing flood water whilst accounting for uncertainty within the modelling and the potential for wave action and debris. The 0.3m minimum uplift is considered to be suitably precautionary.

4.118. As requested by the EA, the minimum solar panel stow levels (mAOD) are presented on Drawing Nos. E216/139-142 Rev A contained in **Appendix 17**.

Solar Array Support Structures

4.119. PV panel supports in flood risk areas would be securely piled into the ground and designed to allow for the effect of flowing water pressures and be resistant to inundation during a flood event.

4.120. The minimal cross-sectional area and spacing of the PV panel supports and equipment framework would allow the free flow of flood waters around the base of the structures. The shape of the panels' supports would be designed to allow the free passage of water around the support. The presence of the panel supports in flood risk areas would not materially impede water flows due to their small size, cross sectional profile and wide spacing (typically one panel support on a solar array for every 8-9m).

Volume of Floodwaters Displaced

4.121. Calculations are usually required for areas where there is a significant loss of floodplain storage (e.g. infilling of the floodplain to provide a platform for development above the flood level). Nonetheless a calculation has been undertaken to assess the small volume of flood storage displaced by the proposed solar array supports.

4.122. The proposed development consists of discrete structures which floodwaters could flow around. The structures are at different levels across the site, which complicates the calculation. A series of assumptions have been made to simplify the calculation while still being suitably precautionary. These assumptions are set out below.

4.123. The Field Numbers are set out in the plan contained in **Appendix 2**. Fields 35 - 43 have been assessed based on a 0.2m variation in the fluvial 'design flood' level. As a precaution, the 'design flood' level is rounded to the highest value in the 0.2m band.

4.124. Where necessary, the fields have been sub-divided further to take into account the topographical variations across the parcel. As a precaution, the minimum ground level for each field is rounded to the lowest value in the 0.2m band. This results in an over estimate of the flood depths compared to the modelled flood depths discussed in paragraph 4.49 above.

4.125. There are five types of solar array proposed on the site affected by the fluvial 'design flood' ('1P6', 'IP12', '1P27', '1P54' and '1P81'). The number of each type of array in each field has been calculated. Where a solar array partially extends into the fluvial 'design flood' extents the whole array has been assessed to both simplify the calculation and take a precautionary approach. The volume of floodwaters displaced per 0.2m slice for each of the five array types has been calculated.

4.126. The assessment is based on flood levels from the site-specific hydraulic flood model approved by the Environment Agency in July 2024. The fluvial 'design flood' is the defended 1% Annual Exceedance Probability ('AEP') plus higher central climate change fluvial flood event (or 1 in 100 year Return Period ('RP')).

4.127. The extents of the fluvial 'design flood' across the site and peak flood level per field are set out on Drawing No. E216/164 contained in **Appendix 18**. The solar arrays affected by the fluvial 'design flood' are shown on Drawing No. E216/165 contained in **Appendix 19.**

4.128. The calculations for the volume of flood water displaced by the solar arrays are contained in **Appendix 20** and summarised as **Table G** below.

Table G: Summary of Flood Volume Displace by Solar Arrays

Calculation Slice Height Above Ground Level (0.2m increments) (mAOD)	Flood Volume Displaced (m^3)
3.7-3.9	1.135
3.9-4.1	4.899
4.1-4.3	7.914
4.3-4.5	10.192
4.5-4.7	6.405
4.7-4.9	2.166
Total	**32.711**

4.129. The volume of floodwaters displaced by the Solar Arrays across the 475 Ha site in the fluvial 'design flood' totals approximately 32.711m^3. This is de minimis in the context of the floodplain on the site. Approximately 35.696 Ha (356,963m^2) of the site is affected by the fluvial 'design flood'. On the basis of a very simple calculation (depth = volume / area) the change in flood level over the operational area of the site (area within security fence) as a result of the volume of floodwaters displaced by the solar arrays is approximately 0.00009164m or 0.09mm. This is negligible. If the whole extents of the floodplain in the fluvial 'design flood' were included in the calculation, the change in water level would be even less.

4.130. It can therefore be concluded that the presence of the solar arrays in the fluvial 'design flood' has a negligible effect of flood levels and, in practice, does not increase flood risk elsewhere.

Solar Farm Zone Security Fence

4.131. It is proposed that the mesh size of any security fencing in the Solar Farm Zone within flood risk areas (fluvial 'design flood') would be increased to a minimum of 0.15m to minimise the risk of it collecting debris and allow flood waters to flow around and through the structure. This is consistent with the EA's guidance[36] which states:

> *'You can put fencing near a main river and on a floodplain but not on the bed or banks of a main river.*
>
> *The fencing must either be post and rail or post and wire. If you use wire, it must be either wire strands or at least 100mm spaced mesh.'*

4.132. This Guidance is enshrined in Schedule 25 Part 2 Paragraph 9 of The Environmental Permitting (England and Wales) Regulations 2016.

Control Equipment

4.133. Ancillary control equipment would be contained in small buildings, typically container units distributed across the Site. Ancillary control equipment includes Inverter Stations which contain an Inverter, Transformers, and associated switch gear.

4.134. In line with normal construction practice, it is proposed that any on site buildings would have floor levels raised at least 0.3m (and up to 0.6m) above existing ground level with appropriate damp proof course protection. This would ensure that the interior of any such building is kept suitably dry.

4.135. The location of ancillary control equipment would be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.

4.136. Avoiding areas of elevated flood risk in the fluvial 'design flood' ensures that the ancillary control equipment can remain safe and operational during times of flooding. Locating ancillary control equipment outside of areas of deeper flood risk (>0.6m) during the fluvial 'credible maximum scenario sensitivity test' ensures the sensitive equipment is set above the elevated risk and appropriately resilient to the effects of the credible maximum climate change scenario.

4.137. The flood hazards which would determine the appropriate locations of the ancillary control equipment are presented on Drawing Nos. E216/143-146 contained in **Appendix 21**.

4.138. The detailed design of the scheme may utilise string inverters located on the back of the frames of the solar arrays. If string inverters are proposed they should be situated a minimum of 0.3m above the fluvial 'design flood' or above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater.

Substation and BESS Compound

4.139. The Substation and BESS Compound are located in the central area of the Solar Farm Zone as indicated on the Parameter Plan contained in **Appendix 2**.

[36] EA (2016) Statutory guidance Excluded flood risk activities. Available from: https://www.gov.uk/government/publications/excluded-flood-risk-activities-environmental-permits/excluded-flood-risk-activities#post-and-rail-or-post-and-wire-fencing-in-a-floodplain (Access on 06.02.24)

4.140. The Substation and BESS Compound would be situated to avoid areas of elevated surface water flood risk and the fluvial 'design flood' extents.

4.141. To ensure the risk of flood risk during the fluvial 'credible maximum scenario sensitivity test' to the Substation and BESS Compound is mitigated over the modelled operational lifetime of the Proposed Development, it is proposed to protect the equipment with a suitably designed earth flood defence bund as an adaptation measure. As a precaution, the height of the earth flood defence bund would be at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect the equipment from inundation.

4.142. An increased freeboard compared with the solar panels is proposed to manage the residual risk of defence failure and provide a higher standard of protection to the sensitive equipment. This is a risk-averse approach to ensure the sensitive equipment is resilient to the effects of the credible maximum climate change scenario.

4.143. The use of a flood defence bund has been selected as the preferential mitigation measure. The raising of the BESS equipment above the fluvial 'credible maximum scenario sensitivity test' flood level is not practical due to the size and weight of the equipment involved. There are also other material planning considerations (such as landscape and noise effects) that need to be taken into account to find the optimum design solution. In addition, the use of the flood defence bund has additional benefits to provide a containment solution to reduce the risk of pollution (which is discussed in more detail in Section 5 below) and provides opportunities for landscaping.

4.144. The earth flood defence bund would incorporate a suitably designed access over the bund to allow for occasional maintenance access as identified on the indicative layout. Alternatively, a suitably designed flood gate could be considered.

4.145. The BESS containers would be raised at least 0.3m (and up to 0.6m) above ground which provides additional protection from the ingress of surface water within the bunded area.

4.146. It is noted the mesh size of the security fence for the Substation and BESS Compound is less than 0.15m. The security fence for the Substation and BESS Compound would be located inside the flood defence bund described above and, therefore, would not interact with flood waters during the fluvial 'credible maximum scenario sensitivity test' flood event. The reduced mesh size at this location is therefore appropriate due to the protection offered by the flood defence bund.

Floodplain Compensation

4.147. As set out above it is proposed to avoid siting ancillary control equipment and the Substation and BESS Compound in areas affected by the fluvial 'design flood'. As such no floodwaters would be displaced by the equipment in the fluvial 'design flood' over the modelled operational lifetime of the Proposed Development. Therefore, on the basis of the results of the site-specific flood modelling no floodplain compensation is required to mitigate the effect of the ancillary control equipment and Substation and BESS Compound for the fluvial 'design flood'.

4.148. The fluvial 'credible maximum scenario sensitivity test' affects greater extents of the site compared with the fluvial 'design flood'. As an appropriate adaptation measure to provide a high level of climate resilience from the outset it is proposed to provide a flood defence bund to protect the Substation and BESS Compound. The inclusion of earth flood defence bund around the Substation and BESS Compound could displace floodwaters during the fluvial 'credible maximum scenario sensitivity test' flood event.

4.149. The flood defence bund is an adaptation measure and its impacts on flood risk elsewhere would only occur if the maximum credible climate change scenario were to be realised over the operational lifespan of the Proposed Development.

4.150. To demonstrate that it is feasible to mitigate the effect of the flood defence bund using an adaptation measure on flood risk during the 'credible maximum scenario sensitivity test' flood event, a 'level for level' and 'volume for volume' floodplain compensation scheme could be provided on the Site.

4.151. Guidance on Floodplain Compensation is set out in section A3.3.10 of CIRIA's report 'Development and flood risk – guidance for the construction industry'[37] (CIRIA C624, 2004). The guidance advocates that for compensatory flood storage to be effective at the same point in a flood event, it should be the same volume and be at the same level relative to the flood level as the lost storage. This requirement is referred to as level for level compensation.

4.152. Level for level compensation is achieved by regrading land to a lower level in order to replace the flood storage volume lost within the floodplain due to the Proposed Development. The guidance advises that losses of flood storage volume should typically be calculated for level bands[38] so that at least five levels bands represent the depth of flooding on the floodplain during the design flood, although level bands of less than 100mm should not be used.

4.153. Level for level floodplain compensation could be provided to mitigate the effect of the earth flood defence bund on flood storage volume. To demonstrate that a floodplain compensation scheme could be provided, a preliminary floodplain compensation scheme is set out on Drawing Nos. E216/161-162 Rev A contained in **Appendix 22**. The calculation is based on 200mm level bands and a 'credible maximum scenario sensitivity test' flood level of 4.751m AOD at this location. Inspection of these plans indicates that in all level bands the volume of floodplain compensation provided is greater than the volume lost as a result of the Substation and BESS Compound. The preliminary floodplain compensation scheme ensures that the Proposed Development would result in no net loss of floodplain storage, would not increase flood risk elsewhere and flood risk betterment would be provided during the fluvial 'credible maximum scenario sensitivity test'.

4.154. Inspection of Drawing Nos. E216/161-162 Rev A contained in **Appendix 22** indicates that the preliminary floodplain compensation scheme could be provided within the DCO limits.

4.155. As set out in paragraph 3.58 above, the 40-year modelled operational lifespan will run to 2069 and energy generation will cease and decommissioning will commence. Decommissioning and handback of the land will be concluded in 2070. The peak river flow climate change allowances are based on a range of epochs. The 2050s epoch covers 2040 - 2069 and the 2080s epoch covers 2070 – 2125. As set out in paragraph 3.77, the decommissioning period only extends one year into the 2080s epoch (2070 – 2125). As a precaution, it is proposed to use the 2050s epoch Upper End 'Sensitivity Test' as a precautionary assessment of the potential fluvial flood risk at the end of the decommissioning period.

4.156. As a precaution and to simplify the delivery of the floodplain compensation scheme and the ongoing operation and management of the Proposed Development, it is proposed to deliver the floodplain compensation scheme for the Substation and BESS Compound in parallel with the delivery of the associated flood defence bund.

[37] CIRIA (2004) Development and flood risk – guidance for the construction industry, CIRIA C624.
[38] Level bands – a term used to quantify the volume of flood waters displaced or flood storage volume provided between two levels e.g. between 10.0mAOD and 10.2mAOD.

4.157. A detailed Flood Management Strategy would be secured by a suitably worded DCO Requirement requiring details to be submitted to and approved by the Local Planning Authority based on the outputs of the EA approved site-specific flood model. The detailed Flood Management Strategy would contain details of the design of a suitable flood defence bund to provide protection to the Substation and BESS Compound during the fluvial 'credible maximum scenario sensitivity test' flood event. The detailed Flood Management Strategy would also contain details of the design of a suitable 'level for level' and 'volume for volume' floodplain compensation scheme to mitigate the effect of the flood defence bund on the potential fluvial flood risk at the end of the decommissioning period (the fluvial 'credible maximum scenario sensitivity test' flood).

4.158. It should be noted this is a precautionary approach to the delivery of the floodplain compensation scheme adaption measure and would result in flood risk betterment over the majority of the operational lifespan of the proposed development and would provide a high level of climate resilience from the outset to the fluvial 'credible maximum scenario sensitivity test' flood event.

4.159. The effect of ancillary control equipment on flood risk elsewhere during the fluvial 'credible maximum scenario sensitivity test' is assessed as 'de minimis' in the context of the volume of flood waters displaced by the equipment and the volume of floodwaters contained in the floodplain in this situation. The design parameters for the ancillary equipment is to raise the equipment on supports up to 0.6m in height. A void would be present under the majority of the ancillary equipment minimising the displacement of floodwaters. The volume of floodwaters displaced would be limited and would have an insignificant effect on flood risk (flood depths and extent) on the Site and elsewhere. Due to the limited scale of the ancillary control equipment no floodplain compensation scheme is deemed necessary to mitigate the effect of this element of the Proposed Development during the fluvial 'credible maximum scenario sensitivity test' flood event.

Onsite Watercourses

4.160. Onsite watercourses would be retained within the Proposed Development. Minimum 7m buffers have been established for all infrastructure (with the exception of fence crossings, culverts and access tracks) from the edge of a bank of any ordinary watercourses on the Site:

4.161. The 7m watercourse buffer and areas where additional consents (land drainage consent) are required are shown on Drawing No. E216/06 Rev D contained in **Appendix 23.**

4.162. The internal access track would utilise existing watercourse/hedgerow crossings where possible.

4.163. It is proposed at detailed design that opportunities are sought within the development parcels for crossings of ordinary watercourses to be formed from single span structures, clear of the watercourse channels, wherever feasible. Where this is not possible, oversized box culverts should be utilised such that existing bed and bank profiles can be retained or reinstated in order to provide ecological benefits and maintain the existing hydrological characteristics of the water environment.

4.164. Section 120 of the Planning Act 2008 allows the inclusion of non-planning consents, permits and licences to be included within the DCO, removing the requirement for the Applicant to apply for them separately which is known as 'disapplication'. The disapplication of Section 23 and Section 66 of the Land Drainage Act 1991 is proposed by the Applicant which would remove the need for the additional consents. Alternatively if disapplication is not secured any new watercourse crossings (Site accesses) which require culverting of an ordinary watercourse could require consent from Selby Area IDB under Section 23(1) of the Land Drainage Act 1991 (as amended by the FWMA 2010). If disapplication is not secured land drainage consent is a separate process from the DCO process and would be undertaken following the approval of the DCO.

4.165. The Proposed Development would require below ground electricity and data cables to cross onsite watercourses. To minimise effects service crossings of watercourses would be rationalised to minimise the number of crossings. Crossings of IDB maintained ordinary watercourses would be installed by trenchless methods under the channel of the watercourse and be based on the following design parameters:

- The service crossing is within 10 degrees of perpendicular to the direction of flow in the watercourse.
- The service crossing is at least 1.5m below the bed of the watercourse along its whole length, and the same height is maintained for at least 5m beyond each bank (measured from the top).
- The service crossing does not pass through any bank, culvert, formal flood defence or other structure.
- Appropriate hazard markers on both banks should be installed.
- Works do not disturb the bed and banks of the watercourse.

4.166. If alternative construction methods for service crossings of IDB maintained ordinary watercourses are utilised, it is likely that IDB Byelaw consent would be required and construction methods should be approved by the Selby Area IDB. Alternatively, the disapplication of these additional requirements may be incorporated into the DCO.

4.167. Landscape planting is required to screen the Proposed Development and would consist of the reinforcement of existing hedgerows and planting of new hedgerows and trees. Landscape planting is predominately 7m from the top of bank of the ordinary watercourses on the Site. To provide a comprehensive landscape scheme sympathetic to existing vegetation new landscape planting is proposed within 7m of an ordinary watercourse at a number of locations on the Site. Where this is proposed at least a 7m area free of development or landscape planting is retained on the opposite side of the ordinary watercourse to ensure maintenance access to the ordinary watercourse is retained. The areas of landscape planting within 7m of an Ordinary Watercourse will be subject to IDB Section 66 (Byelaw) Consent. The proposed landscape planting scheme and areas where landscape planting is within 7m of an ordinary watercourse is shown on Drawing No. 012006.00001.101 Rev 01 reproduced in **Appendix 24**.

Offsite Watercourses

4.168. Inspection of Drawing No. E216/84 Rev C contained in Appendix 8 shows that the Site is remote from offsite flood defences and main rivers. The construction, operation and decommissioning activities would not interact with the offsite flood defences or watercourses.

Summary of Flood Mitigation and Adaptation Measures

4.169. The Proposed Development extends into areas of elevated flood risk from the fluvial 'design flood'. The Proposed Development would be designed to appropriately safe in the fluvial 'design flood' without increasing flood risk elsewhere. The Proposed Development would be designed to be resilient to the fluvial 'credible maximum scenario sensitivity test' flood event with the implementation of adaptation measures where necessary at the appropriate time.

4.170. The following design flood mitigation and adaptation measures are proposed:

- A flood warning and evacuation plan for the relevant phase of the Proposed Development would be contained in the detailed CEMP, OEMP or DEMP and the construction contractor and operating staff would register to receive flood alerts / warnings from the EA and follow site evacuation procedures during periods of elevated flood risk;

- During times of elevated tidal and fluvial flood risk the solar arrays within the areas of elevated flood risk would be rotated to the horizontal stow position which would be a minimum of a 0.3m above the fluvial 'design flood' level or the stow position set above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater;
- Panel supports and security fencing in flood risk areas would be securely piled into the ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event;
- Security fencing mesh size in flood risk areas (fluvial 'design flood') would be increased to 0.15m square to minimise the risk of it collecting debris;
- Ancillary control equipment would be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event.
- Substation and BESS Compound will be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood'.
- Finished floor levels of any ancillary control equipment in the Solar Farm Zone, including Invertor Station, and in Substation and BESS Compound will be raised at least +0.3m above the fluvial 'design flood' level, and would be above the fluvial 'credible maximum scenario sensitivity test' flood level. The equipment would be at least +0.3m (and up to +0.6m) above existing ground level.'
- As an adaptation measure the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect the equipment from inundation;
- As an adaptation measure, a level for level and volume floodplain compensation scheme would be implemented to mitigate the effect of the earth flood defence bund on the potential fluvial flood risk at the end of the decommissioning period (the fluvial 'credible maximum scenario sensitivity test' flood). A preliminary floodplain compensation scheme within the DCO limits has been shown to be feasible.
- A detailed Flood Management Strategy containing details of the flood defence bund and floodplain compensation scheme adaptation measures based on the outputs of the EA approved site-specific flood model would be secured by a suitably worded DCO Requirement;
- Onsite watercourses are retained and existing watercourse crossings are utilised where possible within the Proposed Development;
- Where possible all development (including security fencing) is at least 7m from the onsite ordinary watercourses in accordance with Selby Area IDB byelaws. Additional consents may be required for watercourse crossings (site access or services) and landscape planting where this is not achieved.

4.171. These flood mitigation and adaptation measures would ensure that the Proposed Development would remain operational and safe in times of the fluvial 'design flood' and resilient to the effects of the fluvial 'credible maximum scenario sensitivity test' flood event. The flood mitigation and adaptation measures can be secured by a suitably worded DCO Requirements requiring details to be submitted to and approved by the Local Planning Authority.

Development and Flood Risk

4.172. This section summarises the site-specific flood risk from all sources of flooding when both the Proposed Development and flood mitigation and adaptation measures are taken into account.

4.173. The detailed design of the equipment will be informed by the results of the EA approved site-specific flood modelling based on the principles established in this FRA.

Flooding from Watercourses and Tidal Sources

4.174. As set out above, in terms of providing an acceptable standard of protection against flooding for new development, the Proposed Development has been designed to remain operational and safe during the fluvial ‘design flood’ without increasing flood risk elsewhere.

4.175. The Proposed Development has been designed to be resilient to the effects of the fluvial ‘credible maximum scenario sensitivity test’ flood event with opportunities to apply the adaptive approach to mitigate the effects of the Proposed Development on flood risk elsewhere.

4.176. From an inspection of **Figure 4** it can be seen that when the solar arrays are rotated to a horizontal stow position, the solar panels would be approximately 2m above ground level. The maximum depth of flooding in Solar Farm Zone during the fluvial ‘design flood’ is predominately <0.3m with one isolated low spot in the northwest corner of Field Number 42 where flood waters are up to 1.3m. The stow position is therefore significantly above the fluvial ‘design flood’ level. The outputs of the site-specific flood modelling demonstrate that the minimum freeboard allowances for the stow position of the solar arrays could be achieved. The solar panels would be raised above the fluvial ‘design flood’ and therefore safe from flooding and could continue to operate safely during these conditions.

4.177. The maximum depth of flooding in Solar Farm Zone during the fluvial ‘credible maximum scenario sensitivity test’ is predominately <2.0m with one isolated low spot in the south east corner of Field Number 22 where flood waters are up to 2.17m. This isolated area is within 5m of the security fence at this location and unlikely to be used for solar arrays. The ‘Indicative Design’ contained in the Figure 3.3 of the Environmental Statement shows it is possible to locate solar arrays on the Site in areas where the modelled flood depth in fluvial ‘credible maximum scenario sensitivity test’ is <1.7m. Through the appropriate design of the scheme the solar arrays could be designed to be resilient to the effects of the credible maximum climate change scenario and would be raised above the fluvial ‘credible maximum scenario sensitivity test’ level and there safe from flooding.

4.178. Due to the nature of the proposed equipment in the area of elevated flood risk, the volume of flood water displaced by the PV panel supports and fence posts is negligible in the context of the wider floodplain and flood waters could flow freely around the panel supports, base of the structures, and security fence. On this basis the effect of the panel supports and fence posts in the area of elevated flood risk is assessed as negligible and would not increase flood risk elsewhere during the fluvial ‘design flood’ or the fluvial ‘credible maximum scenario sensitivity test’ flood event.

4.179. Through the sequential approach to locate sensitive equipment in areas of lowest flood risk where possible the risk to ancillary control equipment and the Substation and BESS Compound is very low during the fluvial ‘design flood’ and tidal ‘design flood’. Through siting equipment in these areas there would not be an increase in fluvial or tidal flood risk elsewhere as a result of the Proposed Development.

4.180. Through siting ancillary control equipment in areas of shallower flood depths (<0.6m) during the fluvial 'credible maximum scenario sensitivity test' flood event and setting the equipment above this flood level the ancillary control equipment would be appropriately resilient to the credible maximum climate change scenario.

4.181. The effect of ancillary control equipment on flood risk elsewhere during the fluvial 'credible maximum scenario sensitivity test' is assessed as 'de minimis' in the context of the volume of flood waters displaced by the equipment and the volume of floodwaters contained in the floodplain in this situation.

4.182. The Substation and BESS Compound would be protected by suitably designed earth flood defence bund at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level. The earth flood defence bund would protect the equipment from inundation which would continue to operate safely in times of flooding providing a high level of resilience to the maximum climate change scenario.

4.183. The Substation and BESS Compound floodplain compensation scheme adaptation measures would mitigate the effect of the earth flood defence bund and ensure that flood risk as a result of the earth flood defence bund would not increase on the Site or elsewhere during the fluvial 'credible maximum scenario sensitivity test' flood event. This event represents the potential fluvial flood risk at the end of the decommissioning period. A preliminary floodplain compensation scheme within the DCO limits has been shown to be feasible and could be provided on the Site.

4.184. The early delivery of the Substation and BESS Compound floodplain compensation scheme adaptation measures is a precautionary approach and would result in flood risk betterment over the majority of the operational lifespan of the proposed development and would provide a high level of climate resilience from the outset to the fluvial 'credible maximum scenario sensitivity test' flood event.

4.185. In summary, where built development is proposed, the risk of flooding from fluvial and tidal sources are the same as the pre-development baseline and ranges between 'high' and 'very low' on the Site. The design and management flood mitigation and adaptation measures ensure that the Proposed Development would remain operational and safe during the fluvial and tidal design floods without increasing flood risk elsewhere and would be resilient to the maximum climate change scenario.

Flooding from Surface Water

4.186. Solar arrays, security fencing, and access tracks extend into areas of elevated surface water flood risk.

4.187. When the solar arrays are in their operating (rotating) position, the lower edge of the solar panel is a minimum of 0.9m above ground level (**Figure 4**). Therefore, the solar panels in the stow or operating (rotating) positions would be raised above the deepest low-risk surface water flood level, and so would not be vulnerable to surface water flooding. The solar arrays are therefore compatible in areas of elevated surface water flood risk.

4.188. Solar arrays, security fencing, and access tracks would not be vulnerable to the shallow depths and flow of the surface water. Due to the depth of surface water flooding being less than the fluvial 'credible maximum scenario sensitivity test' flood level, the height of the solar arrays above the highest risk and level of surface water accumulation, and the nature of the equipment, the Proposed Development is appropriate in these areas, would continue to operate safely during periods of flood, and would not increase flood risk elsewhere.

4.189. The Substation and BESS Compound would be preferentially located in areas of very low surface water flood risk.

4.190. Overland flows would be intercepted by the proposed interception swales described in Section 5 below which would ‘slow the flow’ providing flood risk betterment.

4.191. Where built development is proposed, the risk of flooding from surface water sources is the same as the pre-development baseline risk and ranges between ‘high’ and ‘very low’ on the Site. The design and management flood mitigation measures would ensure that the Proposed Development would remain operational and safe during the periods of elevated surface water flood risk and is compatible in these areas without increasing flood risk elsewhere.

Flooding from Groundwater

4.192. The solar panels would be elevated above ground level and all control equipment would be raised at least 0.3m above ground level and would therefore be unaffected by shallow emergent groundwater and overland surface water flows.

4.193. The risk of flooding from groundwater is assessed as ‘very low’ to ‘high’ for the Site based on the available information due to the presence of groundwater in the water-bearing superficial and bedrock deposits and low-lying nature of the Site. The design and management flood mitigation measures ensure the Proposed Development is resilient to shallow emergent groundwater and overland surface water flows and can operate safely in these conditions.

Flooding from Overwhelmed Sewers and Drainage Systems

4.194. There is no change compared with pre-development baseline risk, and therefore no significant foul water drainage infrastructure is required to serve the Proposed Development.

Flooding from Artificial Sources

4.195. Reservoirs are present in the upstream catchment which could pose a risk to the Site. The risk of flooding from artificial sources is considered to be a ‘low’ residual risk. However, due to the management regime for the reservoirs, a failure is considered to be extremely unlikely and a managed risk.

4.196. The design and management flood mitigation and adaptation measures required to ensure the Site is resilient to the fluvial ‘credible maximum scenario sensitivity test’ flood event provide additional resilience for the risk of flooding from reservoir failure.

Residual Risk

4.197. Residual risks are those remaining after applying the sequential approach and after the flood risk management and mitigation measures are implemented. Examples of residual risk include:

- a breach of a raised flood defence, blockage of a surface water conveyance system or failure of a pumped drainage system;
- failure of a reservoir; and a flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot accommodate;
- failure of the panel tracking system during the fluvial design flood event.

4.198. The Proposed Development is not ‘occupied’ and therefore there is no risk to users (construction, operation and decommissioning staff) of the development. Construction or occasional maintenance activities would be scheduled to avoid periods of elevated flood risk. During times of elevated flood risk, no personnel would be onsite and access to the Proposed Development would be restricted.

Therefore, due to its 'unoccupied' nature, the Proposed Development would be safe for users in times of flood. Sensitive plant would be able to be shut down and restarted remotely in response to a flood alert. When a flood alert / warning is issued the Proposed Development would be evacuated as a precautionary measure using the local highway network in accordance with the Proposed Development's flood warning and evacuation plan.

4.199. The proposed flood warning and evacuation plan for the relevant phase of the Proposed Development will be contained in the detailed CEMP, Operational Environmental Management Plan ('OEMP') and Decommissioning Environmental Management Plan ('DEMP') which will be secured by a suitably worded DCO Requirement requiring details to be submitted to and approved by the Local Planning Authority.

4.200. Due to the Site's position in the lower catchment of the River Ouse and River Aire the risk of an extreme fluvial and tidal flood can be readily forecast. This is as a result of the cyclical nature of tides required to combine with a tidal surge (which can also be forecast) and the lag between excessive rainfall in the upper fluvial catchment resulting in increased peak river flows at the Site. As such there would be sufficient warning to evacuate the Proposed Development if a flood warning is issued when onsite maintenance activities are being undertaken before a flood event would occur at the Site.

4.201. There is a residual flood risk to the Proposed Development if the EA's strategic flood defences along the River Aire were to fail. The residual risk of failure of the EA's strategic flood defences is above the standard of protection for new development and a commercial risk to the Applicant.

4.202. The residual risk of the credible maximum climate change scenario is assessed as part of the site-specific flood model. Appropriate adaptation measures are set out in the sections above to ensure the Proposed Development would be resilient to the maximum climate change scenario.

4.203. There is a residual risk of the earth flood defence bund protecting the Substation and BESS Compound being overtopped by flood waters or failing. The residual risk of overtopping is significantly reduced by incorporating a 0.6m freeboard above the fluvial 'credible maximum scenario sensitivity test' flood level. This significantly increases the standard of protection of the earth flood defence bund. The failure of the earth flood defence bund is a commercial risk. The risk of failure would be reduced by regular inspections by site operatives as part of their site-wide maintenance activities. If areas of erosion or deterioration are identified these would be reported to the Site Manager and appropriate remedial measures actioned to ensure the integrity of the earth flood defence bund is maintained.

4.204. There is a residual risk of the failure of the panel tracking system, resulting in a significant portion of the panels being stuck in the downward position.

4.205. The PV solar arrays have been designed to be resistant and resilient to flood waters in the fluvial and tidal design flood events. During times of elevated tidal and fluvial flood risk, and when an Environment Agency flood alert is issued, the solar arrays within the areas of elevated flood risk would be rotated to the horizontal position ('the stow position') to ensure the solar panels are raised above the flood level. This action would be performed remotely and no operatives would be required onsite during periods of elevated flood risk.

4.206. It is proposed to provide a minimum of a 0.3m freeboard between the fluvial 'design flood' level and the stow position of the solar arrays or set the stow position above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater. The lower edge of the panels would be up to 0.9m above ground level at the maximum rotation and the horizontal stow position would be approximately 2m above ground level.

4.207. The risk of the failure of the panel tracking system should be considered a residual risk in the fluvial 'design flood'. Due to the dimensions of the solar arrays, the effect of the failure of the rotating mechanism on flood flows would only occur in areas of the site affected by flood depths >0.9m in the fluvial 'design flood'.

4.208. The modelled flood depths during the fluvial 'design flood' are presented on Drawing No. E216/153 contained in **Appendix 14**.

4.209. The extents of the fluvial 'design flood' where the modelled flood depth is >0.9m across the site are set out on Drawing No. E216/155 contained in **Appendix 25**. Inspection of this drawing indicates that only a very small area of the site area is affected by flood depths >0.9m associated with one isolated low spot in the northwest corner of Field Number 42. The indicative design shows this area where modelled flood depths >0.9m in the fluvial 'design flood' is crossed by an access track and security fence and no solar arrays extend into this area.

4.210. The indicative design demonstrates the Proposed Development can be designed to avoid solar arrays in the low-lying areas of Field 42. No areas of the site where solar arrays are proposed in the indicative design are affected by flood depths >0.9m (the minimum height of the solar array above ground at full rotation) in the fluvial 'design flood'. Therefore, there is no risk of failure of the panel tracking system resulting in a significant portion of the panels being stuck in the downward position affecting flood flows (as the panels even at full rotation the solar panels are above the fluvial 'design flood' depth). The design of the Proposed Development ensures it can remain operational and safe during the fluvial 'design flood'.

4.211. The design of the solar arrays would provide a high level of design resilience in both the fluvial 'design flood' and the fluvial 'credible maximum climate change scenario' flood event.

4.212. It should be noted that regular maintenance of the solar arrays would reduce the risk of failure of the rotating mechanism. Regular maintenance of equipment in areas of elevated flood risk would be set out in the OEMP secured by a DCO Requirement.

4.213. A summary of the potential risk from all sources of flooding during the operational lifetime of the Proposed Development with the various development flood mitigation measures incorporated is shown in **Table H** below.

Table H: Potential Flood Risk During the Operational Lifetime of the Proposed Development from All Sources of Flooding

Flood Source	Potential Risk	Description
Watercourses	High – Very Low	No change compared with pre-development baseline risk. Flood defences along the River Aire are overtopped once the effect of climate change on peak river flows and tidal levels are taken into account. The design and management flood mitigation and adaptation measures ensure the Proposed Development is appropriately flood resilient and resistant and can remain operational and safe during the fluvial and tidal design floods without increasing flood risk elsewhere. Site staff will adhere to site evacuation procedures if an EA flood warning is issued which protects the operatives from the residual risk.
Surface Water	High - Very Low	No change compared with pre-development baseline risk. Majority of the Site is at very low-risk with areas of elevated risk associated with isolated low points where surface waters could collect and the route of onsite ordinary watercourses. The sequential approach to the layout restricts the Substation and BESS Compound to areas of very low-risk. All sensitive equipment is raised above ground level or protected by suitably designed earth flood defence bund and would not be susceptible to shallow overland flows. Overland flows would be intercepted by proposed interception swales providing a degree of betterment downstream.
Groundwater	High – Very Low	No change compared with pre-development baseline risk. All sensitive equipment is raised above ground level and is resilient to shallow emergent groundwater and overland surface water flows and can operate safely in these conditions.
Overwhelmed Sewers	Low - Very Low	No change compared with pre-development baseline risk and no significant foul water drainage infrastructure is required to serve the Proposed Development.
Artificial Sources	Low	No change compared with pre-development baseline risk. The design and management flood mitigation measures required to ensure the Proposed Development is safe from the tidal and fluvial flood event would improve the resilience of the development to the residual risk of flooding from reservoir failure.
Off-site Impacts	Very Low	The delivery of a flood defence bund and a floodplain compensation scheme adaptation measures provide a high level resilience to the fluvial 'credible maximum scenario sensitivity test' flood event.

4.214. Based on the above, it is considered that the proposed design flood mitigation and adaptation measures would safely manage any residual risks from flooding during the design flood and the Proposed Development would remain operational and safe.

4.215. Residual risk to the operatives in event of defence failure is managed through restricting access to the Site and following site evacuation procedures during periods of elevated tidal and fluvial flood risk. The residual risk of failure of the EA's strategic flood defences is above the standard of protection required for new development and therefore a commercial risk for the Applicant.

4.216. The detailed design of the equipment and flood mitigation and adaptation measures would be refined and finalised based on the results of the EA approved site-specific flood and the principles established in this FRA.

Additional Consents

4.217. Section 120 of the Planning Act 2008 allows the inclusion of non-planning consents, permits and licences to be included within the DCO, removing the requirement for the Applicant to apply for them separately which is known as 'disapplication'. The disapplication of Section 23 and Section 66 of the Land Drainage Act 1991 is proposed by the Applicant which would remove the need for the additional consents referenced below and would be obtained by the Applicant in accordance with the Protective Provisions in favour of drainage authorities set out in Schedule 11 to the DCO.

4.218. If disapplication of Section 23 and Section 66 of the Land Drainage Act 1991 is not secured additional consents may potentially be required for any works to watercourses in addition to securing approval of the DCO.

4.219. Culverting of ordinary watercourses (drainage ditches) or the construction of outfalls from the BESS Compound discussed in Section 5 below could require consent from Selby Area IDB under Section 23 of the Land Drainage Act 1991 if disapplication is not secured.

4.220. Selby Area IDB Byelaw 10 states:

> **'No person without the previous consent of the Board shall erect any building or structure, whether temporary or permanent, or plant any tree, shrub, willow or other similar growth within 7 metres of the landward toe of the bank where there is an embankment or wall or within 7 metres of the top of the batter where there is no embankment or wall, or where the watercourse is enclosed within 7 metres of the enclosing structure.'**

4.221. The Parameters plan avoids development within 7m of ordinary watercourses on the Site except where access track watercourse crossings are required. Where works or landscape planting are within 7m of the bank of an ordinary watercourse the requirement for IDB Section 66 (Byelaw) Consents should be assessed if disapplication is not secured.

4.222. Section 66 (Byelaw) consent could also be required from the Selby Area IDB for the outflows into the onsite drainage ditches from the BESS Compound discussed in Section 5 below if disapplication is not secured.

NPPF Planning Policy Requirements

Flood Risk Vulnerability and Flood Zone 'Compatibility'

4.223. Annex 3 of the NPPF sets out the Flood Risk Vulnerability Classification of development and categorises different types of development according to their vulnerability to flood risk. Paragraphs 77-78 of the Flood Risk and Coastal Change Planning Practice Guidance refer to two Flood Zone and Flood Risk Tables. Table 1: Flood Zones provides a definition of each Flood Zone. Table 2: Flood risk vulnerability and flood zone 'compatibility' maps the vulnerability classes against the flood zones to indicate where development is appropriate and where development should not be permitted.

4.224. The EA's Flood Map for Planning[39] indicates that a large proportion of the Site falls within Flood Zone 3 and as set out in paragraph 2.15 these areas are classified as Flood Zone 3a. Smaller areas of Flood Zones 1 and 2 are present on the Site.

4.225. With reference to Annex 3 of the NPPF, solar farms are classified as Essential Infrastructure.

4.226. With reference to Table 2, Essential Infrastructure is appropriate in Flood Zones 1 and 2, and is also appropriate in Flood Zones 3a and 3b if the Exception Test is passed.

4.227. The Notes to Table 2 state that in Flood Zone 3a Essential Infrastructure should be designed and constructed to remain operational and safe in times of flood.

4.228. Notes to Table 2 states that the table does not show the application of the Sequential Test which should be applied first to guide development to the lowest flood risk areas.

Sequential Test

4.229. Paragraph 5.8.36 of the Overarching NPS for Energy (EN-1) includes the requirement to apply and satisfy the Sequential Test as part of site selection.

4.230. Paragraph 5.8.21 of EN-1 states:

> **'The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not possible to locate development in low-risk areas, the Sequential Test should go on to compare reasonably available sites with medium risk areas and then, only where there are no reasonably available sites in low and medium risk areas, within high-risk areas.'**

4.231. Paragraph 5.8.23 of EN-1 states:

> **Consideration of alternative sites should take account of the policy on alternatives set out in Section 4.3 above. All projects should apply the Sequential Test to locating development within the site.**

[39] EA (2023) Flood Map for Planning. Available from: https://flood-map-for-planning.service.gov.uk/

4.232. Paragraph 174 of the NPPF states:

> **'Within this context the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test.'**

4.233. Paragraph 028 of the Flood Risk and Coastal Change PPG sets out 'What is a "reasonably available" site?' and states:

> **'Reasonably available sites' are those in a suitable location for the type of development with a reasonable prospect that the site is available to be developed at the point in time envisaged for the development.**
>
> **These could include a series of smaller sites and/or part of a larger site if these would be capable of accommodating the proposed development. Such lower-risk sites do not need to be owned by the applicant to be considered 'reasonably available'.**

4.234. Solar farm developments have specific technical requirements for a location to be suitable. These include good levels of solar irradiation, appropriate topography (large flat open areas of land) and proximity to an available connection to the national electricity transmissions system ('NETS') or grid with sufficient capacity for the electricity generated by the Proposed Development.

4.235. An Alternative Sites Assessment ('ASA') [EN010140/APP/7.1.2] has been produced which sets out the site selection process undertaken by the Applicant and includes an assessment of the environmental and operational constraints of the Site and alternative sites. The environmental and social constraints which affect the suitability of a site for solar farm development include topography and natural landforms; landscape designations and Green Belt; ecological designations; heritage designations; flood risk constraints; local development allocations; local planning designations and consented schemes; agricultural land classification; proximity to dwellings; brownfield land.

4.236. The ASA [EN010140/APP/7.1.2] proposes a 'search area' with a 5km radius around the Point of Connection ('PoC') to the grid. This search area is informed by the length of the cable route which could affect the environment, stakeholders and community during its construction and operation; the efficiency taking into account electrical transmission losses; and the capital costs which affects viability. In addition the search area is *'driven by the need for the Proposed Development's connection to the grid to be energised as one, rather than in a series of smaller projects'.* A series of smaller sites would therefore not be suitable for the type of development.

4.237. In addition, the search area is further restricted due to the presence of the River Ouse to the north and River Aire to the south of the PoC. Paragraph 2.6.3 of the ASA states:

> **'Bringing forward the Proposed Development on the opposite side of the river opposite to the grid connection point would result in unnecessary complexity for the Proposed Development's engineering solution. This would have additional disbenefits, likely resulting in potential programme delays with unknown commercial implications, which ultimately could be avoided if the Proposed Development was located elsewhere nearby. As such, this constraint aided the decision to dismiss the search area north of the River Ouse and south of the River Aire as part of the site selection process.'**

4.238. The 5km search area is shown on Drawing No. BL-M-4 Rev C reproduced in **Appendix 26**. Inspection of this Drawing indicates that the majority of the search area is classified as Flood Zones 2 and 3 with isolated areas of Flood Zone 1. The areas of Flood Zone 1 are associated with the higher areas of land predominately around areas of built development associated with human settlements such as the villages of Camblesforth, Carlton and Drax Power Station. The isolated smaller parcels of Flood Zone 1 are not considered suitable for the Proposed Development due to their proximity to human settlements in these areas. Inspection of this Drawing indicates that there are no areas of comparable size that are of a lower risk of flooding (i.e. extensive areas of Flood Zone 1).

4.239. The site selection process set out in the ASA [EN010140/APP/7.1.2] identifies that there are no alternative sites suitable for the Proposed Development within the search area taking into account the environmental and social constraints and that the Site is suitable for solar PV development.

4.240. On the basis that no alternative sites suitable for the Proposed Development within the search area have been identified and it can be concluded that there are no reasonably available sites appropriate for the proposed development in the search area with a lower risk of flooding, the Sequential Test can be satisfied.

4.241. By locating development in areas of Flood Zone 2 and 3a the scheme maximises the renewable energy generation potential of the Site and makes use of available capacity in the National Electricity Grid at this location taking into account other material planning and design considerations.

4.242. On this basis it is considered the Sequential Test is satisfied and that a solar farm is compatible at this location subject to satisfying the requirements of the Exception Test as discussed below.

Exception Test

4.243. The Proposed Development is located within Flood Zone 3a. Essential Infrastructure is appropriate in this zone provided the Exception Test is passed.

4.244. Paragraph 177 of the NPPF states:

> **'Having applied the sequential test, if it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.'**

4.245. Paragraph 178 of the NPPF states:

> **'The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. To pass the exception test it should be demonstrated that:**
>
> **a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and**
>
> **b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.'**

4.246. Paragraph 179 of the NPPF goes onto state:

> **'Both elements of the exception test should be satisfied for development to be allocated or permitted.'**

4.247. With respect to part a of the Exception Test, it is clear that renewable energy has wider sustainability benefits by reducing reliance on carbon-based fuels and meeting UK carbon emission and 2050 net zero targets. The nature of the Proposed Development satisfies part a of the Exception Test.

4.248. With respect to part b of the Exception Test, this FRA demonstrates that the proposed mitigation measures would ensure that the Proposed Development would be appropriately safe without increasing flood risk elsewhere.

4.249. The Proposed Development would not be occupied and therefore there would be no risk to users of the Proposed Development. During times of flood risk no personnel would be onsite or have access to the Site. Accordingly, the Proposed Development and its users would be safe.

4.250. Design flood mitigation measures are proposed to either raise sensitive equipment above the design flood level or protect the sensitive equipment from the fluvial and tidal design flood. These measures protect the equipment during the design flood, with an appropriate climate change allowance, and the appropriate design of support structures to withstand flood waters would ensure that the development would remain operational and safe in times of flood.

4.251. A level for level floodplain compensation scheme would be provided to mitigate the effect of the earth flood defence bund displacing flood waters during the fluvial 'credible maximum scenario sensitivity test' flood event. This event represents the potential fluvial flood risk at the end of the decommissioning period. These measures would ensure the risk of flooding elsewhere is not increased.

4.252. The early delivery of the Substation and BESS Compound floodplain compensation scheme adaptation measures is a precautionary approach and would result in flood risk betterment (a reduction in fluvial flood risk for the surrounding land) over the majority of the operational lifespan of the proposed development.

4.253. The provision of interception swales, discussed in Section 5 below, would have a minor benefit in reducing overland flows during extreme rainfall events. On this basis the Proposed Development would not increase flood risk onsite or elsewhere and would preserve the Site's natural drainage regime.

4.254. It is considered that the Proposed Development satisfies both the Sequential Test and the Exception Test, and that development within Flood Zones 3a is compatible with respect to flood risk.

5. SURFACE WATER DRAINAGE ASSESSMENT

Hydrological Effect of Solar Farm Developments

5.1. It is generally accepted that solar farm developments have a minimal effect on runoff rates as long as vegetation is maintained under and around the solar panels. The area of the Site where a solar farm development is located remains a predominately grassed field with discrete control equipment distributed across its area. This general view is supported by guidance, as summarised below, and quantified in the sections below.

5.2. The Building Research Establishment ('BRE') published its 'Biodiversity Guidance for Solar Developments'[40] in 2014. The report recognises that for most solar farm developments:

> **'normally only 25-40% of the surface is over-sailed by panels' and 'because panels are raised above the ground on posts greater than 95% of a field utilised for solar farm development is still accessible for plant growth …'**

5.3. Natural England's 'Technical Information Note TIN101: Solar Parks: Maximising Environmental Benefits'[41] states:

> **'The key to avoiding increased run-off and soil into watercourses is to maintain soil permeability and vegetative cover. Permeable land surfaces underneath and between panels should be able to absorb rainfall as long as they are not compacted and there is some vegetation to bind the soil surface.'**

5.4. In addition, Cook and McCuen's (2013) 'Hydrologic Response of Solar Farms'[42] research paper concludes that provided grass cover is maintained, the addition of solar panels over a grassy field has a limited effect on runoff volumes, the peak runoff and the time to peak. A copy of the research paper's abstract (with our emphasis added) is reproduced below:

> **'Because of the benefits of solar energy, the number of solar farms is increasing; however, their hydrologic impacts have not been studied. The goal of this study was to determine the hydrologic effects of solar farms and examine whether or not storm-water management is needed to control runoff volumes and rates. A model of a solar farm was used to simulate runoff for two conditions: the pre- and post paneled conditions. Using sensitivity analyses, modeling showed that the solar panels themselves did not have a significant effect on the runoff volumes, peaks, or times to peak. However, if the ground cover under the panels is gravel or bare ground, owing to design decisions or lack of maintenance, the peak discharge may increase significantly with storm-water management needed. In addition, the kinetic energy of the flow that drains from the panels was found to be greater than that of the rainfall, which could cause erosion at the base of the panels. Thus, it is <u>recommended that the grass beneath the panels be well maintained or that a buffer strip be placed after the most downgradient row of panels</u>. This study, along with design recommendations, can be used as a guide for the future design of solar farms.'**

[40] BRE (2014) Biodiversity Guidance for Solar Developments. Eds G E Parker and L Greene.
[41] Natural England (2011) Natural England Technical Information Note TIN101 Solar parks: maximising environmental benefits.
[42] Cook & McCuen (2013) Hydrologic Response of Solar Farms, Journal of Hydrologic Engineering, 18(5), 536-541.

5.5. It follows that the majority of the 'developed' Site for the proposed solar farm development would remain as 'soft' surface, with grassland around and underneath the solar panels, which in itself would minimise runoff from the Site.

5.6. For a typical solar farm development, the solar arrays are spaced to avoid any shadowing effect from one panel to another, with topography dictating the exact row spacing, which usually ranges between 3m and 4m. Between each row of solar panels is typically a 3m to 4m vegetated buffer strip, which contributes to slowing the flow of runoff across the development Site.

5.7. **Figure 17** shows a typical scene from an operational solar farm with vegetation cover between and under the solar arrays, which delays surface wate runoff and prevents soil erosion.

Figure 17: A Typical Operational Solar Farm (Credit: Energy Guide UK[43])

5.8. Soil compaction is limited during construction, operation, and decommissioning of solar farm developments. During construction, only light machinery is required to install the solar arrays and vehicle movements would be minimised. Low ground pressure vehicles are recommended during wet weather working. Any HGVs are usually restricted to a temporary construction compound near the Site's entrance. The majority of operational vehicle movements would be restricted to onsite access tracks to minimise the risk of soil compaction. These measures are set out in the Outline Soil Management Resource Plan provided with the Environmental Statement ('ES') at Appendix 14.3 [6.3.14.3] and w be refined in a detailed Soil Management Resource Plan to be secured by DCO requirement.

5.9. If necessary, to alleviate the effects of any compaction during the construction process, any affected areas are harrowed (or, if necessary, chisel ploughed or similar) and seeded.

5.10. During the operation of the Proposed Development, maintenance of the panels is expected to be infrequent, minimal and would only require light machinery. Thus, the infiltration rate of the underlying ground is unlikely to be changed by the Proposed Development.

5.11. During the operation of a typical solar farm development, the areas under and around the solar array would be suitable for grazing by livestock, typically sheep.

[43] Energy Guide UK (2023) Solar Panel Trackers. Available from: https://energyguide.org.uk/solar-trackers/ (Accessed on 22.05.23)

5.12. At present the Site is used for arable agriculture which requires periodic ploughing. Exposed soil is at a greater risk of erosion compared with a field with covering vegetation and can result in greater runoff. Upon completion of the solar farm, the Site would be grassed during the operational lifetime of the Proposed Development thereby reducing the risk of soil erosion and reducing potential runoff compared with the existing condition.

5.13. Taking into account the above, the proposed surface water management measures for the Proposed Development need to be proportionate to the minimal hydrological effect of solar farm developments. The effect of the Proposed Development on runoff rates and volumes is assessed below.

Sustainable Drainage Systems Guidance

5.14. The Proposed Development has an expected energy generating capacity in excess of the 50MW threshold for onshore generating stations in England and therefore constitutes a NSIP and the NPS therefore apply to the DCO application.

5.15. The Overarching NPS for Energy (EN-1) (January 2024) includes the requirement for appropriate arrangements to manage surface water including the use of SuDS.

5.16. Furthermore, paragraph 2.10.85 of the NPS for Renewable Energy Infrastructure (EN-3) states:

> **'Where access tracks need to be provided, permeable tracks should be used, and localised Sustainable Drainage Systems (SuDS), such as swales and infiltration trenches, should be used to control any run-off where recommended.'**

5.17. Whereas paragraph 2.10.154 of EN-3 states:

> **'Water management is a critical component of site design for ground mount solar plants. Where previous management of the site has involved intensive agricultural practice, solar sites can deliver significant ecosystem services value in the form of drainage, flood attenuation, natural wetland habitat, and water quality management.'**

5.18. Paragraph 55[44] in the Flood Risk and Coastal Change planning practice guidance advises that SuDS are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. SuDS can contribute to reducing the causes and impacts of flooding and deliver a wider range of additional biodiversity and environmental net gains.

5.19. Guidance on the design and construction of SuDS is provided in Ciria C753 'The SuDS Manual'[45].

5.20. The principles of the sustainable drainage strategy for the Proposed Development, involving the implementation of SuDS as promoted by the designated NPS and NPPF, are discussed below.

[44] Department for Energy Security and Net Zero (2023) Guidance Flood risk and coastal change - Sustainable drainage systems. Available from: https://www.gov.uk/guidance/flood-risk-and-coastal-change#para55 (Accessed on 22.05.23).
[45] CIRIA (2015) The SuDS Manual (Version 6 including 2016, 2018, 2019) CIRIA C753.

Natural Flood Risk Management Guidance

5.21. Paragraph 64 of the Flood Risk and Climate Change planning practice guide states:

> **'Natural flood management techniques work with natural processes to protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast. They aim to manage the sources and pathways of flood waters whilst providing wider benefits to people, wildlife and the environment.'**

5.22. Ciria published the Natural Flood Management Manual (C802)[46] in 2022 which provides further background information and guidance on the different Natural Flood Management ('NFM') measures that can be implemented to reduce flood risk. NFM measures can be used across the landscape to protect, restore or mimic the natural hydrological processes that occur. These include increasing infiltration of water, slowing the flow of water across the landscape, storing water, and holding back sediment. NFM can also deliver co-benefits such as habitat creation and biodiversity enhancement, soil improvement and retention and water quality improvements.

5.23. The Manual divides NFM into 13 broad categories of which soil and land management, runoff management, and runoff storage are particularly relevant to solar farm developments.

5.24. Soil and land management techniques include changes to land management practices to reduce soil compaction, and encourage more natural habitats to restore or enhance the ability of the soil to infiltrate and store water. Additional vegetation will increase interception and evapotranspiration and an improved soil structure can increase evaporation from the near-surface soil and this can be achieved through the use of cover crops and reduced till techniques (reduced ploughing). Permanent vegetation cover therefore increases surface roughness and maintains soil structure, slowing the flow of runoff.

5.25. Runoff management techniques include buffer strips to interrupt or divert overland flow pathways across the landscape and encourage infiltration into the ground, slowing the flow and diverting water away from problematic locations. As described above, vegetation in buffer strips will increase onsite interception and evapotranspiration. Encouraging areas of temporary standing water and waterlogged ground stores water on the land surface, increasing the potential for evaporation losses.

5.26. Runoff storage techniques include scrapes, bunds and swales to store water on overland flow pathways to reduce the flow towards a watercourse and encourage infiltration. As well as increasing the potential for evaporation losses, these techniques can be used to lengthen the flow pathway, slowing the progress of runoff across the landscape. In addition, infiltration losses increase with increased residence time and even on sites with relatively impermeable ground conditions, long residence time will still encourage infiltration losses.

5.27. The use of both multifunctional SuDS and NFM techniques to manage flood risk from development sites is recognised in paragraph 49 of the Flood Risk and Coastal Change planning practice guidance.

5.28. The nature of solar farm developments in rural locations with minimal impact on runoff rates or volumes mean that NFM techniques are an appropriate means of managing surface water runoff from the Proposed Development that would contribute to delivering flood risk betterment and reducing flood risk overall. NFM techniques are considered in the section below in addition to SuDS techniques.

[46] CIRIA (2022) The natural flood management manual CIRIA C802.

Proposed Surface Water Management Measures

5.29. A sustainable drainage strategy, involving the implementation of SuDS and NFM techniques, is proposed for managing the surface water runoff from the Proposed Development.

Management of Runoff from Solar Panels and Ancillary Control Equipment

Runoff Rate Assessment

5.30. The NPS for Renewable Energy Infrastructure (EN-3) sets out policy on solar PV schemes >50 MW in England. EN-3 identifies indicative impacts of solar schemes which could require assessment by the application. With respect to flood risk and drainage paragraph 2.10.84 states:

> **'As solar PV panels will drain to the existing ground, the impact will not, in general, be significant.'**

5.31. The Proposed Development would have a very limited extent of impermeable ground cover. The area beneath the solar panels would remain grassed and the infiltration rate would not adversely change as a result of the Proposed Development.

5.32. The excavation of cable trenches, which are backfilled with a granular surround to the cables and then backfilled with excavated material, potentially increases the infiltration capacity of the Site as the cable trenches act as land drains.

5.33. Nonetheless, rainwater falling onto each panel would drain freely onto the ground beneath the panel and infiltrate into the ground at the same rate as it does in the Site's existing greenfield state as indicated in TIN101. Thus, the total surface area of the solar PV array will not be considered an impermeable area in this assessment, only the area taken up by the panel supports.

5.34. Similarly, it can be assumed that any rainwater falling onto the permeable access tracks would soak into the ground beneath or adjacent to the tracks at the same rate that it presently does. Upon construction of the Proposed Development, the access tracks would only be infrequently trafficked by maintenance vehicles (van or small tractor). The specification of the access tracks as per Figure 5 will be suitably robust to ensure any compaction as a result of vehicle loading does not compromise the 'permeability' of the structure. Due to the proposed construction of the access tracks and limited vehicle loading the risk of compaction of onsite access tracks over time is assessed as low.

5.35. The effect of the Substation and BESS Compound are considered separately in the sections below.

5.36. The extent of impermeable area created as a result of the Proposed Development is summarised in **Table I** below.

Table I: Created Impermeable Areas

	Quantity	Unit Area (m^2)	Total Area (m^2)
Piles	54,875	0.0044	241.45
Concrete Ballast Foundations[1]	1,421	2.50 x 0.50 = 1.25m	1,776.25
Inverters Stations	28	12.20 x 2.40 = 29.28	819.84
Total Impermeable Area			2,837.54
Solar Farm Zone Area (within security fence)			2,977,387.51
Total Impermeable Area = 0.10% of Total Site Area			

Notes:
1 Concrete ballast foundations calculated from dimensions from 'Elevations with Archaeological mitigation' drawing at Figure 3.17 [6.2.3.17].
2 Calculations exclude the BESS facility which is assessed separately below.

5.37. In is baseline greenfield state, the Site is considered to be 100% undeveloped. As a result of the Proposed Development, the extent of impermeable area would be approximately 2,838 m^2 or 0.10 % of the total Solar Farm Zone area.

5.38. The EA's report Rainfall Runoff Management for Developments [Report – SC030219][47] published in October 2013 provides advice on the management of stormwater drainage for developments including the calculation of greenfield runoff. The report states:

> **'The EA will normally require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year event) the developed rate of runoff into a watercourse should be no greater than the undeveloped rate of runoff for the same event based on the calculation of Q_{BAR} or Q_{MED} and the use of FSSR growth curves.'**

5.39. Table 1 of that Report states that for developments between 0 ha and 50 ha, the Institute of Hydrology (IH) Report 124 Flood Estimation for Small Catchments (1994)[48] method (the 'IH 124 Method') can be used to estimate the greenfield Site flow rate, Q_{BAR} (the Mean Annual Flood).

5.40. By examining the maps contained in Volume V of the Flood Studies Report – NERC:1975[49], the Standard Average Annual Rainfall ('SAAR') and Winter Rain Acceptance Potential ('WRAP') can be used to determine in which Soil Index Class a given site is located, and the corresponding Soil Index value is then used to calculate Q_{BAR} using the IH 124 Method.

5.41. The FSR WRAP Map, shown in Appendix 6, indicates that the Site is located in 'Soil Index Class 2', and a corresponding Soil Index value of 0.3 has been used to calculate Q_{BAR} using the IH 124 Method.

[47] EA (2013) Rainfall Runoff Management for Developments [Report – SC030219]
[48] Institute of Hydrology (1994) Report No. 124 Flood Estimation for Small Catchments.
[49] Natural Environment Research Council (1975) Flood Studies Report

5.42. Q_{BAR} has been calculated for the Site in both the baseline undeveloped 'greenfield' and operational states. Copies of the Micro Drainage greenfield runoff calculations are included in **Appendix 27**. A summary of the pre-development baseline and operational development for the various return period events is shown in **Table J**. The mean annual peak rate of runoff, referred to as Q_{BAR} in IH 124 Method, for the baseline pre-development greenfield Site is 390.5 l/s; for the operational development Site Q_{BAR} is calculated as 391.4 l/s.

Table J: Solar Farm Runoff Rates Assessment

Return Period (Years)	1	Q_{BAR}[a]	30	100
Greenfield Runoff Rates (l/s)	335.9	390.5	686.5	812.3
Operational Development Unmitigated Runoff Rate (l/s)	336.6	391.4	687.9	813.8

[a] Q_{BAR} = Mean Annual Flood with an approximate return period of 2.3 years.

5.43. The calculations contained in **Appendix 27** quantify the effect of the proposed solar farm on greenfield runoff rates. These calculations demonstrate that the effect of the Proposed Development on Q_{BAR} runoff rates would be negligible and only equates to an increase of 0.9 l/s of the greenfield runoff rate across the 297.739 Ha of the Site where solar arrays are proposed (or 0.23 % of the greenfield runoff rate).

Runoff Volume Assessment

5.44. The Depth-Duration-Frequency ('DDF') Model function was used in the Flood Estimation Handbook ('FEH') web service[50] to calculate the depth of rainfall from a 24-hour, 100-year storm event at the Site. The results of this calculation are shown on **Figure 18** below. The rainfall depth is uplifted to take into account the effect of climate change over the lifetime of the Proposed Development. Thus, the 24-hour, 100-year plus climate change design rainfall for the Site is 101.56mm (or 0.102m) (78.12 x 1.3). The total extent of impermeable area created as a result of the Proposed Development would be 2,838 m^2. The volume of runoff generated by this rainfall event falling on 2,838 m^2 impermeable area calculated by this method equates to 289.48 m^3.

5.45. On this basis, the additional runoff generated in the extreme 24-hour duration, 1 in 100 year storm event, including an allowance for climate change, would amount to approximately 289.5 m^3.

[50] UK Centre for Ecology & Hydrology (2023) Flood Estimation Handbook Web Service. Available from: https://fehweb.ceh.ac.uk/ (Accessed on 22.05.23)

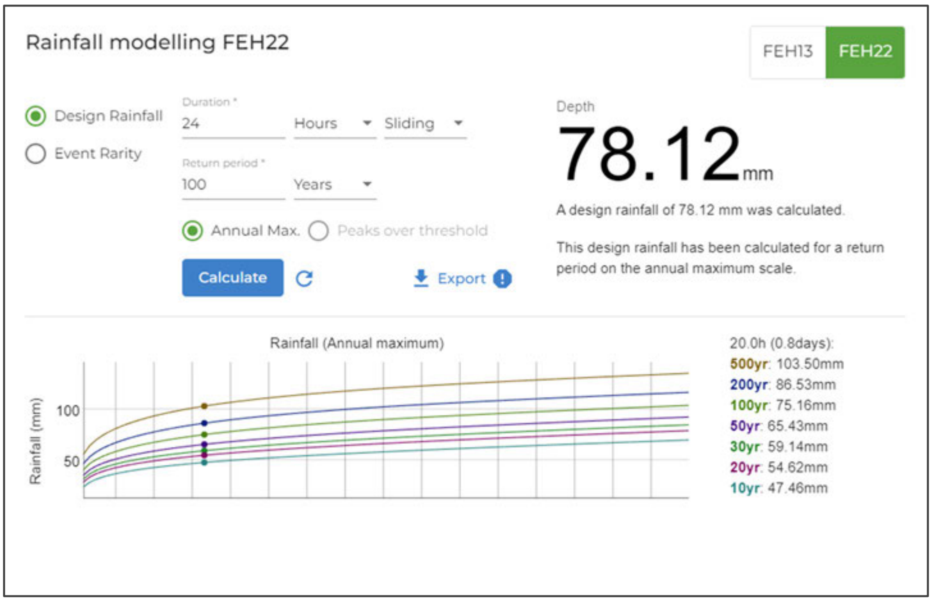


Figure 18: Depth-Duration-Frequency (DDF) Modelling Outputs

Conversion to Pasture

5.46. The proposed conversion to pasture under and around the solar arrays is a key mitigation measure for reducing runoff from the Proposed Development and would be a significant improvement on the existing situation which requires periodic ploughing, exposing soil and temporarily increasing runoff rates.

5.47. Vegetation cover would be maintained in the areas around the solar panels and field margins throughout the lifetime of the development to minimise the risk of soil erosion, reduce runoff rates and promote infiltration and interception losses. Between each row of solar panels and around the margins of the Site, a 3 – 10m vegetated buffer strip is proposed which would contribute to slowing the flow across the Solar Farm Zone in accordance with the good practice suggested by Cook and McCuen.

5.48. The approach to the management of grassland on the Site is set out in the outline Landscape Environmental Management Plan ('oLEMP') [6.3.7.7]. The Proposed Development would incorporate several grassland types to suit the underlying conditions and where possible enhance biodiversity. Existing Arable land within proposed perimeter fence would form 'grazing pastures' (Boston Seeds BS MeadowMax, or similar approved). Areas outside the proposed perimeter fence will form 'tussock grassland' (with Emorsgate Tussock Mixture EM10, or similar approved). These areas will be supplemented by wildflower and wet meadow grassland where appropriate.

5.49. The oLEMP [6.3.7.7] sets out management measures to establish and maintain the grassland areas. These measures ensure that vegetation cover would be well established and maintained across the Site minimising the risk of bare earth occurring and mitigating the effect of the Proposed Development on runoff rates, volumes or time to peak. The measures set out in the oLEMP would be secured by secured by a suitably worded DCO Requirement requiring a detailed LEMP setting out how the landscape planting to be established, managed and maintained over the lifetime of the Proposed Development.

5.50. Natural England encourages existing land drainage to be maintained. Existing onsite drainage ditches or features would therefore be retained in their existing state, and would continue to intercept overland flows from the Site.

5.51. The majority of the Site lies in relatively low gradient land. The proposed conversion to pasture around and under the solar arrays and maintaining vegetation cover would reduce the risk of soil erosion.

Interception Swales

5.52. As discussed above, the mitigation of runoff from solar panel areas, and areas of discrete control equipment, would primarily be achieved by the conversion of the Site to pasture. Nonetheless, interception swales are provided as part of the Proposed Development to intercept runoff, 'slow the flow' and provide flood risk betterment in accordance with industry best practice.

5.53. Whilst it is considered that the solar PV panels oversailing grassland pasture would not result in a material increase in surface water runoff, it is proposed to provide a SuDS arrangement by way of interception swales in the lower areas of the Site to intercept extreme flows which may already run offsite. It is emphasised that the swales do not form part of a formal drainage scheme for the Proposed Development but are provided as a form of 'betterment' intercepting existing overland flows. The proposed interception swales are designed to have a significantly larger capacity than the increase in runoff volume created by the discrete control equipment distributed around the 475 Ha Site.

5.54. The approach is considered a practical implementation of Rural Sustainable Drainage Systems ('RSuDS')[51] as a means of intercepting runoff and 'slow down flow' with the aim to form 'micro-wetlands' for the benefit of farmland biodiversity and encourage localised recharge of groundwater whilst providing a degree of flood risk betterment. The concept of RSuDS has evolved into the broader field of Natural Flood Risk Management (NFM) and Working With Natural Processes methodology (WWNP). The EA's WWNP evidence base, published in February 2018, lists swales as a form of 'runoff pathway management'. These techniques aim to delay and even flatten the hydrograph and reduce peak flow locally for small events by intercepting, slowing and filtering of surface water runoff and encouraging infiltration and soil water storage. The use of interception swales is a practical implementation of a NFM runoff storage technique.

5.55. The proposed drainage arrangements, showing the indicative interception swale locations which are situated having regard to overland flow routes, are shown on Drawing Nos. E216/90-106 Rev C contained in **Appendix 28**.

5.56. The purpose of the interception swales is simply to intercept runoff and encourage depression storage within the feature during the extreme storm event, promoting interception losses by infiltration or evapotranspiration and providing runoff pathway management. As such no specific overflow mechanism is proposed for the Proposed Development. Interception swales would overtop as sheet runoff and overland flow would follow the natural topography as per the pre-development baseline situation. This 'simplified' approach to runoff management is considered appropriate and proportionate to the type of development and magnitude of the effect discussed above and is readily reversible at the end of the operational lifespan of a solar farm development, during the Proposed Development's decommissioning phase.

5.57. The interception swales are proposed around the perimeter and at low points of the Site as a series of discrete 'stepped' units parallel to the Site's contours and perpendicular to the slope to ensure flows are not concentrated or conveyed downhill.

[51] EA (2012) Rural Sustainable Drainage Systems (RSuDS)

5.58. Interception swales are typically formed by creating shallow depressions a minimum of 0.2m deep, with 1 in 3 side slopes, and a base width of 0.5m along the lower boundaries of the Site as shown on the typical details in **Appendix 28**.

5.59. The interception swales have no formal discharge arrangements but would gradually empty by a process of infiltration, evaporation, and evapotranspiration and provide runoff pathway management. Exceedance flows would be managed by overland flow routing which mimic the natural greenfield response of the Site.

5.60. The storage volume of the interception swales has been calculated on the basis that the swales would be 1/2 full (incorporating a 0.1m freeboard). The interception swales provide a total storage volume of approximately 398m^3. This is greater than the volume of additional runoff generated as a result of the 24-hour, 100 year plus climate change rainfall event (289.5m^3). It is therefore considered that the interception swales would adequately mitigate any increase in runoff volume generated as a result of the minor increase in impermeable area created by the discrete control equipment and would be beneficial in reducing the potential runoff from the Site in more extreme storm events.

5.61. Interception swales would be sown with the appropriate seed mix upon construction and vegetation would be maintained by the landowner thereafter for the lifetime of the Proposed Development.

5.62. The interception swales would be located outside of any Root Protection Zones, would not be located within 7m of any ordinary watercourses or drainage ditches and would respect the natural topography in accordance with local bye-laws.

5.63. Considering the above, the designed volume of depression storage provided in the interception swales for the Proposed Development would be more than sufficient to mitigate the change in runoff rates and volumes created by the ancillary control equipment distributed across the Site.

5.64. Where ancillary control equipment is located in an area of elevated fluvial and tidal flood risk it would be protected by a suitably designed earth flood defence bund. As such the negligible additional runoff volume generated by this equipment would be retained in the bunded area and would naturally infiltrate into the ground. The presence of earth flood defence bund further mitigates the effect of the Proposed Development on runoff rates.

Management of Runoff From Substation and BESS Compound

5.65. The BESS Compound consists of a series of Glass Reinforced Plastic ('GRP') kiosks or shipping containers which contain the necessary equipment within the compound which is enclosed by an earth flood mitigation bund. The entirety of the BESS Compound, including the areas beneath the filter drains and porous sub-base, would be lined with an impermeable liner (geomembrane, or similar) to prevent the formation of a pathway between the surface and underlying aquifer. The use of an impermeable liner requires the surface water runoff from the entire BESS Compound to be appropriately managed to ensure flood risk is not increased elsewhere. The proposed surface water management measures to manage runoff from the lined BESS Compound are outlined in the section below.

Selby Area IDB Advice

5.66. The Site falls within the area administered by the Selby Area IDB. The Selby Area IDB's purpose is to manage water levels within the low-lying catchments of the River Aire and River Ouse with the aim of protecting people and their property and their byelaws apply, controlling activities along these watercourses.

5.67. The Selby Area IDB S42 response to the Statutory Consultation Submission at PEIR stage of the DCO application stated:

> **'If the surface water is to be discharged to any ordinary watercourse within the Drainage District, Consent from the IDB would be required in addition to Planning Permission, and would be restricted to 1.4 litres per second per hectare or greenfield runoff and no increase in volume.'**

Runoff Rate Assessment

5.68. The Interim Code of Practice ('ICP') SuDS module in the Micro Drainage design software enables the calculation of greenfield runoff rates based on the IH Report 124 estimation method with pro-rata values for sites smaller than 50 ha. Copies of the Micro Drainage greenfield runoff calculations for the BESS Compound are shown in **Figure 19** below.

```
                ICP SUDS Mean Annual Flood

                         Input

Return Period (years)      1          Soil    0.300
           Area (ha)   2.600         Urban    0.000
           SAAR (mm)     625 Region Number Region 3

                    Results   l/s

                 QBAR Rural  4.1
                 QBAR Urban  4.1

                    Q1 year  3.6

                    Q1 year  3.6
                  Q30 years  7.3
                 Q100 years  8.6
```

Figure 19: BESS Area and Substation Greenfield Runoff Rate

5.69. As set out above the Selby Area IDB runoff rate restriction of 1.4 l/s/ha equates to 3.6 l/s for the 2.60 ha Substation and BESS area. This is less than the greenfield Q_{BAR} rate for the BESS Compound (4.1 l/s).

5.70. It is proposed to limit the developed rate of runoff to 1.4 l/s/ha (3.6 l/s) for the BESS Compound for all rainfall events up to the 100-year return period event, including an allowance for climate change. As such the Proposed Development would reduce flood risk overall when compared to existing greenfield runoff rates.

BESS Compound Proposed Surface Water Management Measures

5.71. SuDS is proposed for managing the disposal of surface water runoff from the Proposed Development associated with the BESS Compound (including the Substation). It is proposed that the runoff from the BESS compound would be collected by a series of filter drains in three sub-catchments. Flows would be conveyed to the filter collector drains by overland flows and via sub surface flows within the porous subbase of the BESS compound. Filter drains would then convey runoff to three attenuation basins designed with sediment forebays to enhance water quality and promote sediment deposition.

5.72. The underlying groundwater is a sensitive receptor. In addition to the above embedded design mitigation measures, as a failsafe and as a precautionary measure a water quality devices (such as a downstream defender supplied by Hydro International, or similar approved) would be fitted to the outfalls from the attenuation basins to further safeguard the quality of day-to-day runoff from oils, debris and sediments. Runoff would be discharged at a controlled rate into the onsite drainage ditches/watercourses.

5.73. To achieve the minimum discharge rates and the Selby Area IDB runoff rate restrictions, the flow rates have been assigned pro rata between three attenuations basins and their associated sub-catchments to ensure the combined discharge rate does not exceed the Selby Area IDB restriction.

5.74. In smaller sub catchments it is proposed that the outflow rate is constrained to 1 l/s which is considered to be the practical minimum discharge rate (taking into account the enhanced blockage risk at low flow rates).

5.75. Flow controls would be utilised at the outfall to restrict runoff to the lowest practical discharge rate with the overall combined discharges being in accordance with the Selby Area IDB restriction of 1.4 l/s/ha. The Preliminary BESS and Substation Drainage Strategy is shown on Drawing No. E216/88 Rev D contained in **Appendix 29**.

5.76. The flow controls would be provided in the form of a vortex flow control device (HydroBrakes or similar approved) located in manhole chambers. The outfalls to the drainage ditches would be fitted with remotely controlled and automated penstocks, which utilise telemetry, to allow for containment during a contamination event. The outfall structures would be fitted with non-return valves to prevent backflows into the drainage system.

5.77. The proposed drainage strategy would ensure that surface water arising from the Proposed Development would be managed in a sustainable manner to mimic the surface water flows arising from the Site prior to the Proposed Development, while reducing the flood risk to the Site itself and elsewhere, taking climate change into account.

5.78. To demonstrate that the attenuation basins are appropriately sized to attenuate the runoff from the lined BESS Compound, a Micro Drainage Source Control model has been created. The effect of the 1 in 100 year storm event including a 30% allowance for climate change has been simulated. Inspection of the Micro Drainage simulation results contained in **Appendix 30** demonstrates that the attenuation basins are suitably sized and runoff would be restricted to the lowest practical discharge rate of 1 l/s whilst also being in accordance with the IDB's runoff rate requirements. The Micro Drainage results outputs are summarised in **Table K** below.

Table K: Substation and BESS Compound Modelling Results Summary

Catchment	Selby IDB Restriction (1.4 l/s/ha)	Greenfield Runoff (l/s)		1:1 Return Period			1:100+30%CC Return Period		
		Q_1	Q_{100}	Outflow Rate (l/s)	Max Attenuation Storage Volume (m^3)	Flood	Outflow Rate (l/s)	Max Attenuation Storage Volume (m^3)	Flood
Attenuation Basin 1	3.6 l/s	3.6	8.6	1.0	~98	No Flooding	1.0	~447	No Flooding
Attenuation Basin 2				1.0	~152	No Flooding	1.0	~674	No Flooding
Attenuation Basin 3				1.6	~355	No Flooding	1.6	~1,560	No Flooding

5.79. From an inspection of **Table K** and the Micro Drainage results output in **Appendix 30**, it can be seen that there would be no flooding during the 1 in 100 year storm events, including an appropriate allowance for climate change, and that the outflow rate would be below the greenfield runoff rate for the higher return periods which accords with good practice advice. **Table K** also illustrates the combined discharge rate from attenuation basins does not exceed the IDB's runoff rate restriction (3.6 l/s) for the BESS Compound. Therefore, on the basis of the preliminary calculations, suitably designed attenuation basins could accommodate runoff from impermeable areas associated in the BESS compound.

Fire Water

5.80. The surface water drainage strategy for the BESS Compound has been devised to minimise the risk of pollution in the event of a fire and to contain and manage runoff.

5.81. The entire BESS Compound area, including the areas beneath the filter drains and porous sub-base, would be lined with an impermeable liner (geomembrane, or similar) to minimise the risk of a pathway forming between the surface and underlying aquifer. Any joints in the impermeable liner would be appropriately sealed to prevent leakage to ground.

5.82. A more detailed specification of the impermeable liner used would be provided at detailed design, with the necessary details subject to approval from the local planning authority as per Requirement 3 of the dDCO. The detailed design of the impermeable liner would take into account best practice design guidance and any geomembrane liner product and installation would comply with the relevant British Standard and manufacturers recommendations.

5.83. The presence of the flood defence bund and remotely operated / automated penstocks which utilises telemetry on the outfalls from the surface water drainage system to the ditch/watercourse network would contain runoff in event of a fire. An appropriate product would be specified at detailed design such as 'ToggleBlok' supplied by Sandfield Penstock Solutions (or similar approved). The penstock and telemetry could be linked to the onsite monitoring system which would monitor the site for any unusual activity (such as malfunctions or even fire) and penstocks would be automated to close in the event of the alarm being triggered. A more detailed specification of the penstocks and onsite telemetry would be provided at detailed design, with the necessary details subject to approval from the local planning authority as per Requirement 3 of the dDCO.

5.84. In accordance with the National Fire Chiefs Council (NFCC) document entitled 'Grid Scale Battery Energy Storage System planning – Guidance for FRS' (Version 1.0) dated November 2022 above ground tanks are provided adjacent to the Substation and BESS Compound to supply water in the event of an emergency. The volume of water allowed for is approximately 228 m^3 (1,900 litres per minute for two hours).

5.85. In the unlikely event of a fire, the automated penstocks on the outfalls would be closed remotely and any resulting runoff would be contained in the surface water drainage system. The proposed SuDS features have 1,314m^3 additional volume within the 'freeboard' allowance which is significantly in excess of the volume of water required to be supplied on the Site for a fire response.

5.86. If contamination is found to be present the contaminated water could be tankered away for offsite treatment and disposal.

Water Quality Assessment

5.87. Effective controls, such as spill containment, proper storage, and runoff management, are essential to mitigate risks and protect water quality. The proposed Surface Water Drainage Strategy incorporating Source Control (filter drains / porous subbase) and Strategic SuDS Features (attenuation basins) provides treatment of surface water runoff. With reference to Chapter 26 of the CIRIA SuDS Manual 2015 a water quality assessment of the proposed Surface Water Drainage Strategy has been undertaken using the simple index approach.

5.88. To deliver adequate treatment, the SuDS features should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type):

Total SuDS mitigation index > pollution hazard index

5.89. Where the mitigation index of an individual feature is insufficient, two features (or more) in series will be required, where:

Total SuDS mitigation Index = mitigation index$_1$ + 0.5(mitigation index$_2$) + etc

5.90. From Table 26.2 in the CIRIA SuDS Manual 2015 the pollution hazard indices for each contaminant type for the proposed land use comprising equipment and access roads are shown in **Table L** below.

Table L: Pollution Hazard Indices

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Other roofs as a proxy for equipment (typically commercial/industrial roofs)	Low	0.3	0.2	0.05
Low traffic roads and non-residential car parking with infrequent change i.e. < 300 traffic movements/day as a proxy for internal access roads	Low	0.5	0.4	0.4

5.91. From Table 26.3 in the CIRIA SuDS Manual 2015 the indicative SuDS mitigation indices for discharges to surface waters for different SuDS features which could be utilised on the development site are shown in **Table M** below.

Table M: Indicative SuDS Mitigation Indices for Discharges to Surface Waters

Type of SuDS Feature	TSS	Metals	Hydrocarbons
Filter drain	0.4	0.4	0.4
Detention basin	0.5	0.5	0.6
Water Quality Device Downstream Defender Votex (Supplied by Hydro International)	0.3	0.2	0.2

5.92. **Table N** below summarises the catchment areas on the development site, the associated pollution hazard indices and the appropriateness of the proposed SuDS feature to deliver adequate treatment.

Table N: Total Mitigation Index

Catchment	Pollution Hazard Level	SuDS Feature	SuDS mitigation index					
			Total suspended solids (TSS)		Metals		Hydrocarbons	
			SuDS Mitigation Index *[Target]*	Pass / Fail	SuDS Mitigation Index *[Target]*	Pass / Fail	SuDS Mitigation Index *[Target]*	Pass / Fail
Equipment	Low	Filter Drain + Detention Basin + Water Quality Device	0.4 + (0.5x0.5) + (0.5x0.3) = 0.8 *[0.3]*	P	0.4 + (0.5x0.5) + (0.5x0.2) = 0.75 *[0.2]*	P	0.4 + (0.5x0.6) + (0.5x0.2) = 0.8 *[0.05]*	P
Internal Access Roads	Low	Filter Drain + Detention Basin + Water Quality Device	0.4 + (0.5x0.5) + (0.5x0.3) = 0.8 *[0.5]*	P	0.4 + (0.5x0.5) + (0.5x0.2) = 0.75 [0.2]	P	0.4 + (0.5x0.6) + (0.5x0.2) = 0.8 *[0.4]*	P

5.93. With reference to **Table N** above it can be seen that the total pollution mitigation equals or exceeds the pollution hazard index (for each contaminant type) for the proposed land uses and so the proposed surface water drainage scheme delivers adequate water quality treatment.

5.94. The embedded design mitigation measures in the form of the design of the surface water drainage scheme incorporating SuDS Features (filter drains and detention basins) and a supplementary water quality devices would intercept potential contaminates (sediments, hydrocarbons etc) and provide a level of treatment (such as adsorption[52] and bioremediation[53] within the topsoil/filter media and/or UV action) which would safeguard the quality of surface water discharging from the Substation and BESS Compound to the adjacent drainage ditches and indirectly to the underlying aquifer.

5.95. In addition to the design mitigation measures described above, operational controls to monitor for, prevent, and manage spills and leaks within the Substation and BESS Compound will be set out in the updated outline OEMP recommending additional detailed controls in a Site Maintenance Plan and a detailed OEMP will be secured by a DCO requirement.

5.96. The combined effect of embedded design mitigation measures and operational controls reduce the potential risk of contamination from the day-to-day operation of the Substation and BESS Compound on the quality of surface water runoff and indirect risk to underlying groundwater to an acceptable level.

[52] Adsorption is the process of the adherence of gas, liquids or dissolved solids to the surface of solids (such as clay particles within the soil).
[53] Bioremediation is the treatment processes that use microorganisms (usually naturally occurring) such as bacteria, yeast, or fungi to break down hazardous substances and pollutants.

Summary of Surface Water Management Measures

5.97. The Proposed Development and mitigation measures described in this FRA are compatible with NFM and retain existing ditch / watercourse network that crosses the Site. Through conversion to grassland pasture and the introduction of interception swales creating significant amount of onsite depression storage, the Proposed Development would restore and enhance natural hydrological processes to 'slow the flow', providing a benefit in reducing overland flows during extreme rainfall events. Shallow attenuation basins utilising flow controls would provide attenuation storage mitigating the effect of the BESS area and substation on surface water runoff. On this basis, the Proposed Development would not increase flood risk onsite or elsewhere and would preserve the Site's natural drainage regime; and is considered a proportionate approach to surface water management on a rural solar farm development and is a practical implementation of NFM.

SuDS Construction and Maintenance

5.98. The interception swales and attenuation basins would be maintained throughout the modelled operational lifetime of the Proposed Development by the landowner generally in accordance with the recommendations in CIRIA C753 '*The SuDS Manual*'. The maintenance procedures are set out in **Table O.** The maintenance of the SuDS Features would be set out in the oLEMP with details to be provided in a detailed Landscape Environmental Management Plan ('LEMP') to be secured by an appropriately worded DCO requirement.

Table O: SuDS Maintenance Procedures

Maintenance Schedule	Required Action	Frequency
Interception Swales		
Regular Maintenance	Litter and debris removal.	As required.
	Grass cutting or animal grazing – to retain grass height to site owner's specification.	As required.
	Manage other vegetation and remove nuisance plants.	Monthly (as stated, then as required)
Occasional Maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible.	Annually
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required.	Annually, or if bare soil is exposed over 10% or more of the swale treatment area.
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding.	As required.
	Re-level 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.
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip.	As required.
Monitoring	Inspect infiltration surfaces for ponding, compaction, and silt accumulation. Record areas where water is ponding for > 48 hours.	Monthly, or when required.
	Inspect surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.

Maintenance Schedule	Required Action	Frequency
	Attenuation Basins	
Regular Maintenance	Remove litter and debris	Monthly
	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, non return valve, other mechanical devices and telemetry systems	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 (as set out in Chapter)
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 Actions	Repair erosion or other damage by reseeding or Re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Construction of SuDS

5.99. A drainage check sheet is reproduced in **Appendix 31**. The use of a single check sheet would ensure that any drainage issues are picked up at an early stage.

5.100. In circumstances where little vegetation cover is present on commencement of construction, it is recommended that the interception swales are provided at the outset. Similarly, if during construction it is evident that the surface of the Site is becoming significantly disturbed, then implementing interception swales immediately would act to restrict potential runoff and act as silt traps.

5.101. If, however, the Site remains “clean” and vegetated during construction, it would be advisable to leave the construction of the interception swales to the end of the construction programme so as to maximise the benefits of the existing vegetation cover.

5.102. The timing of the provision of the interception swales is therefore a matter for the construction site manager to determine.

6. CONCLUSIONS

6.1. This FRA has been prepared on behalf of the Applicant in connection with the Proposed Development on land to the south west of the village of Camblesforth, North Yorkshire. This FRA supports an application for a DCO and has been updated to collate additional submissions made to the EA within the Examination period.

6.2. The main part of the Site, referred to on the Parameter Plan, Figure 3.2 [6.2.3.2] of the ES, as the Solar Farm Zone, is situated to the south west of the village of Camblesforth, to the north of the village of Hirst Courtney and Hirst Road, to the south of the A1041 and to the east of the Selby Branch of the East Coast Mainline railway. The Site is located within the administrative area of North Yorkshire Council. The Underground Cable Corridor for the Proposed Development extends to the east of Drax Power Station. The overall Site comprises around 475 hectares and encompasses a number of interconnected parcels of predominantly agricultural land, consisting of fields used for grazing and arable cropping.

6.3. The Proposed Development comprises the construction of a solar farm consisting of ground mounted PV modules mounted on metal frames, with associated site infrastructure, ancillary control equipment, energy storage and an underground connection to the local electricity grid.

6.4. With reference to the GOV.UK's Flood Map for Planning (Rivers and Sea), the majority of the Site falls within Flood Zone 3 with smaller areas of Flood Zone 2 and Flood Zone 1. This is due to the Rivers Ouse to the north and River Aire to the south which converge to the east of the Site. Due to the presence of flood defences along the River Aire and River Ouse, the areas of Flood Zone 3 on the Site are defined as Flood Zone 3a. Solar farms are compatible in areas of Flood Zones 1, 2 and 3a.

6.5. The Sequential Test is a risk-based approach used to locate development to the lowest risk areas available. A solar farm of the proposed magnitude of the Proposed Development requires an appropriate connection to the National Electricity Grid where there is available capacity. The area in the vicinity of the Site are classified as Flood Zones 2 and 3 and areas of lower risk of flooding (Flood Zone 1) are limited when other material planning considerations (landscape, agricultural land quality etc) and design considerations (slope of site and aspect) have been taken into account which also have implications for the suitability of sites for renewable energy schemes. The site selection process set out in the ASA [EN010140/APP/7.1.2] identifies that there are no alternative sites suitable for the Proposed Development within the search area taking into account the environmental and social constraints and that the Site is suitable for solar PV development. On the basis that no alternative sites suitable for the Proposed Development within the search area have been identified and it can be concluded that there are no reasonably available sites appropriate for the proposed development in the search area with a lower risk of flooding and the Sequential Test can be satisfied.

6.6. A solar farm is classed as essential infrastructure and so the Exception Test is passed owing to the fact that the wider sustainability benefits provided by the solar farm outweigh the flood risks; also, the measures proposed in this FRA would make the development safe for its users without increasing flood risk elsewhere.

6.7. EA maintained flood defences are present in the vicinity of the Site on both the River Ouse and River Aire. The flood defences provide a level of protection which could be overwhelmed in the fluvial 'design flood' and actions are required to ensure the standard of protection can be maintained to mitigate the effect of climate change. A site-specific flood model for the Site has been produced to determine the fluvial and tidal 'design floods' and provide a credible maximum scenario sensitivity test. The site-specific flood model was approved by the EA in July 2024. The EA approved site-specific flood model will inform the detailed design of the flood mitigation and adaptation measures based on the principles established in this FRA.

6.8. In addition to flooding from rivers and the sea, this FRA has considered the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

6.9. An assessment has been made of the potential risk from all sources of flooding to and from the development site, with reference to available flood risk information, for existing conditions pre-development, and post-development with the various development mitigation measures incorporated.

6.10. The pre-development baseline potential flood risk to the Site from overwhelmed sewers and artificial sources is considered to be 'low' to 'very low'. There are areas of elevated risk ('high' – 'medium') associated with the combined risk of flooding from watercourse and tidal sources due to the proximity of the Site to the River Aire and River Ouse, low points where surface waters could collect and the likely presence of shallow groundwaters in underlying superficial and bedrock deposits.

6.11. The Proposed Development extends into areas of elevated flood risk from the fluvial 'design flood'. The Proposed Development would be designed to appropriately safe in the fluvial 'design flood' without increasing flood risk elsewhere. The Proposed Development would be designed to be resilient to the fluvial 'credible maximum scenario sensitivity test' flood event with the implementation of adaptation measures where necessary at the appropriate time.

6.12. The Site layout has been devised using a sequential approach to locate sensitive equipment in areas of lowest flood risk where possible, taking into account other material planning considerations and operational requirements. For the Proposed Development in areas of elevated flood risk, flood resilience and resistance measures have been considered to manage the residual flood risk to the Proposed Development. The following design flood mitigation and adaptation measures are proposed:

- A flood warning and evacuation plan for the relevant phase of the Proposed Development would be contained in the detailed CEMP, OEMP or DEMP and the construction contractor and operating staff would register to receive flood alerts / warnings from the EA and follow site evacuation procedures during periods of elevated flood risk;
- During times of elevated tidal and fluvial flood risk the solar arrays within the areas of elevated flood risk would be rotated to the horizontal stow position which would be a minimum of a 0.3m above the fluvial 'design flood' level or the stow position set above the fluvial 'credible maximum scenario sensitivity test' level, whichever is greater;
- Panel supports and security fencing in flood risk areas would be securely piled into the ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event;

- Security fencing mesh size in flood risk areas (fluvial 'design flood') would be increased to 0.15m square to minimise the risk of it collecting debris;
- Ancillary control equipment would be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood' and in areas affected by flood depths <0.6m in the fluvial 'credible maximum scenario sensitivity test' flood event;
- Substation and BESS Compound would be preferentially located in areas of very low surface water flood risk and very low fluvial flood risk in the fluvial 'design flood';
- Finished floor levels of any ancillary control equipment in the Solar Farm Zone, including Invertor Station, and in Substation and BESS Compound will be raised at least +0.3m above the fluvial 'design flood' level, and would be above the fluvial 'credible maximum scenario sensitivity test' flood level. The equipment would be at least +0.3m (and up to +0.6m) above existing ground level.'
- As an adaptation measure, the Substation and BESS Compound would be protected by a suitably designed earth flood defence bund. The height of the proposed earth flood defence bund would be raised at least +0.6m above the fluvial 'credible maximum scenario sensitivity test' flood level to protect the equipment from inundation;
- As an adaptation measure, a level for level and volume floodplain compensation scheme would be implemented to mitigate the effect of the earth flood defence bund on the potential fluvial flood risk at the end of the decommissioning period (the fluvial 'credible maximum scenario sensitivity test' flood). A preliminary floodplain compensation scheme within the DCO limits has been shown to be feasible.
- A detailed Flood Management Strategy containing details of the flood defence bund and floodplain compensation scheme adaptation measures based on the outputs of the EA approved site-specific flood model would be secured by a suitably worded DCO Requirement;
- Onsite watercourses are retained and existing watercourse crossings are utilised where possible within the Proposed Development;
- Where possible all development (including security fencing) is at least 7m from the onsite ordinary watercourses in accordance with Selby Area IDB byelaws. Additional consents may be required for watercourse crossings (site access or services) and landscape planting where this is not achieved.

6.13. These flood mitigation and adaptation measures would ensure that the Proposed Development would remain operational and safe in times of the fluvial 'design flood', result in no significant loss of floodplain storage, and would not significantly impede water flows or increase flood risk elsewhere. These flood mitigation and adaptation measures would also ensure that the Proposed Development would remain resilient to the effects of the fluvial 'credible maximum scenario sensitivity test' flood event. The flood mitigation and adaptation measures can be secured by a suitably worded DCO Requirements requiring details to be submitted to and approved by the Local Planning Authority.

6.14. With respect to surface water runoff, the solar panels would be raised above the existing ground allowing a grass sward to be maintained underneath the panels. Rainfall falling onto the photovoltaic panels would runoff directly to the ground beneath the panels and infiltrate into the ground at the same rate as it does in the Site's existing greenfield state. Access tracks would be permeable in nature. The extent of impermeable cover as a result of the Solar Farm amounts to only 0.1 % of the Solar Farm Zone area. The effect on the Mean Annual Flood (Q_{BAR}) is minimal and only equates to a 0.23% increase compared with the greenfield runoff.

6.15. A sustainable drainage strategy, involving the implementation of SuDS in the form of interception swales, is proposed for managing surface water runoff on the development Site. Interception swales are proposed at the low points of the Solar Farm Zone area to intercept extreme flows, which may already run offsite and provide runoff pathway management. The volume of storage provided within the proposed interception swales (398m^3) is greater than the additional runoff generated as a result of the extreme 1 in 100 year storm event, including an allowance for climate change (289.5m^3). The interception swales are therefore an appropriate form of mitigation given the 'temporary' nature of the Solar Farm, and a proportionate mitigation measure given the negligible hydrological effect of a Solar Farm and are a practical implementation of NFM.

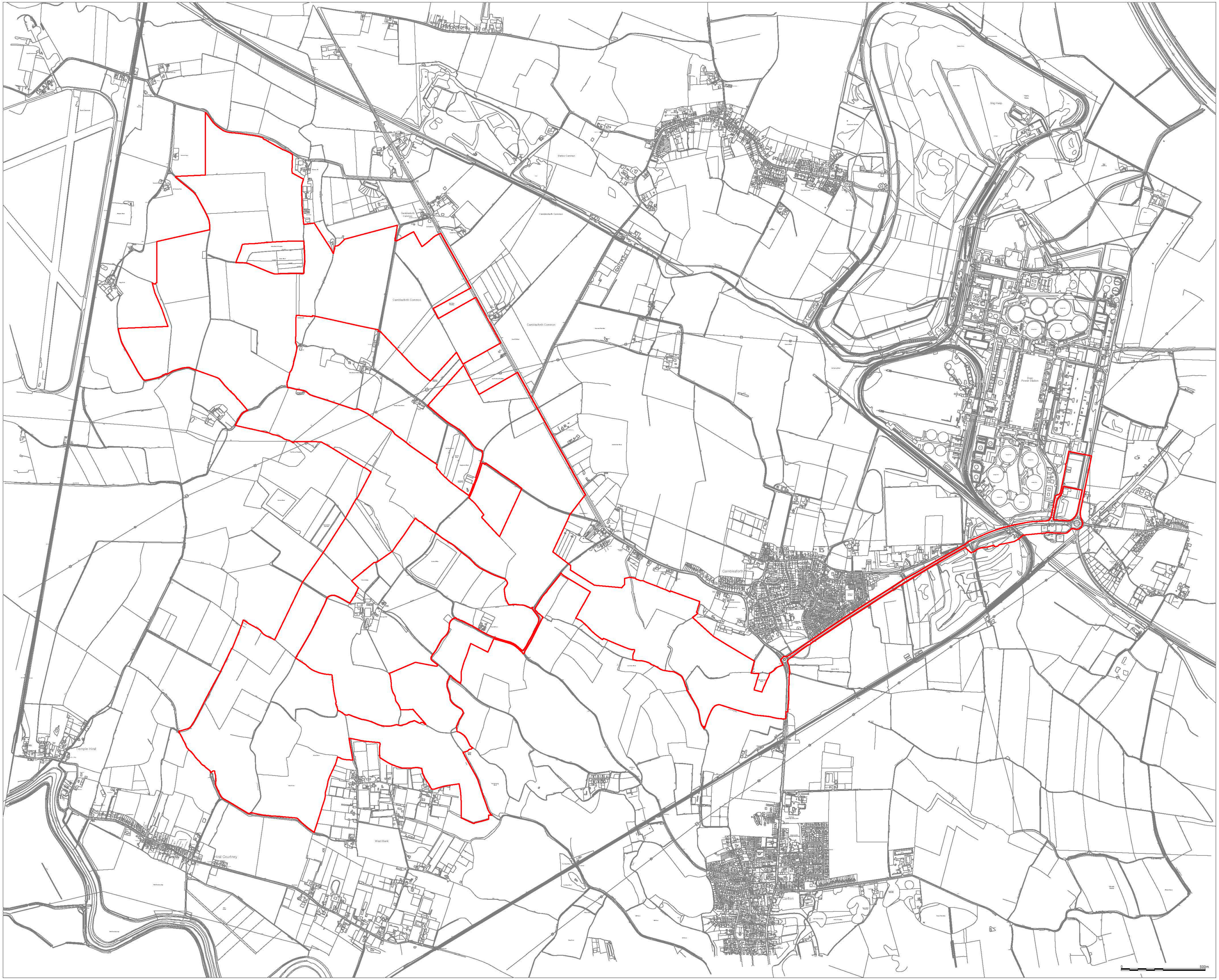
6.16. A SuDS is proposed for managing the disposal of surface water runoff from the BESS Compound (including a 132 kv Substation). It is proposed that runoff from the BESS Compound would be collected by filter drains. The filter drains would convey the runoff to three shallow attenuation basins (attenuation basins 1, 2 and 3). Runoff would be discharged at a controlled rate into the onsite drainage ditches, at a combined rate no greater than 1.4 l/s/ha (3.6 l/s) in accordance with Selby Area IDB requirements. The proposed drainage strategy would ensure that surface water arising from the BESS Compound would be managed in a sustainable manner to mimic the surface water flows arising from the Site prior to the Proposed Development, while reducing the flood risk to the Site itself and elsewhere, taking climate change into account.

6.17. Existing drainage features would be retained and the Site would remain vegetated throughout construction and operation of the Solar Farm to prevent soil erosion. The proposed interception swales would lead to an overall reduction in surface water flow rates from the Site and mitigate any increase in run-off due to the minor reduction in the overall permeable area of the Site. On this basis the Proposed Development would not increase flood risk onsite or elsewhere and would preserve the Site's natural drainage regime.

6.18. The overall conclusions drawn from this FRA are that future users of the development would remain appropriately safe throughout the lifetime of the Proposed Development, and that subject to a DCO Requirement requiring the drainage arrangements as indicated on plans E216/88 Rev D and E216/90-106 Rev C to be implemented and maintained in accordance with the procedures set out at **Table O** of this FRA and a Check Sheet attached as **Appendix 31**, the Proposed Development would not increase flood risk elsewhere and would reduce flood risk overall.

Appendices

Appendix 1



KEY

Site Boundary

N

Revisions:
First Issue- 03/05/2022 JS
01 - (12/07/2022 JS) Revised boundary
02 - (21/02/2023 JS) Revised boundary
03 - (20/04/2023 JS) Revised boundary
04 - (28/04/2023 JS) Revised boundary
05 - (12/06/2023 JS) Revised boundary
06 - (20/07/2023 JS) Revised boundary
07 - (03/08/2023 AD) removal of sheets 2 & 3
08 - (11/10/2023 JS) Revised boundary
09 - (30/01/2024 JS) Revised boundary
10 - (07/02/2024 JS) Revised boundary
11 - (15/02/2024 AH) Revised boundary

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Project Title:

Helios Renewable Energy Project

Drawing Title:

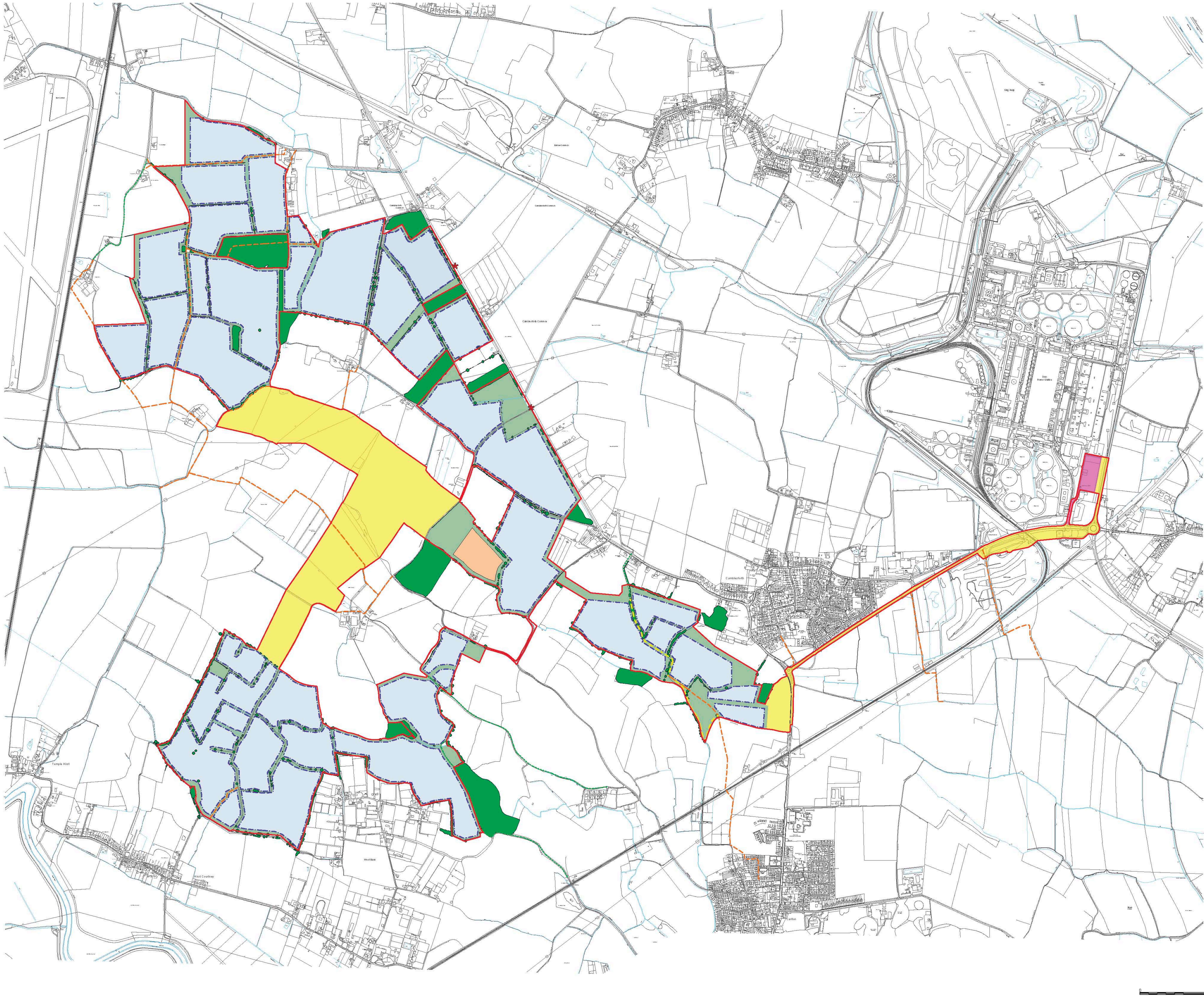
Figure 1.1
Order Limits Location Plan

DRWG No:	Rev:	Sht no:
DX-01-P01	11	1/1

Drawn by :	Checked by:
AH	NK

Scale:	Date:
1:10,000 @ A1	15/02/2024

Appendix 2



KEY

- Site Boundary
- Existing Vegetation
- Public Footpath
- Other Route with Public Access
- Permissive Footpath
- Security Fence
- Solar Farm Zone
  Includes:
  - Solar PV Modules
  - Inverters/Transformers
  - Access Tracks
  - Access Gates
  - CCTV
  - Associated Cabling
- Substation and Battery Energy Storage System (BESS) Compound
  Includes:
  - 132kV Substation
  - BESS and associated infrastructure
  - Access Tracks
  - Access Gates
  - Fencing
  - Earth Flood Defence Bund
  - Attenuation Ponds
  - CCTV
  - Water Tanks
  - Associated Cabling
- National Grid Substation and Access
- Green Infrastructure
  Includes:
  - Habitat Areas
  - Access Track Crossings
- Proposed Site Entrance
- Underground Cable Corridor

N

Revisions:
First Issue- 21/04/2023 JS
01 - (28/04/2023 JS) Revised boundary
02 - (12/06/2023 JS) Revised boundary
03 - (15/06/2023 JS) Revised layout
04 - (20/07/2023 JS) Revised layout and boundary
05 - (04/08/2023 AD) Key and graphical changes
06 - (30/08/2023 JS) Revised layout and key updates
07 - (11/10/2023 JS) Revised boundary
08 - (01/02/2024 JS) Revised layout and boundary
09 - (07/02/2024 JS) Revised boundary
10 - (15/02/2024 AH) Revised boundary
11 - (15/04/2024 JS) Revised layout

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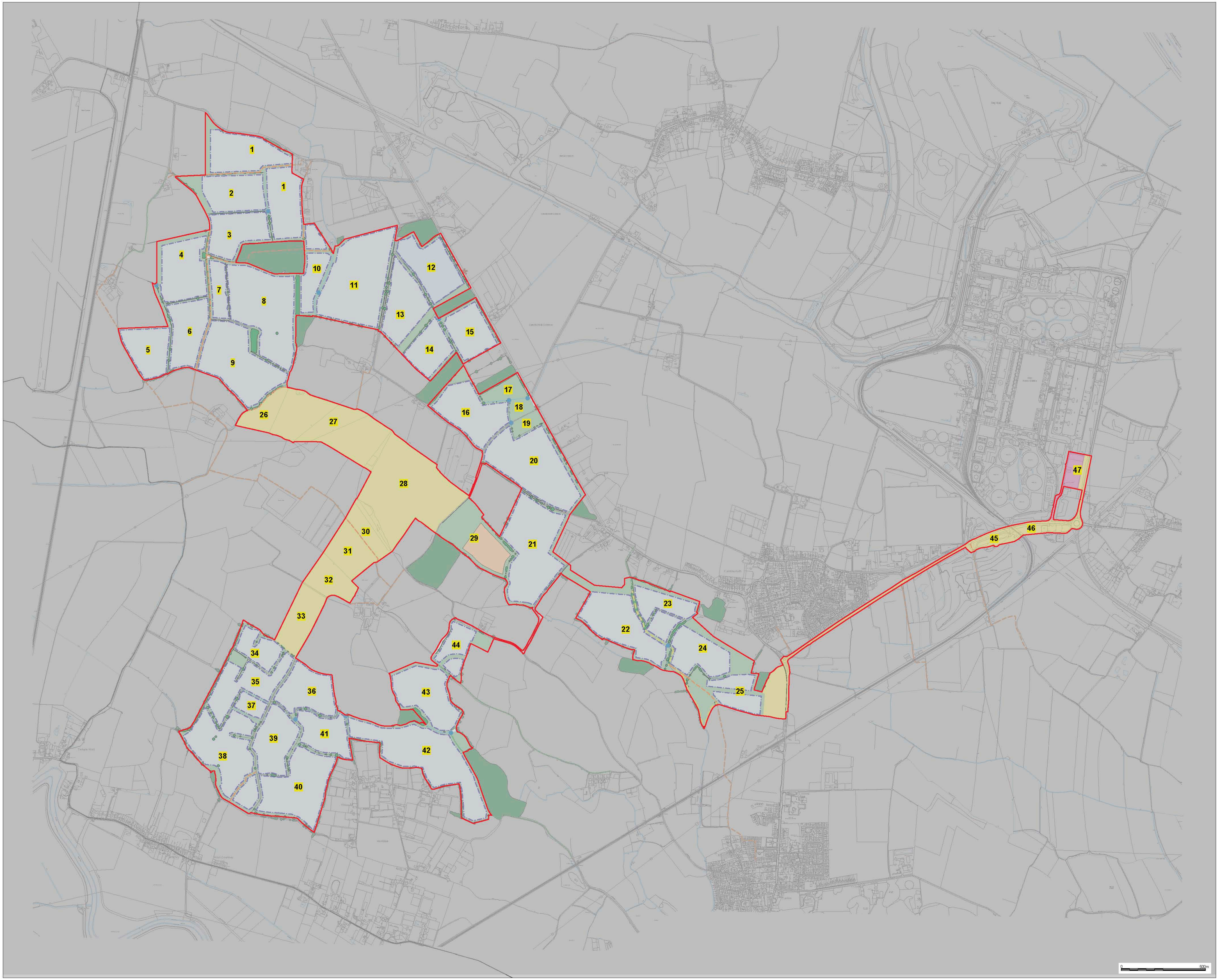
Project Title:

Helios Renewable Energy Project

Drawing Title:

Figure 3.2
Parameter Plan

DRWG No:	Rev:	Sht no:
DX-01-P02	11	-
Drawn by : JS	Checked by: KL	
Scale: 1:10,000 @ A1	Date: 15/04/2024	



KEY

Site Boundary

15 Field Number

N

Revisions:
First Issue- 23/05/2023 JS
01 - (13/07/2023 JS) Background plan updated
02 - (24/07/2023 JS) Background plan updated
03 - (04/08/2023 AD) graphical changes
04 - (15/04/2024 AH) Updated boundary

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Project Title:

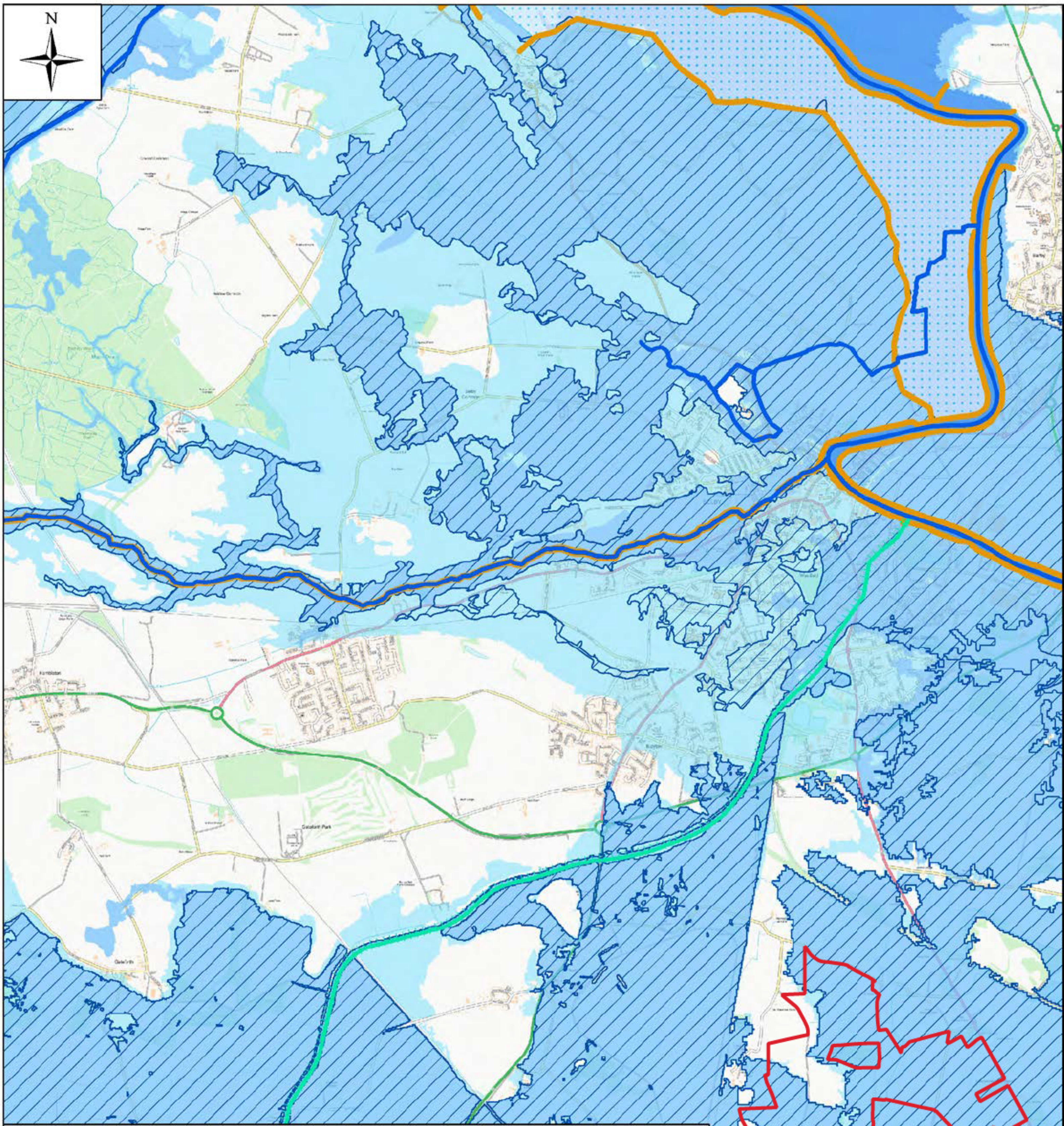
Helios Renewable Energy Project

Drawing Title:

Figure 3.1
Field Boundaries Plan

DRWG No:	Rev:	Sht no:
DX-01-P44	04	-
Drawn by : AH	Checked by: KL	
Scale: 1:10,000 @ A1	Date: 15/04/2024	

Appendix 3



Legend

- Selby District Council Boundary
- Main Rivers
- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

0 0.5 1 2 km

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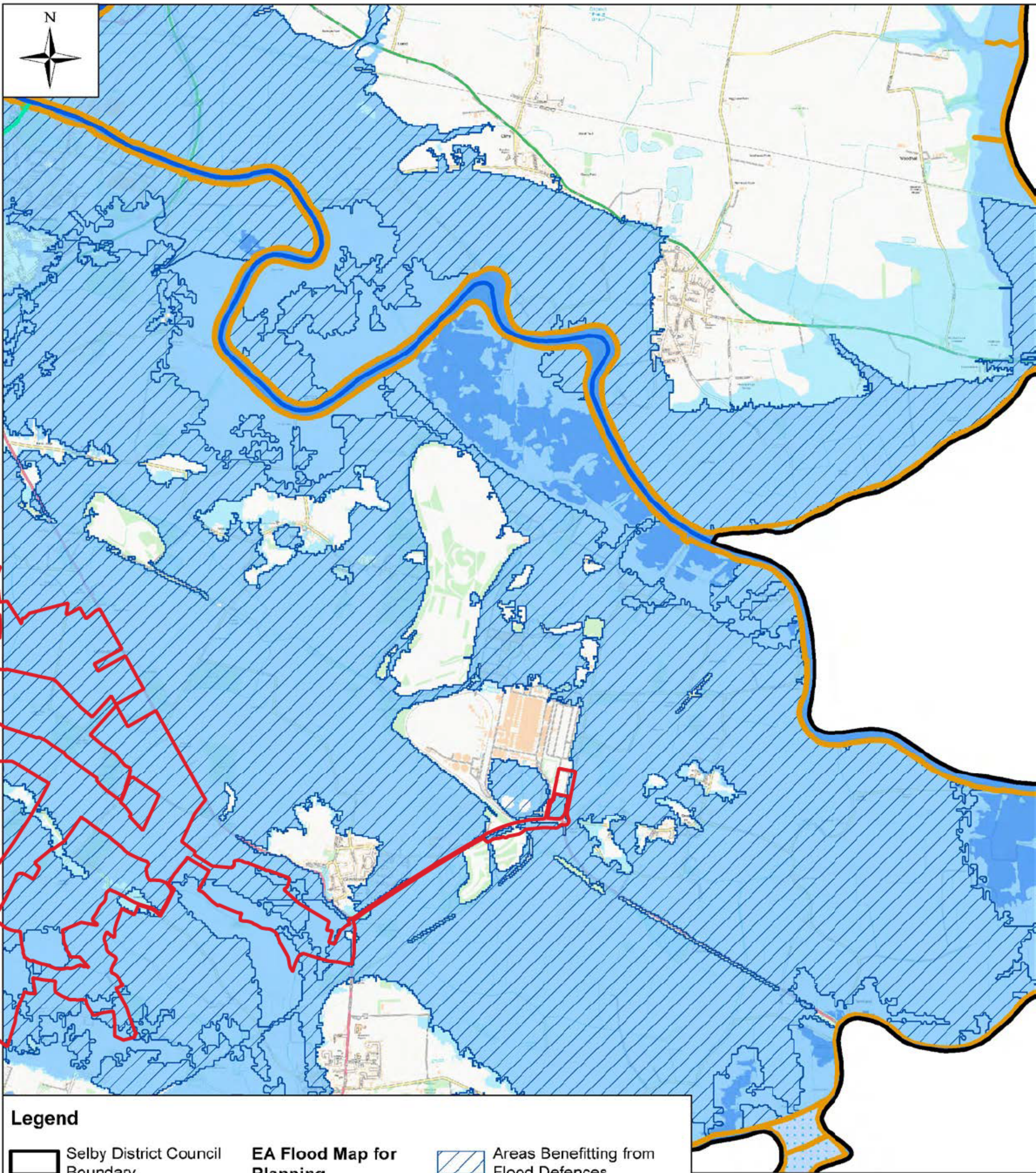
Client: SELBY DISTRICT COUNCIL	Title:	Drawn: TC		Checked: HC	
	ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET E	Verified: CS		Approved: IB	
Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update		Date: 01/08/2022		Scale at A3: 1:30,000	
		Drawing Number:	FIGURE A8 - E		A3



Legend

- Selby District Council Boundary
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- Canals

EA Flood Map for Planning

- Flood Zone 3b
- Flood Zone 3a
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- Areas Benefitting from Flood Defences
- Flood Storage Area
- Flood Defences

0 0.5 1 2 km

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Drawn: TC		Checked: HC	
Verified: CS		Approved: IB	
Date: 01/08/2022		Scale at A3: 1:30,000	
Drawing Number: FIGURE A8 - F			A3

Client: SELBY DISTRICT COUNCIL

Title: ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING- INSET F

Project: Selby District Council Level 1 Strategic Flood Risk Assessment Update