Rosefield Solar Farm

Preliminary Environmental Information Report

Volume 1
Chapter 15: Water

September 2024

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15. Water

15.1. Introduction

15.1.1. This chapter presents a preliminary assessment of the likely significant effects arising from the construction, operation (including maintenance) and decommissioning of Rosefield Solar Farm upon the water environment and should be read in conjunction with the following figures and appendix in **Volume 2 and Volume 3 respectively**:

- **Figure 15.1: Flood Zone and Watercourse Mapping;**
- **Figure 15.2: Surface Water Flood Mapping;**
- **Figure 15.3: Water Framework Directive and Designated Areas;** and
- **Appendix 15.1: Flood Depth Analysis.**

15.1.2. This preliminary assessment has considered flood risk from all sources (including groundwater), but water quality to surface waterbodies only. Groundwater is considered in **Chapter 10: Land, Soil and Groundwater**.

15.2. Stakeholder engagement

15.2.1. **Table 15.1** provides a summary of the engagement undertaken to date to inform this preliminary assessment.

Table 15.1 – Engagement undertaken to date

Stakeholder	Date and method	Key matters discussed
Environment Agency	06 February 2024 – Meeting (online video conference call)	Informed the Environment Agency that some solar modules are likely to be located within Flood Zone 2 and Flood Zone 3. This was accepted in principle, subject to further discussion on the design details. Confirmation was also provided that firewater drainage will be considered as part of the assessment of the BESS.
Buckinghamshire Council – Lead Local Flood Authority	01 May 2024 – Email	Buckinghamshire Council (the Lead Local Flood Authority) provided

Stakeholder	Date and method	Key matters discussed
		information pertaining to the accepted drainage principles for solar farms, with case study applications provided for reference.
Buckinghamshire Council – Lead Local Flood Authority	07 May 2024 – Meeting (online video conference call)	Outlined the requirements for surface water drainage design and the need to consider overland flood flow routes through the Site.

15.3. Legislative framework, planning policy and guidance

15.3.1. The preliminary assessment has been undertaken with regard to the following legislation, planning policy and guidance.

Legislation

- Land Drainage Act 1991[1];
- The Water Framework Directive 2000/60/EC[2], which is transposed into legislation for England via The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017[3];
- Flood and Water Management Act 2010[4];
- Water Act 2003[5];
- Water Resources Act 1991[6];

[1] Land Drainage Act 1991. Available online https://www.legislation.gov.uk/ukpga/1991/59/contents
[2] Water Framework Directive 2000/60/EC. Available online: https://eur-lex.europa.eu/eli/dir/2000/60/oj
[3] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Available online: https://www.legislation.gov.uk/uksi/2017/407/contents/made
[4] Flood and Water Management Act 2010. Available online: https://www.legislation.gov.uk/ukpga/2010/29/contents
[5] Water Act 2003. Available online: https://www.legislation.gov.uk/ukpga/2003/37/contents
[6] Water Resources Act 1991. Available online: https://www.legislation.gov.uk/ukpga/1991/57/contents

- Water Act 2014[7];
- Water Industry Act 1991[8];
- The Environmental Permitting (England and Wales) Regulations 2016[9];
- Control of Pollution (Oil Storage) (England) Regulations 2001[10];
- The Flood Directive 2007/60/EC[11], which is transposed into legislation for England via the Retained EU Law (Revocation and Reform) Act 2023[12]; and
- The Environment Act 2021[13].

National planning policy

- Overarching National Policy Statement for Energy (NPS EN-1) (2023)[14] - Section 5.8 'Flood Risk' outlines the requirement to consider an approach to flood risk and flood risk management (as summarised in Paragraph 5.8.7), and the requirements for surface water drainage (as summarised in Paragraph 5.8.27);
- National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) (2023)[15] – Section 2.10 gives specific consideration to solar development, specifically in relation to the layout and design which should consider the mitigation of flood risk (Paragraph 2.10.60). The

[7] Water Act 2014. Available online: https://www.legislation.gov.uk/ukpga/2014/21/contents/enacted
[8] Water Industry Act 1991. Available online: https://www.legislation.gov.uk/ukpga/1991/56/contents
[9] The Environmental Permitting (England and Wales) Regulations 2016. Available online: https://www.legislation.gov.uk/uksi/2016/1154/contents/made
[10] Control of Pollution (Oil Storage) (England) Regulations 2001. Available online: https://www.legislation.gov.uk/uksi/2001/2954/contents
[11] The Flood Directive 2007/60/EC. Available online: https://www.legislation.gov.uk/eudr/2007/60
[12] Retained EU Law (Revocation and Reform) Act 2023. Available online: https://www.legislation.gov.uk/ukpga/2023/28/contents
[13] The Environment Act 2021. Available online: https://www.legislation.gov.uk/ukpga/2021/30/contents
[14] Department for Energy Security and Net Zero. (2023). Overarching National Policy Statement for Energy (EN-1). Available online: https://www.gov.uk/government/publications/overarching-national-policy-statement-for-energy-en-1
[15] Department for Energy Security and Net Zero (2023). National Policy Statement for Renewable Energy Infrastructure (EN-3). Available online: https://www.gov.uk/government/publications/national-policy-statement-for-renewable-energy-infrastructure-en-3

Flood Risk Assessment shall consider the impact of drainage (as per Paragraph 2.10.84) and value delivered by drainage and flood attenuation (as per Paragraph 2.10.154);

- National Policy Statement for Electricity Networks Infrastructure (NPS EN-5) (2023)[16] – Section 2.3 details issues relating climate change and outlines the considerations required with relation to flood risk;
- National Planning Policy Framework (NPPF) (2023)[17] - Section 14 'Meeting the challenge of climate change, flooding and coastal change' sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere; and
- Flood Risk and Coastal Change National Planning Practice Guidance (Department for Levelling Up, Housing and Communities, 2022)[18].

Local planning policy

- Vale of Aylesbury Local Plan (VALP) 2013 – 2033 Adopted Plan (2021)[19], specifically Policy I4 'Flooding'; and
- Local Plan for Buckinghamshire: Draft vision and Objectives for 2040[20], with particular reference to Objective 2: 'Mitigating/adapting to climate change' and Objective 6: 'Infrastructure'.

[16] Department for Energy Security and Net Zero (2023). National Policy Statement for Electricity Networks Infrastructure (EN-5). Available online: https://www.gov.uk/government/publications/national-policy-statement-for-electricity-networks-infrastructure-en-5
[17] Ministry of Housing, Communities and Local Government and Department for Levelling Up, Housing and Communities. (2023). National Planning Policy Framework. Available online: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[18] Ministry of Housing, Communities and Local Government and Department for Levelling Up, Housing and Communities (2022) Flood Risk and Coastal Change Planning Practice Guidance. Available online: https://www.gov.uk/guidance/flood-risk-and-coastal-change
[19] Vale of Aylesbury Local Plan (VALP) 2013 – 2033 Adopted Plan (2021). Available online: https://buckinghamshire-gov-uk.s3.amazonaws.com/documents/Aylesbury_local_plan_L46JWaT.pdf
[20] Buckinghamshire Council, The Local Plan for Buckinghamshire - Draft vision and objectives (2023). Available online: https://buckinghamshire-gov-uk.s3.amazonaws.com/documents/Draft_vision_and_objectives_2_1.pdf

Guidance

- Planning Inspectorate - Advice Note Eighteen: The Water Framework Directive (June 2017)[21]; and
- Flood Risk Assessments: climate change allowances (Environment Agency, 2022)[22].

15.4. Study area

15.4.1. For the purposes of this preliminary assessment, the Site and a 1 km buffer have been considered as the Study area to identify hydrological receptors that could be impacted by the construction, operation (including maintenance) and decommissioning of Rosefield Solar Farm. A 1 km buffer is considered appropriate for water environment assessments, based on professional judgment. This is considered a sufficient distance to enable the deposition of silts in overland flows and dilution of any concentrated pollutants so that waterbodies at a greater distance than 1 km would not be at significant risk of being affected.

15.4.2. The Study area is depicted within **Figure 15.1** in **Volume 2** to show the areas of Flood Zone 2 and Flood Zone 3 and watercourses which have been considered as part of this preliminary assessment. The Study area is depicted within **Figure 15.2** in **Volume 2** to show the surface water flooding and overland flow paths which have been considered as part of this preliminary assessment. Finally, the Study area is depicted within **Figure 15.3** in **Volume 2** to show the Water Framework Directive waterbodies which have been considered as part of this preliminary assessment.

15.5. Establishing baseline conditions

15.5.1. An initial desk-based hydrology study has been undertaken to inform this preliminary assessment, which has included a review of existing watercourses, water quality, surface water drainage/flood risk and areas prone to fluvial flooding as identified on the Flood Map for Planning[23].The watercourses and flood zones from the Flood Map for Planning are shown in **Figure 15.1** in **Volume 2**.

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[21] Planning Inspectorate - Advice Note Eighteen: The Water Framework Directive (version 1, June 2017). Available online: Advice Note Eighteen (www.gov.uk)
[22] Environment Agency (2022). Flood Risk Assessments: climate change allowances. Available online: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[23] Environment Agency. Flood Map for Planning. Available online: Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)

15.5.2. Initial baseline information on the physical environment has been collected from the following sources:

- Flood Map for Planning;
- Risk of Flooding from Surface Water maps[24];
- The British Geological Survey (BGS) Geology Map;
- Defra MAGIC Map[25] (Drinking Water Safeguard Zone (Surface Water), Sites of Special Scientific Interest; Special Areas of Conservation, Special Protection Areas);
- Soilscapes[26];
- Statutory Main River Map[27];
- Catchment Data Explorer: Water environment and Water Framework Directive classifications[28];
- 1 m LiDAR Digital Terrain Model; and
- Ordnance Survey Mapping.

15.5.3. Additionally, an assessment as provided in **Appendix 15.1** in **Volume 3** outlines the estimated flood depths for a 1% annual exceedance probability event (1 in 100 year return period) within Parcel 3.

15.6. Environmental baseline

Site description

15.6.1. The Site is currently agricultural land, which is predominantly a mixture of arable land and pasture.

15.6.2. Within the Site, land is understood to drain as overland runoff towards the areas of localised lowest topographies and/or naturally infiltrate where the ground conditions allow. There are a series of drains/watercourses identified on Ordnance Survey mapping across the Site; these are

[24] Environment Agency. Risk of Flooding from Surface Water Extents. Available online: Risk of flooding from surface water extent (data.gov.uk)
[25] Department for Environment, Food & Rural Affairs. MAGIC Map (2023). Available online: MAGIC (defra.gov.uk)
[26] Cranfield University LandIS Scoilscapes Viewer (2024). Available Online: Soilscapes Viewer (www.landis.org.uk/soilscapes/)
[27] Environment Agency. Statutory Main River Map. Available online: Statutory Main River Map (arcgis.com)
[28] Environment Agency. Catchment Data Explorer. Available online: Catchment Data Explorer (https://environment.data.gov.uk/catchment-planning)

predominantly unnamed headwaters and are classified as Ordinary Watercourses (those not designated by the Environment Agency as Main Rivers). The Ordinary Watercourses within the Site and the Study area fall outside of any Internal Drainage Board districts.

Watercourses

15.6.3. The single largest Ordinary Watercourse network close to the Site is located on the eastern boundary of Parcel 3, which flows north/north eastwards and feeds the headwaters of Claydon Brook Tributary located on the eastern boundary of Parcel 3 and Claydon Brook located immediately north of Parcel 3. Watercourses of interest within the Study area are marked in **Figure 15.1** in **Volume 2**.

15.6.4. The Ordinary Watercourse identified as Muxwell Brook rises adjacent to the south of Parcel 2 (north of Field D29) and intersects through Parcel 1a (north of Field C1 and C2).

15.6.5. From the Environment Agency's Main River mapping, the nearest Main River watercourse is the River Ray, located approximately 200 m to the south of Parcel 2 and within the Study area. The Site boundary of the cable route corridor intersects this river.

15.6.6. Within the Study area, an unnamed tributary of the River Ray is located 400 m to the southwest of Parcel 1a and is also designated as a Main River. This is fed by Muxwell Brook which originates from within the Site.

Fluvial flood risk

15.6.7. With reference to the Flood Map for Planning (reproduced in **Figure 15.1** in **Volume 2**), the vast majority of the Site is Flood Zone 1. There are Flood Zone 2 and Flood Zone 3 areas located at the northeastern boundary of the Site. This means that several fields of Parcel 3 are partially within the fluvial flood zones (Fields E10, E11, E20, E21 and E23). The flood zones are limited to the lower topographical areas of these fields, which slope down towards the adjacent Ordinary Watercourse, Claydon Brook Tributary, on the eastern boundary of the Site.

15.6.8. Following consultation with the Environment Agency, it is understood that this flood zone is derived from a nationalised modelling data set (named JFLOW) and as a result there are no model-specific flood water levels available for this area of flood zone. However, as per the assessment described below, a flood water level has been estimated from the delineation of the flood extents against topography.

15.6.9. With reference to the flood depth assessment presented in **Appendix 10.1** in **Volume 3**, the assessment concludes maximum flood depths of up to 1.0 m could be anticipated towards the north of the Parcel 3 within the

areas of Flood Zone 3, close to the National Grid East Claydon Substation and at the confluence of Claydon Brook and the Tributary. Towards the south of Parcel 3 within Flood Zone 3 it is anticipated flood depths could reach a maximum of 0.5 m.

15.6.10. The Flood Map for Planning also identifies a limited encroachment of Flood Zone 3 at the south of the Site against the boundary of Parcel 1a (Field C1). Given the limited encroachment into this area of Flood Zone 3, there is a limited associated risk and this has therefore not been considered any further in the assessment of flood depths; additionally, no Solar PV modules, BESS or Satellite Collector Compounds are proposed within Parcel 1a. There are some areas of flood zone south of Parcel 2, located within the Study area. Given the distance from the Site, these flood zone areas have not been considered any further as they will not be affected by Rosefield Solar Farm.

Surface water flood risk

15.6.11. With reference to the Risk of Flooding from Surface Water Extent mapping (reproduced in **Figure 15.2** in **Volume 2**), there are several overland flow routes identified across the Site. Generally, these overland flow routes are attributable to localised topographical depressions, some of which are indicative of minor Ordinary Watercourses, drains and headwaters.

15.6.12. The flow pathways shown on the Risk of Surface Water Extents mapping shows that there are several watershed catchments across the Site and Study area. Runoff from Parcel 2 and Parcel 3 contribute to the Claydon Brook Tributary watershed catchment, draining in a north easterly direction. The north of Parcel 1, and a limited extent of the north of Parcel 2, contribute to the north westerly flowing watershed catchment that also flows into the Claydon Brook/Padbury Brook catchment. The south of Parcel 1, Parcel 1a and Parcel 2 contribute to southern watershed catchments. This arrangement is indicative of the Site being relatively high within the local watershed catchments in topographical terms.

15.6.13. One of the areas of greatest surface water flooding extents is attributable to the Claydon Brook Tributary at the eastern boundary of Parcel 3 (Fields E10, E11, E20, E21 and E23), and the upslope overland tributaries of the watercourse which extents southwards to Parcel 2 (particularly Fields D7, D8, D9, D10, D15, D16, D18 and D19). The mapping extents indicate these areas are calculated as having a 3.3% Annual Exceedance Probability (AEP) (1 in 30 year return period) of flooding.

15.6.14. Several fields within Parcel 1 are identified as having areas of surface water flood risk, including Fields B1, B2, B3, B7, B13, B14, B16, B18, B20, B21, B22, B23 (north and south), although generally only relatively small areas of the fields are affected. The mapping extents indicate that these areas are calculated as having a 1% AEP (1 in 100 year return period)

chance of flooding. Areas at risk of more frequent (3.3% AEP or 1 in 30 year return period) flooding are limited to the boundary within Parcel 1, specifically limited areas close to the eastern boundary of Fields B20, B23 (north and south), B16 and B22 (centrally). Field B18 has an isolated area of 1% AEP and 3.3% AEP chance of flooding centrally indicating a low spot within this field.

15.6.15. Lastly, mapping identifies surface water flood risk through Parcel 1a (western and northern area of Field C1 and extreme northern area of Field C2) associated with Muxwell Brook. The mapping extents indicate that these areas are calculated as having a 1% AEP and 3.3% AEP chance of flooding.

15.6.16. More broadly, the remaining surface water flood extents across the Site appear to be relatively narrow flow paths with only limited flood risk to the Site identified. Overland flow paths continue through the Study area to reach higher order watercourses.

15.6.17. In the baseline situation, whilst some areas of flood risk have been identified, a review of the above information concludes that flood risk across the Site and Study area is generally focused within localised and specific areas, and the Site is predominately classified as being at a very low to low risk from flooding.

Water quality

15.6.18. The Drinking Water Safeguard Zone (Surface Water) indicates the Site and Study area are within these designated areas. The safeguard areas identify areas “at risk” of failing the drinking water protection objectives of the Water Environment (Water Framework Directive) Regulations 2017. Further analysis of the safeguard zones indicates the Site is within two Surface Water Safeguard Zones Actions Plans, as outlined below.

15.6.19. The southern area of the Site is within the Lower Thames (Cookham-Egham-Teddington) Drinking Water Protected Area (safeguard zone identification number SWSGZ4016). In summary, the catchment is at risk from Carbetamide (pesticide), Metaldehyde (pesticide), and Propyzamide (pesticide), with those chemicals under consideration being Carbendazim (pesticide), Flufenacet (pesticide), MCPA (pesticide) and Mecoprop (pesticide). National and local initiatives are in place or planned to raise awareness and to work with pesticide users and landowners to reduce the risk of pesticides and nutrients reaching watercourses. Some of these initiatives are targeted specifically at controlling pesticide use, whereas others are more generic and aim to encourage good agricultural practice.

15.6.20. The northern area of the Site is within the River Great Ouse including Grafham Water Drinking Water Protection Area (safeguard zone identification number SWSGZ1012). In summary, the catchment is at risk

from Carbetamide (pesticide), Metaldehyde (pesticide), Propyzamide (pesticide) and Quimerac (pesticide). The release of the pesticides and herbicides are outlined in the Surface Water Safeguard Zones Action Plan[29] as being at most significant during the application of the pesticide, with later releases possible during its manufacture, transportation and storage. The plan notes that typical pathways are from fields as diffuse pollution resulting from the movement of soil to drains; this can arise from flooding, surface water runoff and heavy rainfall. It is noted that these flow paths can be influenced by the linear depressions associated with agricultural practices.

Water framework directive waterbodies

15.6.21. Water Framework Directive waterbodies are identified using the online Catchment Data Explorer map (reproduced in **Figure 15.3** in **Volume 2**) The mapping shows a total of four classified waterbodies within the Study area. These are outlined below with a summary of the existing baseline conditions of the watercourses for Cycle 3 (2019 and 2022 classifications).

15.6.22. The nearest Water Framework Directive waterbody to the Site is Claydon Brook Tributary located along the eastern boundary of Parcel 3. The length of designated watercourses is relatively short at a 1.6 km channel reach. The watercourse is given a hydromorphological designation of heavily modified. The watercourse is given a moderate ecological status, with the “Reasons For Not Achieving Good” status generally categorised as agricultural and land management.

15.6.23. The second Water Framework Directive waterbody is Claydon Brook, which is located at the northern extent of Parcel 3. Given the 15.6 km length of the watercourse, only the most downstream extent of the watercourses comes within the Study area and therefore the Site generally has a minimal contribution to the watershed catchment of this watercourse. The watercourse is given a hydromorphological designation of heavily modified. The watercourse is given a moderate ecological status, with the “Reasons For Not Achieving Good” status generally categorised as agricultural and land management and the water industry.

15.6.24. The third Water Framework Directive waterbody is Claydon Brook DS Granborough which intersects within the Site boundary at the north of Parcel 3 and flows north-westwards out of the Study area. The watercourse begins at the confluence of Claydon Brook Tributary and

[29] Environment Agency, Surface Water Safeguard Zones Action Plan: River Great Ouse including Grafham Water, October 2022. Available at: https://environment.data.gov.uk/farmers/

Claydon Brook. The watercourse is given a hydromorphological designation of heavily modified. The watercourse is given a moderate ecological status, with the “Reasons For Not Achieving Good” status generally categorised as agricultural and land management and the water industry.

15.6.25. Lastly, the fourth Water Framework Directive waterbody is Ray and tributaries North East of Grendon Underwood, which is also classified as a Main River. The watercourse is predominately within the Study area, though the Site boundary of the cable route corridor south of the Site intersects the watercourse. The watercourse is not designated artificial or heavily modified. The watercourse is given a moderate ecological status, with the “Reasons For Not Achieving Good” status generally categorised as agricultural and land management and the water industry.

15.6.26. In the baseline situation it is likely that the watercourses within the Study area would be subject to limited inputs of pollutants, particularly nutrients and metals, associated with farming activities, urban runoff and sewer company discharges. As the classified watercourses within the Study area are of ‘moderate’ overall quality, this suggests that these baseline sources of pollution have not significantly impacted water quality within the catchments under consideration.

Designated sites potentially vulnerable in relation to their hydrological function

15.6.27. There are no Sites of Special Scientific Interest, Special Areas of Conservation, Ramsar sites or Special Protection Areas within the Site boundary.

15.6.28. As shown in **Figure 15.3** in **Volume 2**, there are two Sites of Special Scientific Interest outside the Site boundary but within the Study area. Sheephouse Wood is located immediately outside of the south boundary of Parcel 1 and west of Parcel 1 and Finemere Wood is located immediately outside of the south boundary of Parcel 2.

15.6.29. Neither site is potentially vulnerable in relation to its hydrological function and therefore these sites are not considered further within this preliminary assessment.

Future baseline

15.6.30. With regards to flood risk, it is generally accepted by climate scientists that climate change will cause UK weather to become milder and wetter during the winters. For example, within the Upper and Bedford Ouse Management Catchment, which Claydon Brook is within, the current guidelines for peak rainfall allowance increases suggest between a 25% and 40% increase in peak rainfall for a 1% annual exceedance rainfall

event by the 2070s[30]. The current guidelines for peak river flow allowances within this catchment are increases between 19% to 58% by the year 2080[31].

15.6.31. The implications of the climate change allowances suggest that the future baseline of flood risk within the Site may see an exacerbation of flood extents and flood depths in areas where there is already shown to be flood risk. However, based on professional judgement, the 1% AEP event (fluvial Flood Zone 3) with the inclusion of climate change rarely exceeds the extents and depths represented by the 0.1% AEP event (fluvial Flood Zone 2).

15.6.32. To determine the impacts of climate change on future flood risk at the Site to any further degree of certainty, a flood modelling exercise using the appropriate climate change allowances would be required. The need (or otherwise) for such modelling will be discussed with the Environment Agency and Buckinghamshire Council (being the Lead Local Flood Authority), and if required will be included to inform the ES.

15.6.33. The future baseline of water quality is unlikely to change from the existing baseline. Assuming no changes in agricultural practices and the water industry there is no reason to suggest that water quality will change.

15.7. Mitigation embedded into the design

15.7.1. This preliminary assessment has been based on the principle that measures have been 'embedded' into the design of Rosefield Solar Farm to remove potential likely significant effects as far as practicable, for example by the considered placement of infrastructure. Embedded (primary) environmental mitigation measures that are considered to be an inherent part of Rosefield Solar Farm are detailed within **Chapter 5: Approach to the EIA**.

15.7.2. There is an emphasis on the location and siting of components of Rosefield Solar Farm so reference is made to **Figure 1.2: Zonal Masterplan** in **Volume 2** throughout.

15.7.3. The embedded mitigation measures relevant to water and the benefits these provide are outlined in **Table 15.2** below.

[30] Defra. Climate change allowances for peak rainfall in England. Available online: Climate Change Allowances (data.gov.uk)
[31] Defra. Climate change allowances for peak river flow in England. Available online: Climate Change Allowances (data.gov.uk)

Table 15.2 – Embedded mitigation measures relevant to water

Embedded mitigation measures relevant to water	Benefit
Panel design and panel height of Solar PV modules within Flood Zone 3	Where Solar PV modules are proposed within Flood Zone 3, the design of the arrays would enable the panels to sit above the flood water level and only the supporting structure of the panel would be below the flood water level. This will mitigate against the potential damage caused by flooding. Of additional note, the Solar PV modules would not require ground raising, therefore any Solar PV modules within Flood Zone 3 will not lead to a loss of floodplain. Panel supports below the flood level are considered to displace a negligible volume of flood water (subject to confirmation from the Environment Agency).
Solar PV modules design inclusion of a rainwater gap	The proposed design allows for rainwater to drain into the spacing between rows of panel arrays. This ensures the runoff from the Site would not increase as a result of the panels. This is accepted as per NPS EN-3 Paragraph 2.10.84; 'As solar PV panels will drain to the existing ground, the impact will not, in general, be significant.'
Siting of: Satellite Collector Compounds, Main Collector Compound, Rosefield Substation and BESS outside of Flood Zone 2 and Flood Zone 3	By proposing to place these compounds and structures outside of Flood Zone 2 and Flood Zone 3 (for both siting scenarios), the likelihood of damage from fluvial flooding is reduced. By ensuring these compounds remain outside of flood zones means there will be no loss of floodplain and therefore no requirement to provide floodplain compensation. The development extents are shown in **Figure 15.1** in **Volume 2**, where the eastern boundary of development extents are defined by the outline of Flood Zones 2 and 3, and therefore the compounds or BESS do not extend into Flood Zones 2 and 3.
Inclusion of a formalised surface water drainage strategy for; Satellite Collector Compounds,	A formalised surface water drainage system for these areas of hardstanding will be designed for the operational (including

Embedded mitigation measures relevant to water	Benefit
Main Collector Compound, Rosefield Substation and BESS	maintenance) phase. This would ensure surface water runoff volumes and water quality leaving the compounds can be controlled and managed. The inclusion of restricted discharge rates to pre-development greenfield runoff rates will ensure that there is no exacerbation of flood risk on or off-site as a result of Rosefield Solar Farm. The drainage strategy will be designed to ensure the water quality of surface water drainage discharged from Site is of acceptable standards. A temporary surface water drainage strategy is required for the construction and decommissioning stages to ensure no temporary increase in surface water runoff in the intermediatory stages where there may be an increase in impermeable hardstanding but no permanent functioning or online surface water drainage infrastructure.
Inclusion of fire water runoff drainage provisions for BESS	It is anticipated that Rosefield Solar Farm would include the provision of fire water runoff storage within the Site to ensure that any contaminated surface water runoff does not enter the wider environment in the unlikely event of a fire. The drainage designs will follow the appropriate best practice guidance.
Minimum offset of least 10 m either side of Main Rivers, and 6 m from ditches and ordinary watercourses, to all fence lines within Rosefield Solar Farm. Where crossing points are required over Main Rivers or ordinary watercourses, these will be designed to minimise effects on floodplain and any biodiversity interest associated with the watercourse.	Rosefield Solar Farm will factor in an offset from watercourses. An offset from watercourses will reduce the impacts that can be associated with construction and decommissioning activities. During the operational (including maintenance) phase, the offset will ensure a reduced flood risk to Rosefield Solar Farm.

15.8. Optionality

15.8.1. **Chapter 5: Approach to the EIA** sets out those elements of Rosefield Solar Farm for which optionality is present within the current design and sets out the scenarios assessed for the purpose of this PEIR.

15.8.2. The preliminary design principles as outlined in **Chapter 5: Approach to the EIA** and preliminary parameter plans (**Figures 3.1** to **3.5** in **Volume 2**) set out the reasonable 'worst case scenario' that has been assessed within this chapter. The 'worst case scenario' options in relation to this preliminary water assessment are described in **Table 15.3** below.

Table 15.3 – Optionality scenarios assessed

Project element	Scenario assessed for this preliminary assessment
Solar PV modules	The indicative area for Solar PV modules is shown on the proposed Zonal Masterplan in **Figure 1.2** in **Volume 2**. The worst-case extent of Solar PV modules have been assessed, including where Solar PV modules are proposed within Flood Zone 3.
Balance of Solar System	This preliminary assessment assumes the use of string inverters as this is considered to be the worst case as these will be placed underneath Solar PV modules including those modules proposed within the extents of Flood Zone 3.
Satellite Collector Compounds	There are five fields that are considered suitable for Satellite Collector Compounds, as shown on the proposed Zonal Masterplan in **Figure 1.2** in **Volume 2** (Fields B10, B23, D8, D9 and D17). All possible fields are outside of Flood Zone 2 and Flood Zone 3 and are therefore all assumed to be equal negligible fluvial flood risk.
Main Collector Compound	All possible fields considered suitable for the Main Collector Compound are outside of Flood Zone 2 and Flood Zone 3 and are therefore all assumed to be equal negligible fluvial flood risk.
BESS	There are two scenarios outlined for the proposed location of the BESS in **Chapter 5: Approach to the EIA**. The proposed BESS are within Field D8, D9 and E23 for both scenarios. Additionally for both scenarios, the proposed BESS development extents show that

Project element	Scenario assessed for this preliminary assessment
	BESS units will be located outside of Flood Zone 2 and Flood Zone 3. For the purpose of this preliminary assessment, Scenario 1 is considered the worst case scenario due to the placement of the BESS in Field E11 closest to the Flood Zone 2 and Flood Zone 3.
Rosefield Substation	There are two scenarios outlined for the proposed location of the Rosefield Substation in **Chapter 5: Approach to the EIA**. Rosefield Substation will either be in Field E11 for Scenario 1, or the predominately northern area of Field E23 for Scenario 2. For the purpose of this preliminary assessment, Scenario 1 is considered the worst case scenario due to the placement of Rosefield Substation in Field E11 closest to the Flood Zone 2 and Flood Zone 3.
Construction Compounds	Potential locations for the proposed Construction Compounds are outlined in **Figure 3.6** in **Volume 2**. The Construction Compounds, will remain outside of Flood Zone 2 and Flood Zone 3. Given the proximity to the Flood Zones, a Satellite Compound in Field E21 and a Construction Compound in Field E20 is considered to be the reasonable worst case scenario.
Cable Route	Cable Route options A and B, as outlined in **Figure 3.2** in **Volume 2**, do not cross Flood Zone 2 or Flood Zone 3, nor do they appear to cross any significant watercourses along the route. Given the negligible difference between the routes with regards to the sensitivity of the water environment, Option B has been considered the reasonable worst case option in line with **Chapter 5: Approach to the EIA**.

Preliminary assessment assumptions

15.8.3. For the purposes of this preliminary assessment, it has been assumed that Rosefield Solar Farm will be developed in line with the proposed Zonal Masterplan (**Figure 1.2** in **Volume 2**) and that the Satellite Collector Compounds, Main Collector Compound, Rosefield Substation and BESS will remain outside of Flood Zone 2 and Flood Zone 3.

15.8.4. It is assumed that the Solar PV modules will be of a design that will facilitate flooding below the panels at no detriment to the structure holding the panels off the ground. It is assumed that the panel design will allow for

the panels to be raised above the flood water level. Only flood water level estimates can be made at this stage, based on the delineated levels provided in **Appendix 15.1** in **Volume 3**. The flood water level is subject to change if further flood modelling studies are undertaken.

15.8.5. It has been assumed that following the cessation of agricultural activities within the areas of Rosefield Solar Farm, vegetation cover will be established particularly within the areas of Solar PV modules, as opposed to the current scenario of periodic bare ground following crop harvests.

15.9. Approach to the preliminary assessment

15.9.1. The preliminary assessment of likely significant effects for water has taken into account the sensitivity of the receptor and the magnitude of the impact on that receptor. The stages of this assessment are as outlined below.

15.9.2. Criteria for determining the sensitivity of the receptor is based on professional judgement (in the absence of specific industry recognised guidance) and from the sources of information outlined for the preliminary assessment of the baseline conditions in **Section 15.6**. The sensitivity of the receptor has been defined to range from 'high' to 'negligible'. The criteria and examples of designations or circumstances that are required to evidence the sensitivity selection are set out in **Table 15.4**.

15.9.3. The criteria used to assess the magnitude of impact are outlined in **Table 15.5**. The allocation of the level of magnitude is identified through the consideration and application of professional judgement and the preliminary assessment of the supporting evidence.

15.9.4. The determination of the significance of effect is achieved using the matrix presented in **Table 15.6**. It should be noted that effects can either be beneficial or adverse.

Table 15.4 – Criteria for determining the sensitivity of receptor

Sensitivity of receptor	Criteria guide
High	The receptor has low ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance. In terms of hydrological receptors, this relates to: • A watercourse of National importance; • Areas of Flood Zone 3 or at a high risk of surface water [or other forms of] flood risk;

Sensitivity of receptor	Criteria guide
	• Water Framework Directive recorded watercourse achieving 'Good' or targeted as 'Good' status (including immediately downstream watercourses); • Regional sewer or water supply networks; • A flood plain or defence protecting between 1 and 100 residential properties or industrial premises from flooding; and • Sites of Special Scientific Interest (SSSI), Ramsar sites, Special Protected Areas (SPAs) and Special Areas of Conservation (SACs) which are potentially vulnerable in relation to their hydrological function.
Medium	The receptor: has moderate capacity to absorb change without significantly altering its present character; has some environmental value; and is of regional importance. In terms of hydrological receptors this relates to: • A watercourse of Regional importance; • Areas of Flood Zone 2 or medium surface water flood risk; • Water Framework Directive recorded watercourse achieving 'Moderate' or targeted as 'Moderate' status (including immediately downstream watercourses); • Local sewer or water supply networks.
Low	The receptor is: tolerant of change without detriment to its character; of low environmental value; of local importance. In terms of hydrological receptors this relates to: • A watercourse of Local importance; • Areas of Flood Zone 1 or low surface water flood risk; • Water Framework Directive recorded watercourse achieving 'Poor' or targeted as 'Poor' status (including immediately downstream watercourses); and • On-site sewer or water supply networks.

Table 15.5 – Criteria for determining the magnitude of impact

Magnitude of impact	Criteria guide
High	Total loss or major alteration to key elements or features of the baseline conditions to the extent that post-development character or composition of baseline conditions will be fundamentally changed. (E.g. large increase or decrease in peak flood level, significant deterioration or improvement of water quality).
Medium	Loss or alteration to one or more key elements or features of the baseline conditions to the extent that post-development character or composition of the baseline conditions will be materially changed. (E.g. moderate increase or decrease in peak flood level, moderate deterioration or improvement of water quality).
Low	Minor shift away from baseline conditions. Changes arising will be detectable but not material; the underlying character or composition of the baseline conditions will be similar to the pre-development situation. (E.g. slight increase or decrease in peak flood level, slight deterioration or improvement of water quality).
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation. (E.g. no discernible effects on hydrological elements (neither beneficial nor adverse).

Table 15.6 – Criteria matrix for determining significance of effect

Magnitude of impact	Sensitivity		
	High	Medium	Low
High	Major	Major/Moderate	Moderate/Minor
Medium	Major/Moderate	Moderate	Minor
Low	Moderate/Minor	Minor	Minor/Negligible
Negligible	Negligible	Negligible	Negligible

15.9.5. The terms used within **Table 15.6** are defined as follows:

- Major adverse/beneficial effect: where the development will cause significant improvement (or deterioration) to the existing environment.

- Moderate adverse/beneficial effect: where the development will cause noticeable improvement (or deterioration) to the existing environment.
- Minor adverse/beneficial effect: where the development will cause perceptible improvement (or deterioration) to the existing environment.
- Negligible: no discernible improvement or deterioration to the existing environment.

15.9.6. For the purposes of this preliminary assessment, moderate or major beneficial/adverse effects are deemed to be significant. Minor beneficial/adverse or negligible effects are deemed to be not significant.

15.9.7. Where the significance matrix indicates a range for the effect significance (e.g. 'moderate/minor'), professional judgement can be applied to select one option (which would be justified by evidence, as appropriate) or an effect significance range can be applied. If a significance of effect is assigned as 'moderate/minor', this would be considered significant unless further information could be provided to downgrade the significance effect to 'minor'.

15.10. Assessment of likely effects (without additional mitigation)

15.10.1. This section considers the effects that may arise during the construction, operation (including maintenance) and decommissioning phases of Rosefield Solar Farm in the absence of additional mitigation, taking into account the above embedded mitigation measures outlined in **Table 15.2** and assessing the reasonable worst case scenarios as outlined in **Table 15.3**.

Construction and decommissioning phases

15.10.2. With regards to fluvial flood risk, as the Construction Compounds, Satellite Collector Compounds, Main Collector Compound, Rosefield Substation Compound and BESS are all to be located within Flood Zone 1 and are therefore outside of Flood Zone 2 and Flood Zone 3, these components will have negligible impacts on flood risk during the construction and decommissioning phases for both scenarios.

15.10.3. During the construction and decommissioning phases, it is expected that there will be requirements to place machinery temporarily within Flood Zone 2 and Flood Zone 3 whilst groundworks are undertaken. It is not expected that this will result in any change of flood risk from baseline conditions.

15.10.4. The construction and decommissioning phases would result in an increase to the potential for soil erosion where there will be vehicle movements, earthworks and vegetation stripping. These onsite activities will have the potential to increase silt laden runoff and mobilisation of pesticides,

herbicides and fertilisers already present within the soil, resulting in the sedimentation and pollution of watercourses, which could degrade water quality of the receiving Water Framework Directive classified waterbody. As the soil is already frequently disturbed for crop harvest and ploughing, then the construction and decommissioning phases would not deviate significantly from the baseline situation.

Operational (including maintenance) phase

15.10.5. With regards to fluvial flood risk, as the Satellite Collector Compounds, Main Collector Compound, Rosefield Substation Compound and BESS are all to be located within Flood Zone 1 and outside of Flood Zone 2 and Flood Zone 3, these components will have negligible impacts on flood risk during the operational (including maintenance) phase.

15.10.6. The Solar PV modules are to be located within Flood Zone 2 and Flood Zone 3 within parts of Parcel 3 as shown in **Figure 2.1** in **Volume 2**. However, unlike the Compounds, Solar PV modules do not require ground raising and therefore there will be a negligible loss of flood plain as result of siting modules within Flood Zone 3.

15.10.7. Flood risk as a result of increased surface water runoff from increased hardstanding areas (e.g. Satellite Collector Compounds, Main Collector Compound, Rosefield Substation and BESS) will be mitigated against using formalised surface water drainage.

15.10.8. With the rainwater gap provided for between rows of Solar PV modules, there is no anticipated increase in volumes or rates of surface water runoff from areas of Solar PV modules within Rosefield Solar Farm.

15.10.9. During the operational (including maintenance) phase, overland surface water runoff from Solar PV modules could potentially create pathways between Rosefield Solar Farm and the Water Framework Directive classified waterbodies. It is expected that once vegetation is established on the land underlying the Solar PV modules, then soils will be stabilised and there will be negligible impacts on water quality discharging overland from these areas. Until vegetation is established it is expected that temporary silt fencing will remain in place.

15.10.10. The cessation of agricultural practices on the land could improve the quality of water runoff due to the reduction in the application of pesticides, herbicides and fertilizers, as well as the reduction in bare land cover between crop harvests.

15.10.11. During the operational (including maintenance) phase, formalised surface water drainage for areas of hardstanding will consider best practice for the mitigation of potential water quality pollution prior to discharge via a formalised outfall to a watercourse. Fire water runoff will be considered as

part of the surface water drainage elements of the BESS, and how pollutants associated with fire water can be prevented from leaving the Site, via a penstock valve or similar.

15.11. Additional mitigation

Construction and decommissioning phases

15.11.1. An Outline Construction Environmental Management Plan will be submitted in support of the DCO application. The Outline Construction Environmental Management Plan is expected to include measures to mitigate the risk of increased runoff during the construction phase of Rosefield Solar Farm such as:

- The use of permeable materials for construction or lay-down areas;
- Constructing and using access tracks early in the programme;
- Appropriate storage of hydrocarbons and other pollutants; and
- Use of low-pressure tyres to limit compaction.

15.11.2. An Outline Decommissioning Environmental Management Plan will be submitted in support of the DCO application. The Outline Decommissioning Environmental Management Plan will include measures to mitigate the risk of increased runoff during the decommissioning phase of Rosefield Solar Farm such as:

- The use of permeable materials for compounds or lay-down areas; and
- Access tracks would remain until late in the programme and other mitigation (low-pressure tyres, tillage and storage of chemicals) would also be used.

Operational (including maintenance) phase

15.11.3. An Outline Operational Environmental Management Plan will be submitted in support of the DCO application. The Outline Operational Environmental Management Plan will set out measures in relation to the water environment.

15.12. Assessment of residual effects (with additional mitigation)

Construction, operational (including maintenance) and decommissioning phases

15.12.1. The Construction Compounds, Satellite Collector Compounds, Main Collector Compound, Rosefield Substation, BESS and Cable Route will be located within Flood Zone 1 for both Scenario 1 and Scenario 2 and reasonable worst case scenarios, which is land classified as a **low**

sensitivity receptor to fluvial flood risk. As there will be no impacts on the flood plain as a result of Rosefield Solar Farm during construction, operation (including maintenance) and decommissioning, the magnitude of impact is considered to be **negligible**, resulting in a **negligible adverse** significance of effect, which is considered to be **not significant**.

15.12.2. The Solar PV modules will predominantly be located within Flood Zone 1, though a small percentage of panels may be within Flood Zone 2 and Flood Zone 3 in Parcel 3. This land is classified as a **high** sensitivity receptor to fluvial flood risk. However, as there are no impacts on the flood plain as a result of Rosefield Solar Farm during construction, operation (including maintenance) and decommissioning, the magnitude of impact is considered to be **negligible**, resulting in a **negligible adverse** significance of effect, which is considered to be **not significant**.

15.12.3. Much of Rosefield Solar Farm will drain towards Water Framework Directive classified waterbodies which are shown to be **medium** sensitivity receptors. With the embedded and additional mitigation in place during construction, operational (including maintenance) and decommissioning phases, the magnitude of impact is shown to be **negligible adverse**, resulting in a **negligible** significance of effect, which is considered to be **not significant**.

15.13. Opportunities for enhancement

15.13.1. The provision of a surface water drainage strategy (secured in the Outline Surface Water Drainage Strategy which will be submitted in support of the DCO application) for areas of proposed hardstanding will capture surface water runoff from these areas and will be discharged back into the environment and limited to greenfield runoff rates (typically the 1 in 1 year rate or QBAR rate (equivalent to the 1 in 2.3 year)). This means for rainfall events greater than the QBAR event, there is a reduction in the peak rates of surface water runoff leaving the development compared to the baseline scenario. The resulting effect is flood risk may be reduced within the catchment theoretically.

15.13.2. The provision of vegetation cover (for the duration of the operational (including maintenance phase) below the Solar PV modules within Rosefield Solar Farm will help slow the rate of surface water runoff from the Site during high intensity rainfall events and promote the interception of surface water runoff. Compared to the baseline scenario, agricultural practices will periodically result in bare vegetation ground cover and exposed soils which can potentially increase the rate of surface water runoff. Linear depressions caused by the repeated movement of agricultural vehicles over the soil can also increase the velocity in which surface water leaves the Site and potentially increase peak runoff rates.

15.13.3. The cessation of arable agricultural activities and reduction in livestock grazing will result in a reduction of the application of pesticides, herbicides and fertilisers and effluent within the Site which would help improve the quality of surface runoff. Vegetation cover will also stabilise soils and reduce the mobilisation of these materials.

15.14. Difficulties and uncertainties

15.14.1. The following difficulties and uncertainties have been encountered in undertaking this preliminary assessment:

- The information provided in this PEIR is preliminary and is based on the information available at the time of writing. A full assessment of likely significant effects will be reported in the ES;
- The preliminary assessment of flood risk has been based on model data derived from a nationalised modelling data set. Therefore, flood depths and water levels are indicative. To provide any increase in certainty in flood depths, levels and extents a bespoke hydraulic flood modelling exercise would be required. The need (or otherwise) for such modelling will be discussed with the Environment Agency and Buckinghamshire Council (being the Lead Local Flood Authority);
- The impacts of climate change on the extents of Flood Zone 3 have been assumed to result in flooding with extents no worse than indicated by Flood Zone 2 extents. A hydraulic modelling exercise would be required to determine flood depths, water levels and extents with the inclusion of a climate change factor. The need (or otherwise) for such modelling will be discussed with the Environment Agency and Buckinghamshire Council (being the Lead Local Flood Authority);
- The surface water drainage strategy has not been designed at the time of writing this preliminary assessment. Therefore, the principles of the drainage strategy outlined in this preliminary assessment are based on assumption that best practice will be followed;
- No environmental surveys have been undertaken for the preliminary assessment of the Water Framework Directive classified waterbodies. Baseline conditions are based on the Cycle 3 classifications and are assumed to be correct; and
- It has been assumed that the flood plain volume lost from the supports of Solar PV modules is negligible and no further mitigation is required. Further consultation is required with the Environment Agency to confirm this can be considered the case.

15.15. Further work required to inform the ES

15.15.1. To form a robust ES, the following work is proposed so that all aspects will be suitably considered.

15.15.2. A Flood Risk Assessment will be undertaken which will inform the ongoing design of Rosefield Solar Farm. The Flood Risk Assessment will be submitted in support of the DCO application and in parallel with the preparation of the ES.

15.15.3. The Flood Risk Assessment will be undertaken in accordance with the policy requirements set out at 5.8.13-23 of NPS EN-1 (2023). The Flood Risk Assessment will be made using the data available for the fluvial and the surface water flood risk and establishing which areas of Rosefield Solar Farm are at risk from these flood risk sources. The assessment will consider the vulnerability of those using the Site, including arrangements for safe access and escape.

15.15.4. A quantitative assessment will be made in relation to whether Rosefield Solar Farm will cause an increase in flood risk elsewhere, either as a result of modifications to the flood plain or changes in ground permeability which can alter the surface water runoff from the Site. The assessment will be made by calculating greenfield runoff rates from the Site and ensuring that surface water runoff rates from proposed areas of impermeability (as a result of construction and operation (including maintenance)) do not exceed existing greenfield runoff rates. The quantitative assessment into runoff rates will also consider the requirements for sustainable drainage systems (SuDS) to mitigate against any potential increases in runoff rates from impermeable constructed areas.

15.15.5. Through the implementation of the Outline Surface Water Drainage Strategy, the Flood Risk Assessment will if practicable identify and secure opportunities to reduce the causes and impacts of flooding overall, making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management.

15.15.6. The Environment Agency will be formally consulted on the latest updated Zonal Masterplan and their opinion on the requirement for bespoke hydraulic flood modelling will be sought.

15.15.7. The Environment Agency will be formally consulted to seek their opinion on whether the volume of flood water displaced by panel supports can be considered as negligible or whether flood plain compensation (by way of minor land reprofiling) should be considered.

15.15.8. The Environment Agency will be formally consulted on the requirement for Water Framework Directive screening, scoping and impact assessment in line with the recommendations of the Planning Inspectorate's Advice Note Eighteen: the Water Framework Directive.

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