OAKLANDS FARM SOLAR PARK

Applicant: Oaklands Farm Solar Ltd

Environmental Statement
Chapter 8 – Water Resources and Flood Risk
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Oaklands Farm Solar Park - Environmental Statement Volume 1

Chapter 8: Water Resources and Flood Risk

Final report
Prepared by LUC
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Chapter 8
Water Resources and Flood Risk

Introduction

8.1 This chapter considers the potential effects of the Proposed Development on water resources (including surface and ground water), drainage and flood risk.

8.2 This chapter provides a synopsis of the relevant policy and guidance documents. It describes the assessment methodology and baseline hydrological conditions on Site, as informed by a Land Quality Desk Study (**Appendix 9.1: Land Quality Desk Study and Preliminary Coal Mining Risk Assessment**) and Flood Risk Assessment and Outline Drainage Strategy (**Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**). Where relevant, this chapter then describes a summary of the likely environmental impacts and, where these are considered to be significant, the proposed mitigation measures required to avoid, prevent, reduce or offset adverse effects.

8.3 This chapter does not consider private water supplies as throughout the consultation and data request stages, the presence of such supplies were not recorded and it is assumed that properties on Site and within the Study Area are mains fed (public water supplies).

8.4 **Chapter 9: Ground Conditions** considers the effect of construction phase activities on the ground conditions beneath the Site. **Chapter 6: Ecology** considers the effect of construction phase activities on ecological receptors, some of which may be via the hydrological pathways discussed within this chapter.

8.5 The hydrology assessment was undertaken by Yellow Sub Geo Ltd. This chapter is supported by the following figures available in **Volume 2**:

- **Figure 8.1: River Mease Catchment Plan**
- **Figure 8.2: Water Resources Study Area**
- **Figure 8.3: River Basin Management Plan Catchment Areas**
- **Figure 9.1: Field and Historic Map Observations**

8.6 The following appendices are also referred to throughout this chapter:

- **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**
- **Appendix 8.2: Oaklands Solar Farm: Water Framework Directive Assessment**
- **Appendix 9.1: Land Quality Desk Study and Preliminary Coal Mining Risk Assessment**

Scope of the Assessment

Effects Assessed in Full

8.7 The following potential effects have been identified for consideration in this assessment.

Construction phase

8.8 During the construction phase certain aspects of the Proposed Development have the potential to adversely affect the local water environment if mitigation measures are not employed.

8.9 The following aspects are considered to have the potential to affect the hydrological regime during the construction phase of the Proposed Development:

- Direct effects during construction, including:
  - Leaks and spills of pollutants.
  - Erosion of sediment and soils.
  - Compaction of soils.
  - Disturbance of the ground to install foundations and cable routes for the Proposed Development infrastructure and access tracks.
  - Disturbance of watercourses to create crossings for plant and machinery.
- Direct and indirect effects on the local hydrological regime due to construction works encountering potentially contaminated materials within areas of historical backfill (such as made ground) to the former gravel pits and marl pits present in some areas of the Site, including the potential for mobilisation of such materials in groundwater.

Operational phase

- Indirect effects on groundwater and soils due to the change from intensive agriculture to low intensity grazing across the Site.
- Indirect effects on local flow regimes from alteration of infiltration rates due to the change in land use from intensive arable agriculture to the Proposed Development and associated infrastructure such as the Proposed Development's substation, energy storage systems and inverters.
- Potential impact on the hydrological regime brought about by the introduction of structures such as the Proposed Development's substation, inverters and energy storage systems.

8.10 In each of these aspects, mitigation measures have been embedded within the design and implementation of the construction phase to prevent the likelihood that a significant effect may occur.

Decommissioning phase

8.11 During the decommissioning phase certain aspects of the Proposed Development have the potential to adversely affect the local water environment if mitigation measures are not employed. Decommissioning phase direct and indirect effects are considered to be the same as the construction phase effects listed above. Mitigation measures to avoid these effects will be detailed in a Decommissioning Phase Environmental Management Plan (outline provided at **Appendix 4.5**) secured through a requirement attached to the DCO and subject to approval by South Derbyshire District Council prior to decommissioning.

Cumulative Impacts

8.12 The construction and operational effects on the local hydrological regime will be assessed alongside those effects from six further schemes within the local. Schemes within 1km of the Proposed Development are assessed as projects within close proximity are more likely to have cumulative impacts due to factors such as shared resources, infrastructure and similar environmental settings. Renewable energy developments have been focussed upon to enable the overall sustainability to be assessed by looking at the long-term implications of multiple similar projects on an area's resources and local community. These projects are summarised within **Table 8.9** and namely:

- DMOT/2023/0621 development of an Energy Storage System (ESS) and substation development on Land at Barr Hall Farm, Drakelow, South Derbyshire.
- DMPA/2021/1221 (Consented) The installation of a Battery Storage Facility with associated infrastructure and access, grid connection consisting of the erection of a substations, control buildings, communications cabinets, battery transformers, proposed boundary treatment and installation of CCTV with associated works at Land to the north of the Royle Farm Business Park, Caldwell Road, Burton-on-Trent.
- 20/01245/FULM (Under construction) Installation of a solar farm comprising ground mounted solar PV panels (143,000) with a generating capacity of up to 49.9MW, including mounting system, battery storage units, inverters, underground cabling, stock proof fence, CCTV, internal tracks and associated infrastructure, landscaping and environmental enhancements for a temporary period of 40 years and a permanent grid connection hub. Land South of Main Road Haunton Tamworth Staffordshire.
- CW9/1022/22 Application for proposed construction and operation of the Swadlincote Resource Recovery Park comprising an Energy Recovery Facility and Aggregate Recovery Facility together with ancillary infrastructure including grid connection works, substation, CHP off-take provision, internal vehicular circulation and yard areas, weighbridges, car parking, temporary construction compound and laydown area, security fencing and gates, drainage, landscaping and offsite habitat compensation on Land adjacent to Willshee's Waste And Recycling Limited, Keith Willshee Way, Cadley Hill, Swadlincote, DE11 9EN.
- DMPA/2020/0542 (Consented) The variation of condition 5 of permission ref. 9/2018/0223 (relating to the construction of a 40MW energy storage scheme with 1 no. building (sui-generis use) to provide back up electricity services to the grid for a period of 25 years from the date of commission of the battery storage scheme) at Breach Farm, Cadley Lane, Caldwell, Swadlincote, DE12 6RJ.
- CW9/0420/7 (Under construction) Construction and operation of an 18MW Renewable Energy Centre and associated infrastructure on land at the former Drakelow C Power Station, Walton Road, Drakelow.

8.13 Given the location and scale of the above developments, all six have been taken forward to the cumulative impact assessment such that potential impacts on hydrological receptors may be appropriately assessed.

Effects Scoped Out

8.14 In light of the Scoping Opinion (see **Appendix 2.2**), no aspects of the hydrology topic area have been 'scoped out' of detailed assessment. This is considered to be a precautionary approach and therefore presents the worst-case scenario.

Assessment Methodology

Legislation and Guidance

Legislation

8.15 This assessment is carried out in accordance with the principles contained within the following legislation:

- Flood and Water Management Act 2010. This sets out a large scale overview of flood risk and assigns responsibility to local authorities to manage flood risk from groundwater, surface water and ordinary watercourses.
- The Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (2000/60/EC). This sets out the basis for assessing quality of surface waters and groundwaters.
- Land Drainage Act 1991. This act denotes functions of LLFA's and regulations in regard to the control of flow of Watercourses.
- Groundwater Directive 2006/118/EC. This sets out the regime for groundwater quality standards and introduces measures to prevent or limit pollution of groundwater.
- Environmental Damage (Prevention and Remediation) (England) Regulations 2015. This sets out the requirements where damage to land or water by pollution is caused.
- The Environmental Permitting (England and Wales) Regulations 2016. This sets out the environmental permitting regime.
- Construction (Design and Management) Regulations 2015. This requires consideration of the health and safety of workers during the construction phase of a project.

Guidance

8.16 This assessment is carried out in accordance with the principles contained within the documents described below:

- The Department for Levelling Up, Housing and Communities updated the National Planning Practice Guidance on land affected by contamination[1] and on water supply, wastewater and water quality[2] (22nd July 2019). This provides guiding principles on how planning can deal with land affected by contamination and ensure water quality and the delivery of adequate water and wastewater infrastructure.
- Rainfall Runoff Management for Developments[3] provides advice for regulators, developers and local authorities on the requirements for storm water drainage design for new developments.
- PINS Advice Note 18 – The Water Framework Directive[4] (WFD). The purpose of this Advice Note is to alert applicants to the requirements of the WFD and WFD Regulations 2017, as applicable to NSIPs under the Planning Act 2008.
- The SuDS Manual (C753) (2015)[5]. Incorporates industry practice and guidance in delivering the SuDS requirement to meet the 'Government non statutory technical standards'.

[1] Department for Levelling Up, Housing and Communities (2019) Land Affected by Contamination. Available at: https://www.gov.uk/guidance/land-affected-by-contamination [Accessed 29/09/23]

[2] Department for Levelling Up, Housing and Communities (2019) Water supply, wastewater and water quality. Available at: https://www.gov.uk/guidance/water-supply-wastewater-and-water-quality [Accessed 29/09/23

[3] Defra and the Environment Agency (2013) Rainfall Runoff Management for Developments. Report SC030219. Available at: https://assets.publishing.service.gov.uk/media/602e7158d3bf7f7220fe109d/_Rainfall_Runoff_Management_for_Developments_-_Revision_E.pdf [Accessed 29/09/23]

[4] Planning Inspectorate (2017) Advice Note 18 – Water Framework Directive. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-18/ [Accessed 29/09.23]

[5] Ciria (2015). The SuDS Manual. Available at: https://www.ciria.org/ItemDetail?iProductCode=C753F&Category=FREEPUBS [Accessed 29/09.23]

- National Policy Planning Framework[6] (2023) Sections 14 and 15. Section 14 details a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change and water supply. Section 15 provides guidance to ensure that new and existing developments do not affect or are not affected by the pollution of water. It also states that developments should help to improve local environmental conditions including water quality.

National Policy

8.17 The Overarching National Policy Statement (NPS) for Energy (EN-1)[7] notes that there may be negative effects on water quality, water resources (Section 5.15) and flood risk (Section 5.7) from energy generation projects during construction and operation. As such, in terms of good design principles and sustainability (Section 4.5 of EN-1), energy generation infrastructure needs to consider and, where appropriate, mitigate against effects from flood risk including sustainable drainage and climate change along with potential negative impacts to water resources and quality.

8.18 The November 2023 draft Overarching NPS for Energy (EN-1)[8] to be designated is in keeping with the above current version. However, it also includes advice on how such developments may provide wider environmental gains (Section 4.6) over and above Biodiversity Net Gain which include the potential reduction of off-site flood risk.

8.19 The November 2023 draft NPS for Renewable Energy Infrastructure (EN-3)[9] to be designated, provides advice with regards to siting of critical equipment in relation to potential flood risk (paragraph 2.10.60). It also notes that any development will need to appropriately consider drainage but confirms that as solar arrays drain to the existing ground, the impact will not in general be significant (paragraph 2.10.84). It notes that, where possible, flood risk and

[6] Department for Levelling Up, Housing and Communities (2023) National Planning Policy Framework Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 [Accessed 09/01/24]

[7] Department for Energy and Climate Change (2011) Overarching National Policy Statement for Energy (EN-1)

[8] Department for Energy Security and Net Zero (2023) Draft Overarching National Policy Statement for Energy (EN-1)

[9] Department for Energy Security and Net Zero (2023) Draft National Policy Statement for Renewable Energy Infrastructure (EN-3)

drainage elements should also seek to enhance biodiversity especially where sites are removed from intensive agriculture (paragraph 2.10.89).

Local Policy

8.20 South Derbyshire District Council (SDDC)'s Local Plan[10] makes reference to hydrology in Policy SD2, Flood Risk. It states that "*Suitable measures to deal with surface water will be required on all 108 sites in order to minimise the likelihood of new development increasing flood risk locally. Any developments that could lead to changes in surface water flows or increase flood risk should be managed through the incorporation of Sustainable Drainage Systems (SUDS)"*

8.21 The Local Plan also has a strategic objective to "*ensure future development is locally distinctive and environmentally, socially and economically sustainable through the achievement of design excellence, addressing the causes and effects of climate change and reducing waste and pollution".*

Consultation

8.22 In undertaking this assessment, consideration has been given to the scoping responses and other consultation which has been undertaken as detailed in **Table 8.1**.

[10] South Derbyshire District Council (2016) South Derbyshire Local Plan. Available at: https://www.southderbyshire.gov.uk/our-services/planning-and-building-control/planning/planning-policy/local-plan

Table 8.1: Consultation Responses

Consultee	Issue Raised	Response/Action Taken
Scoping Consultation Responses		
The Planning Inspectorate September 2021	Hydrology should be scoped into the assessment.	Agreed. Hydrology is an integral part of this chapter.
	PINS note the proposed use of mitigation measures, namely sustainable urban drainage. The design of such mitigation measures should be informed by relevant and up to date climate change allowances for the project's lifespan	Source control SuDS features are proposed for the Site with surface water run-off discharged to ground. All necessary mitigation has been informed by relevant and up to date climate change allowances for the Proposed Development's lifespan.
	The Environmental Statement (ES) should provide detailed information on the potential impacts of the Proposed Development on the River Mease Special Area of Conservation (SAC), such as the potential for sediment from the Proposed Development entering the watercourse. Agreement on the impacts and conclusions of assessment should be sought from Natural England.	This is included in the application in the form of a report to inform HRA (**Appendix 6.2**).

Consultee	Issue Raised	Response/Action Taken
	The Applicant should append a draft/outline SWMP to the ES and demonstrate how this document will be secured, through the DCO or other legally binding mechanism	This is included in the outline Construction Environmental Management Plan (CEMP) in **Appendix 4.3** of Volume 3 of the ES.
Derbyshire County Council September 2021	Welcomes the undertaking and submission of a 'Robust Report thoroughly assessing Flooding'. No further requirements.	Flood Risk Assessment and Outline Drainage strategy provided in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**
Rosliston and Drakelow Parish Councils September 2021	Hydrology should be scoped into the assessment.	Hydrology is assessed in this chapter.
Environment Agency September 2021	Welcomes the undertaking and submission of a Flood Risk Assessment (FRA). Indicate the LLFA (Derbyshire Council) should be consulted for their views on hydrology. Requirements to follow additional advice regarding panel layout and watercourse easement.	The author consulted the LLFA on hydrology on the June 27th 2023 and their response is outlined in this table Flood Risk Assessment and Outline Drainage strategy provided in **Appendix 8.1: Flood**

Consultee	Issue Raised	Response/Action Taken
	No further requirements for groundwater over and above a desk based assessment on ground conditions.	**Risk Assessment and Outline Drainage Strategy** Desk top study provided in **Appendix 9.1: Land Quality Desk Study and Preliminary Coal Mining Risk Assessment**.
Public Health England September 2021	Recommends that a CEMP be provided to demonstrate that construction phase effects can be controlled and mitigated. Requires consideration for potential impacts to environmental receptors such as watercourses. Sets out guidance for assessment of emissions to water. Requirements for an assessment of land quality are set out, including consideration of emissions and effects to water associated with; a) pre-existing ground conditions; b) construction-phase activities c) operational phase activities.	Consideration of potential impacts to environmental receptors has been included in **Table 8.6**. An Outline CEMP is included at **Appendix 4.3**. Potential impacts to watercourses and assessment of emissions to water are assessed in this chapter in accordance with the guidance provided. Land quality is considered within this chapter, specifically in relation to pre-existing hydrological conditions with wider land quality

Consultee	Issue Raised	Response/Action Taken
		effects assessed in **Chapter 9: Ground Conditions**. b) and c) control of emissions during construction and operational phase and re-use of soils are included within the Outline CEMP (**Appendix 4.3**) and outline Operational Environmental Management Plan (**Appendix 4.4**)
South Derbyshire District Council (SDDC)	Consideration to be given to the sensitivity of the Mease SAC to nutrient release. Consideration to be given to the potential of the development to alter surface water run-off and drainage characteristics. Consideration to be given to the development's potential to damage field drains which may affect the local hydrological regime Implementation of an appropriate Sustainable Drainage System (SUDS)	These concerns are assessed in this chapter within the following paragraphs: ■ Paragraph 8.49 - Mease SAC ■ Paragraph 8.65 - Surface water run-off and SUDS ■ Paragraph 8.97 - land drains
PEIR Consultation Responses		

Consultee	Issue Raised	Response/Action Taken
South Derbyshire District Council (SDDC)	Potential grading of parts of the site and storing of heavy machinery may lead to soil compaction, and subsequent surface water run-off that would need to be addressed	This is addressed in effect C3 in **Table 8.6** within this chapter and in **Chapter 9: Ground Conditions**
Derbyshire County Council Response to PEIR consultation	The Applicant should provide an assessment of any potential the proposed development might have to exacerbate climate change impacts, such as drought and flood risk. In order to maximise infiltration a soil management plan should be developed which demonstrates how damage to soil horizons and ground cover will be mitigated and remediated during and after construction and for future decommissioning. There is a suggestion that chisel ploughing will be undertaken on completion of construction works to improve infiltration and counter compaction – how will this be carried out with the solar arrays in place? A construction phase surface water management plan should be incorporated. Measures should be incorporated to mitigate against potential erosion of the ground underneath the lower edges of the arrays.	All necessary mitigation has been informed by relevant and up to date climate change allowances for the Proposed Development's lifespan. An assessment of the Proposed Development and Climate Change is considered at paragraphs 8.58 - 8.61 of this chapter. Soil management plan has been developed and accompanies the CEMP in **Appendix 4.3**. Chisel ploughing will not take place on site. Instead low bearing pressure plant will be used to minimise potential local compaction of near surface soils.

Consultee	Issue Raised	Response/Action Taken
	Any surface water drainage system should be sustainable and with multiple benefits. Ordinary watercourses within the site should be modelled to ensure infrastructure is kept outside of areas of risk.	Surface water management measures are included within the Outline CEMP. Overall erosion and erosion of the ground underneath the lower edges of the arrays will be reduced as vegetation will be in place all year round, and therefore the underlying soil will not be left bare or compacted by agricultural activities. The vegetation will intercept and buffer the runoff from the panels as described in section 6.4.1 of **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**. A Sustainable urban drainage system has been proposed and is described in detail in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy** this both attenuates the surface water flows, and allows for interception of pollutants.

Consultee	Issue Raised	Response/Action Taken
	As requested by the Environment Agency, there should be a minimum of 8m easement between the top of any watercourse bank and any infrastructure. Any watercourses crossings, or changes to existing crossings, may need Land Drainage Consent from the LLFA and should be designed so as to not impeded drainage. Drawings of battery storage and transformer details in the FRA do not appear to show the gravel bases referred to within paragraphs 5.6 and 5.7.	The surface water flood map, which is likely to more accurately reflect the risk of flooding from the ordinary watercourse than the flood zone mapping has been assessed and discussed in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy** Addressed in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy** section 5.1 Addressed in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy** section 5.1 A drainage and containment system is now proposed for both the battery energy storage system and sub-station for drainage and fire-fighting water control.

Consultee	Issue Raised	Response/Action Taken
		See updated FRA in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**
Direct consultation with the project team		
Flood Risk Management Derbyshire County Council (DCC) Email correspondence with project team 05/07/23	The compatibility of the Site to accommodate the solar farm with minimal grading and disturbance of natural ground and vegetative cover. A soil management plan to address any anticipated issues with ground stability, soil erosion and concentrated runoff should be included. DCC want to know about any ground disturbing activities that will be necessary such as method of installation of array supports, access road grading, stream crossings, grading for larger structures (substations, parking, etc). Regarding impermeable surfaces the DCC want to know the overall total of new impermeable cover and percent cover. They would be most interested in larger areas that could produce concentrated runoff and what management scheme is proposed for each. Some basic calculations will be needed for greenfield runoff rates and to	A soil management plan has been developed and accompanies the CEMP in **Appendix 4.3**. Impermeable surfaces and runoff is addressed in paragraph 8.111 and the FRA found in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy.** The FRA also specifies greenfield runoff rates and volumes.

Consultee	Issue Raised	Response/Action Taken
	demonstrate the effect of the Proposed Development on runoff rates and volumes.	
Environment Agency email to project team 23/03/22	We note that although you state the proposed panels will be located outside the floodplain, from a review of your proposed plans it appears as it some of your solar array does, or could fall within the 100 year plus climate change flood extent once modelling inaccuracies and climate change is taken into account. We note your query with regards to the potential need for a WFD assessment and recommend that you undertake a screening assessment to ascertain whether this would be a formal requirement for the planning application or not. Please find attached what would seem to be appropriate Guidance Notes for your assistance in respect of flood risk and WFD Screening. From the drawings, it looks like the solar panel array will be set closer to the watercourse. The RBMP data you should use would be for the waterbody GB104028047180. You should also check if it would impact the waterbody GB104028047310.	A Water Framework Directive Screening has been undertaken is presented in **Appendix 8.2**.

Study Area

8.23 The study area has been defined to include the entirety of the two sub-catchments in which the Site is located; that of the Pessall Brook and that of the unnamed tributary of the River Trent which flow through the Site. Where the Site sits on the edge of these catchments, an additional 500m buffer has been included around the Site boundary of the Proposed Development (the Study Area) which encompasses areas within the two wider catchments of the River Mease and River Trent (see **Figure 8.2: Water resources study area**). 500m is considered to be an appropriate buffer for a comprehensive assessment to ensure all potential likely significant effects are assessed, the broader scope helps ensure that all relevant watercourses are considered within the assessment. By including a wider buffer area, the hydrological connectivity of watercourses can be assessed and any potentially indirect impacts on watercourses can be captured.

Desk Based Research and Data Sources

8.24 The desk based research for this chapter is detailed within **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy** which contains the FRA and Outline Drainage strategy.

8.25 Further to the above the following data sources have also informed the assessment: **Appendix 9.1: Land Quality Desk Study and Preliminary Coal Mining Risk Assessment**, within which the full list of data sources is referenced. **Appendix 9.1** includes environmental database reports covering the Study Area (Envirocheck refs: 279264891_1_1 and 283096012_1_1).

Field Survey

8.26 A Site walkover survey was undertaken to inform the writing of the FRA and Land Quality Desk Study. The visit was undertaken on 16 July 2021 and comprised a combination of walkover and, where access allowed, vehicular survey of the study area. This survey enabled the identification of general ground conditions and a survey of the watercourses and water features on Site and across the study area. A second visit was undertaken on the 23 June 2022 to ascertain the location of land drains across the Site area.

Assessing Significance

8.27 The following criteria have been defined for use in assessing the sensitivity of receptors, the magnitude of anticipated change to receptors caused by the Proposed Development and the resulting magnitude of effect that is created.

Sensitivity

8.28 The following table provides the framework for defining the sensitivity of receptors.

Table 8.2: Classification of sensitivity

Classification	Definition
High	The receptor has little ability to absorb change without fundamentally altering its present character, is of high environmental value, or of international importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional or national importance.
Low	The receptor has high capacity to absorb change without significantly altering its present character, has low environmental value, or is of local importance.

Magnitude of change

8.29 The potential changes brought about by the Proposed Development are identified and classified according to their magnitude of change. These changes are adverse unless specifically labelled as being beneficial. The categories of the magnitude of change are defined below.

Table 8.3: Classification of magnitude of change

Classification	Definition
Large	There would be fundamental changes to the hydrology. For example: ■ Loss or extensive change to a fishery. ■ Loss of regionally important public water supply. ■ Loss or extensive change to designated nature conservation site. ■ Reduction in waterbody WFD classification. ■ Increase in peak flood level (>100mm).
Medium	There would be material but non-fundamental changes to the hydrology. For example: ■ Partial loss in productivity of a fishery. ■ Degradation of regionally important water supply or loss of significant commercial /industrial/agricultural supplies. ■ Contribution to reduction in water body WFD classification. ■ Partial loss or change to an aquifer. ■ Increase in peak flood level (>50mm).
Small	There would be detectable but non-material changes to the hydrology. For example: ■ Minor effects on water supplies. ■ Minor effects on aquifer, abstractions or structures. ■ Increase in peak flood level (>10mm).
Negligible	■ The Proposed Development is unlikely to affect the integrity of the water environment. ■ Discharges to watercourses have no significant loss in quality, fishery productivity or biodiversity.

Classification	Definition
	■ No increase in flood risk

Significance

8.30 The predicted significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change as detailed in **Table 8.4** below. Major and moderate effects are considered significant in the context of the Infrastructure Planning (Environmental Impact Assessment) Regulations.2017 (the EIA Regulations).

Table 8.4: Matrix for assessment of significance of effects

		Magnitude of change			
		Large	Medium	Small	Negligible
Sensitivity	High	Major	Moderate or Major	Minor or Moderate	Minor
	Medium	Moderate or Major	Moderate	Minor	Negligible
	Low	Minor or Moderate	Minor	Negligible	Negligible

Assessment Limitations

8.31 The assessment of cumulative effects within this chapter assumes that other schemes will be constructed in accordance with current best practice and adopt a similar range of mitigation as shall be deployed on the Proposed Development.

8.32 Notwithstanding this, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental effects on the local hydrological regime.

8.33 There are no other known limitations to the assessment undertaken.

Baseline Conditions

8.34 The Site comprises a series of agricultural fields from three different farms: Park Farm, Fairfield Farm and Oaklands Farm. The fields are bordered by a combination of wooden fencing, mature hedgerows and country roads. The fields are further bisected by access tracks and public footpaths. The Site is variable in elevation generally sloping down from an elevated high point of 92m above Ordnance Datum (aOD) in the southern section of Site to around 64m aOD at the northern extent. **Figure 9.1: Field and Historic Map Observations** summarises the features identified during the site walkover and review of historical Ordnance Survey mapping.

8.35 It was noted during a Site walkover that there are many localised changes in slope on Site. The changes in slope are more pronounced in the fields to the south which are undulating in nature. Some of these changes in slope are coincident with areas that are shown on historical Ordnance Survey mapping to be former gravel pits (at the junction of fields Park Farm (P4 and P5) and marl pits (in fields Oaklands (O4 and O11). The location of these features is illustrated in **Figure 9.1: Field and Historic Map Observations**. Historical mapping also indicates the location of a number of former ponds (in fields O16, O14, O21 and O12) and a former reservoir (in field O5), which are no longer present and hence have likely been infilled. Structures labelled as New Barn were constructed in field O12 in the 1880s and subsequently demolished in the 1990s, these features are also labelled on **Figure 9.1: Field and Historic Map Observations**.

Geology

8.36 Geology across the Proposed Development is discussed in **Chapter 9: Ground Conditions**. The Edwalton Member which generally comprises a siltstone and very fine-grained mudstone is mapped as bedrock beneath the Site. Diamicton (glacial till) is recorded as covering the southern half of the Oaklands Farm area, the northern half of the Park Farm area and the far east of the Park Farm area. The stream corridor that crosses the south-west of the Park Farm area and provides the connection between the two farms is shown as underlain by alluvium.

Contaminated land

8.37 The preliminary conceptual site model and risk assessment included within **Appendix 9.1: Land Quality Desk Study and Preliminary Coal Mining Risk Assessment**, concludes

that potential risks to controlled waters (groundwater and surface water) from land quality are of a low order. This is on the basis that the Site is of agricultural nature and has been throughout its history and therefore provides little potential for contamination sources.

8.38 Notwithstanding this, the existence of historic marl and gravel pits and historic infilled reservoir and ponds provides the potential for there to be localised made ground on Site which may provide some limited point sources of contamination.

8.39 The degree to which fertilisers added to the soil are taken up by the crops and the degree to which they are washed out from the soil by run-off will depend upon many factors, including the timing and manner of application, the degree to which the volume of nutrients added to the soil are matched to plant demand and the prevailing weather and soil conditions at the point of application. Notwithstanding this, it is reasonable to assume that at least some of the added nutrients are leached and enter local groundwater, watercourses and water features.

Soils and agricultural land

8.40 The alluvial soils in close proximity to watercourses are described by the BGS as permeable, seasonally wet, with impeded drainage. The soils across the vast majority of the Site are described by the BGS as ‘loamy and clayey soils with slightly impeded drainage’.

8.41 Agricultural land practices are discussed further in **Chapter 15: Agriculture and Land Use.**

Hydrogeology and hydrology

8.42 The alluvium and glaciofluvial deposits beneath the central and northern areas of the Site are classified by the Environment Agency (EA) as Secondary A Aquifers. These are defined by the EA 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’.

8.43 The Edwalton Member bedrock beneath the Site is classified as a Secondary B Aquifer. These are defined by the EA as ‘predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering’.

8.44 The Site is predominantly within the catchment of the River Trent, more specifically within the *Trent – River Tame to River Dove water body* catchment. A very small area of the far

southern edge of the Oaklands Farm area drains into the catchment of the River Mease, more specifically the *Mease from Hooborough Brook to Trent water body* catchment. The River Mease is a SAC (see **Figure 8.3: River Basin Management Plan Catchment Areas**).

8.45 The catchment of the River Mease, as defined by the EA Catchment Data Explorer[11], has been superimposed as the grey hatched area on **Figure 8.1: River Mease Catchment Plan**. As can be seen, it covers just the very southern part of field O1. There are no water features shown on Ordnance Survey mapping in the field, and none were noted during the site walkover. The southern Site boundary here is formed by the northern edge of Church Street. Two small ponds are shown by Ordnance Survey mapping to be present offsite on the opposite, southern side of Church Street. Within the River Mease catchment, no watercourses have been recorded on or in close proximity to the Site. Whilst the topography is such that this small part of field O1 is in the catchment of the River Mease, there is no direct pathway to the River Mease itself. The field will drain to ground with groundwater movement beneath Church Road before draining to the pond and if present, field ditches in offsite fields to the south. This in turn will then drain to the Pessall Brook (1km to the south) which in turn then drains to the River Mease.

8.46 The majority of the Site drains to the River Trent (approximately 1.4km to the west and north-west of the Site) via an unnamed tributary that flows though the Site. This is shown on Ordnance Survey mapping to originate in the village of Rosliston and flow northwards through fields that lie offsite to the east, in close proximity to fields O21, O10, O8 and O7. This stretch of the stream was within an area of overgrown vegetation that made it inaccessible during the walkover. This tributary then joins a small area of ponded water east of fields O21 and O10 before crossing onto Site between fields O23 and O22, in the area of the Proposed Development that joins the two farms. From here the stream flows beneath Rosliston Road and forms the western Site boundary. Further north of this point, the stream and Site boundaries part. The tributary eventually joins the River Trent approximately 1.4km to the north-west.

8.47 A secondary tributary to this tributary is shown on Ordnance Survey mapping to collect water from a series of field ditches near the Oaklands Farm area (fields O5 and O18 to O18,

[11] Environment Agency Catchment Data Explorer, updated 14th September 2021. https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3303

O12 and O19) before flowing along the northern boundary of field O22. It then joins the main tributary immediately upstream of Rosliston Road.

8.48 Further areas of ponded water were noted on the 2021 aerial imagery to be located in field P8 of the Park Farm area. This area was fenced off with mature trees surrounding it so was not accessed during the walkover survey.

Water Quality

8.49 A very small area of the far southern edge of the Oaklands Farm area drains into the catchment of the River Mease, more specifically the *Mease from Hooborough Brook to Trent water body* catchment. As classified by the EA catchment data explorer[12] the ecological status of this catchment is determined as moderate with the reasons for not achieving good status as follows:

- Poor nutrient management affecting macrophytes classification.
- Poor soil management affecting fish classification.
- Sewage discharge affecting fish classification.
- Land drainage modifications affecting fish classification.

8.50 The majority of the Site drains to the River Trent through two adjacent catchments with the majority draining via the '*River Tame to River Dove Waterbody'* catchment and a limited portion of the north-east of the Site draining to the River Trent via the '*Darklands Brook Catchment (trib of Trent) Water Body'*. The Darklands Brook waterbody is classified as moderate and the River Tame to Dove catchment poor with the relevant combined reasons for not achieving good determined as:

- Sewage discharges affecting fish, invertebrates and phosphate classification.
- Poor livestock management affecting phosphate, macrophytes and invertebrates classification.
- Urbanisation affecting macrophytes invertebrates and phosphate classification.

[12] Environment Agency Catchment Data Explorer, updated 14th September 2021. https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3303

Current Flood Risk

8.51 Greenfield run-off is the estimated run-off from the Site in its original condition. Greenfield run-off from the Site has been estimated using the IH124 methodology on the UK SUDS online tool[13] based on a 1ha parcel of land in the centre of the Oaklands Farm area as a representative calculation. This is used to represent the baseline drainage conditions within the Site which are detailed in full in the Flood Risk Assessment in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**.

Table 8.5: Greenfield run-off rates (calculated using UK SUDS online tool)

Greenfield run-off rates	Results
QBAR (l/s)	4.34
1 in 1 year (l/s)	3.6
1 in 30 year (l/s)	8.68
1 in 100 year (l/s)	11.15
1 in 200 year (l/s)	13.19

8.52 However, greenfield run-off is an estimate of run-off from the Site in a natural condition. Land use, including agricultural use, changes the natural run-off, so the baseline conditions at the Site will already include a modification to greenfield run-off.

8.53 Of particular note is the current use of heavy agricultural machinery on Site as part of the existing land management activities. Use of this machinery can compact soils, reducing infiltration and increasing run-off. Growing seasonal crops results in bare soils during winter months, increasing winter water run-off. The actual current run-off rates are therefore considered likely to exceed the modelled greenfield run-off rates.

8.54 The risk of flooding from fluvial and tidal flooding is summarised in the Flood Risk Assessment in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy** as

[13] https://www.uksuds.com/tools/greenfield-runoff-rate-estimation

follows '*the current annual flood risk from these sources range from low to high. Flood risk is generally low (Annual Exceedance Probability [AEP] less than 0.1%) except for a corridor following the unnamed Ordinary Watercourse'*. The EA Flood Map for Planning indicates that the majority of the Site is in Flood Zone 1 with an annual risk of fluvial flooding less than 1 in 1,000. However, small areas bordering the Ordinary Watercourse are in Flood Zones 2 and 3, with an annual risk of fluvial flooding greater than 1 in 1,000.

8.55 Surface water flooding arises from rainfall intensities exceeding the rate at which the ground can absorb the water and the local drainage system has capacity for. Mapping of surface floodwater indicates a network of flow paths channelling excess water across the Site to the watercourse particularly across fields O16, O17, O14 and O13 with some limited areas of ponding where surface water may collect before slowly infiltrating into the soil. The likely depth of flooding in a medium risk event is, outside of the river channel, typically less than 300mm.

Future Baseline in the Absence of the Proposed Development

8.56 Current land management practices lead to bare soil in winter periods and compaction of soils under agricultural vehicles during crop management. Continuation of these practices will likely exacerbate the effects of increased duration and intensity of rainfall events (as are expected from climate change modelling) and hence contribute to further deterioration in soil structure, soil carbon storage and overall soil health. This in turn will lead to increased surface run off due to poor infiltration and groundwater storage.

8.57 The continued use of the Site for intensive arable farming will likely prevent improvement to current soil, groundwater or surface water quality and will likely cause further deterioration of it due to continued use of pesticides and fertilisers.

Implications of Climate Change

8.58 Current climate change projections (UKCP18) are for increased winter rainfall and an increase in heavy rain days. Given the arable nature of the majority of the land, and hence the exposure of soils due to ploughing on a regular basis, this will likely lead to increased soil loss through erosion and run-off.

8.59 Increased rainfall and increased intensity of rainfall has the potential to lead to increased leaching and run-off of contaminants, both from point sources (e.g. discrete areas of made ground) and diffuse sources (e.g. agrochemicals).

8.60 Increased winter rainfall, in combination with the increased number of winter storms, has the potential to lead to greater periods of saturated ground with a subsequent increased potential for overland flow and localised surface water flooding.

8.61 Summer rainfall is predicted to decrease, however intensity of summer storms is predicted to increase which has the potential to increase periods of localised surface water flooding and run-off.

Design Considerations and Embedded Mitigation

8.62 The key sensitive receptor with respect to water quality and run-off is the water within the unnamed ordinary watercourse. The scoping responses from the EA have been used, together with the FRA (see **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**) and professional judgement experience, to guide the proposed construction design and methodology.

8.63 The Proposed Development has been designed such that the land surrounding and beneath the solar panels will be returned to grassland, and potential grazing. Upon completion of the construction phase, fields that currently are used to produce arable crops (in excess of 50% of the land based on recent aerial photography) will become vegetated year-round. The sward within the Site boundary will be allowed to grow and will not be cropped or harvested. As a result, there will not be periods of exposed bare soil.

8.64 Unlike under the current land management scenario, during the operational phase of the Proposed Development, the fields will not be accessed by heavy plant or machinery, thus reducing compaction effects on the soil.

8.65 The proposed drainage strategy is detailed in the appended FRA (see **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**). As far as possible and in accordance with SuDS best practice, the key principle of the strategy is source control whereby all surface water run-off is discharged to ground as close to the point of interception as possible. This will include:

- Solar panel arrays will allow incidental run-off to infiltrate to ground below the panels.
- All trackways constructed to be permeable (i.e. unsealed), and as such will maintain infiltration capacity similar to the bare soil cover under the current scenario. The proportion of land given over to trackways is significantly smaller than that currently left as bare soil thus this represents a significant betterment.
- Where concrete pads are required a gravel-filled drainage trench shall be constructed around the structure, thus providing soakaway capacity equivalent to the infiltration capacity lost beneath the structure.

8.66 As detailed in the FRA in **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy** parts of the Proposed Development remain at risk of flooding from surface water, including from small channels and ditches within the Site. The flood depth in these areas is expected to be less than 300mm. Solar panels are unlikely to be affected by this flooding, should it occur, and no specific mitigation is required to protect them other than ensuring the bottom edge of the panels is not within 300mm of the ground within the mapped surface water flood risk area. As the lowest part of the solar panels is to be 800mm above ground level, there is sufficient height above the estimated potential flood level that is predicted to effect the northern section of panels only.

8.67 Inverters, transformers and the Proposed Development's substation will not be sited within the fluvial or surface water flood risk areas.

8.68 With the exception of the BESS and the Proposed Development's substation compounds, all run-off from the proposed structures will be dealt with locally with source control measures, whereby all surface water run-off is discharged to ground as close to the point of interception as possible, as detailed in the FRA (see **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**) and the Site will not generate extra run-off.

8.69 To mitigate risks from contaminated water during a fire event at the BESS and the Proposed Development's substation compounds, these areas will be mostly impermeable, with water diverted into an underground storage area which can be isolated if required. The BESS will comprise a 100% impermeable sub-base with drainage infrastructure built into or below the sub-base to divert runoff to a lined contaminant tank/pond in the unlikely event of a battery fire. Once in the tank testing, flow control and pumping will ensure the safe discharge and removal of the water. Control valves will be engaged at the earliest detection of a fire to initiate release

of the surface and fire water contaminant. Approximately 20% of the Proposed Development's substation footprint will be comprised of impermeable material. The remaining 80% of the Proposed Development's substation footprint can be considered permeable with a gravel sub-base that will allow natural drainage/infiltration. During normal rainfall events surface water will bypass these tanks will be discharged at a rate limited to the greenfield runoff rates for the same event, with outfalls into the drainage ditch approximately 300m northwest of the compounds as detailed in the FRA (see **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**). In the event of a fire, the tanks will be isolated and the water contained until tested. If the water is tested and confirmed to be contaminated, the water will be removed from the tankers by specialists and disposed of at an appropriate facility rather than into the environment.

8.70 To mitigate a potential increase in flows/volumes due to reduced attenuation with the increase in impermeable surfaces, the storage areas at the BESS and the Proposed Development's substation compounds may include water flow technology, such as a Hydrobrake, to reduce outflows to the greenfield runoff rates for the same event.

8.71 The Proposed Development has been designed to avoid fluvial flood risk zones associated with the unnamed watercourse which meanders through the Site. Potential surface water (pluvial) flood risk has been mitigated though design in three ways:

- All infrastructure such as the BESS and the Proposed Development's substation will be raised with a void beneath.
- The vast extent of the Site includes elevated solar panels on discrete piled foundations.
- The proposed cable route between the Proposed Development and its connection to the National Grid Drakelow substation will be entirely underground, and therefore there will be no above ground structures relating to the cable route to impede surface water runoff.

8.72 Therefore, whilst surface water flow paths may locally be slightly diverted, overall they shall not be affected and therefore flood risk off Site will not be increased by the Proposed Development.

Construction Environmental Management Plan (CEMP)

8.73 In order to ensure that the construction works are designed and implemented to minimise pollution and contamination, an Outline CEMP has been prepared for the Proposed Development (**Appendix 4.3**). The purpose of this document is to provide a series of measures

that will be implemented during the construction phase in order to suitably control and mitigate its environmental impact.

8.74 The Outline CEMP presents the commitments made by the Applicant to suitably limit environmental impacts of construction as part of the Proposed Development. This document will demonstrate that the Proposed Development can be delivered in such a way as to reduce, minimise or eliminate environmental impacts during the construction phase.

8.75 Prior to construction a detailed CEMP will be drawn up to provide detailed information as to how t the principles set out within the Outline CEMP will be delivered during construction. The final detailed CEMP will be submitted to the Local Planning Authority (LPA) for approval prior to commencement of development and be secured by way of a DCO requirement.

8.76 The Outline CEMP includes a sub-section (**Section 2.6**) which will form the construction Surface Water Management Plan for the Proposed Development.

Watercourses buffers

8.77 In accordance with EA scoping requirements, there will be a minimum 8m buffer along all on Site watercourses (with the exception of water crossings).

8.78 In order to ensure that these standoffs are implemented, the outline CEMP stipulates that a works stand-off from watercourses shall be maintained during the construction phase, with no works undertaken within an 8m easement with the exception of water crossings. The turf in these stand-off areas shall be maintained intact and undisturbed throughout the construction phase, thus forming a vegetated filter strip, providing protection to the watercourses from silt and run-off.

8.79 These vegetated filter strips shall be protected during the works by use of silt fencing, barrier fencing, soil berm or similar to clearly demarcate the stand-off areas and to provide a barrier to movement of plant and migration of silt as required.

8.80 The Site is of an undulating topography and therefore to minimise the potential for generation of silt-laden or otherwise contaminated run-off, and to sever pathways between the construction works and the watercourses, the CEMP includes the following:

- Phasing of works, particularly phasing of required turf and topsoil strip, such that as little bare soil is exposed at any one time.

- Sealing of all soils in storage areas (stockpiles) using an excavator bucket at the end of each shift, to minimise the potential for sediment to be washed off during a rainfall event.
- Formation of all stockpiles outside of the 8m works stand-off zones adjacent to watercourses/ ditches.

8.81 Where long-term storage of soil is planned, vegetation on stockpiles shall be allowed to naturally regenerate and/ or be seeded to facilitate a cover of vegetation.

8.82 If required, a combination of ditches, berms and sediment traps will be employed in order to control the direction and to slow the flow of rainwater run-off.

8.83 Diversion of surface water from areas of bare soil into freely draining pond/ lagoon areas to enable it to drain to ground. Where volumes and infiltration rates prevent this, water will be allowed to drain to the watercourses only if it is suitably free of visual evidence of silt or other contamination. The vegetated buffer along the watercourse will act as a filter strip but should also be supplemented with silt fencing to ensure no water pollution occurs.

8.84 Where water is visibly turbid (silt-laden) or impacted by contaminants, it shall be directed to a settlement pond to enable silt to fall out of suspension or treated prior to discharge using one or a combination of; a proprietary water treatment system (e.g. silt-buster); hay bale and/ or sedimat weirs or mats or similar; temporary grips and/ or; proprietary silt filtration devices (e.g. Naylor's SmartFilter).

8.85 The weather forecast will be monitored daily throughout the construction of the Proposed Development, in order to predict periods of likely heavy rainfall. Where heavy rainfall is predicted works may need to be suspended. Ahead of a period of forecasted heavy rain, the site works will be inspected to identify areas susceptible to sediment run-off and implement additional precautions as necessary. Such precautions may include additional sediment trap weirs, or covering of stockpiles.

8.86 At each watercourse crossing point pollution prevention measures shall be put in place prior to the start of works in that area. Examples of such measures include:

- Use of silt fencing on either side of the track across the top of the crossing.
- Use of silt control measures within the watercourse, such as bales, booms, sedimats or other measures to control any spread of silt should it enter the watercourse.

- Use of edge-protection berms to prevent migration of silt sideways from trackway into watercourse.

8.87 There is a requirement in the Outline CEMP for mitigation measures to be implemented to ensure the management of flood risk during the construction of the Proposed Development and the protection of sensitive receptors from potential contamination during the works.

Assessment of Construction Effects

8.88 The assessment of effects is based on the project description as outlined in **Chapter 4: Project Description**. Unless otherwise stated, potential effects identified are considered to be adverse.

Receptors

8.89 The relevant receptors are surface water, local watercourses and rivers and the groundwater beneath the Site. These receptors are adjudged to be able to absorb some change, but to already be partially impacted by the current land management practices on Site and on much of the surrounding farmland.

8.90 These receptors are summarised in **Table 8.6** below.

Table 8.6: Receptors considered during the assessment

Receptor	Importance	Sensitivity (see Table 8.2)	Justification
Groundwater beneath the Site	Local	Medium	The strata present beneath the Site are classified as secondary aquifers.
Ordinary Watercourses	Local	Medium	The unnamed watercourse on site has not been considered within the local River Basin Management Plan and provides a long flow path to the River Trent.

Receptor	Importance	Sensitivity (see Table 8.2)	Justification
River Mease	International	High	Due its status as a SAC.
River Trent	Regional	Medium	Based on its current and predicted poor status under the River Basin Management Plan.

Predicted Construction Effects

8.91 The construction of the Proposed Development has the potential to cause changes to the local hydrological regime, if unchecked by proper environmental controls. These impacts could take the form of:

- Pollution from fuels, oils and other chemicals that are being used and/ or stored on site entering the soils and groundwater following spills, leaks or accidental releases (C1 – **Table 8.7**)
- Erosion of sediment/ silt due to exposed soils being eroded by rainfall (C2 – **Table 8.7**)

8.92 Construction phase activities (C1 and C2 – **Table 8.7**) could disturb, expose and/or mobilise existing contaminants and pollutants within the Site into surface water run-off which drains to local drainage ditches and watercourses. The works will introduce new potential sources of contamination through the temporary storage of chemicals/ fuels and potentially through the importation of construction materials and earthworks. Furthermore, potential contamination sources have been identified, including infilled ground and use of pesticides etc (see **Chapter 9: Ground Conditions** for further detail).

8.93 Key potential pollution sources from construction activities include:

- Mobilisation and deposition of fine materials (e.g. silts and clays) from the use of machinery and vehicles (e.g. access routes, construction compounds, storage areas).
- Pollution risk in relation to the use of certain materials (e.g. cement, lubricants).
- Accidental leaks or spills during transportation, storage, maintenance and re-fuelling.

- Creation of new access tracks for construction related traffic - and with the movement of vehicles to, from and around the Site.
- Soil erosion and increased sediment loading from localised changes to catchment hydrology (e.g. compaction of soil surfaces and the excavation of material).
- Concentrated flows of water and the increased potential from erosion and mobilisation, such as along temporary drains in areas with steep gradients.
- Provision of temporary onsite sanitary facilities for construction site staff could also introduce a source of pollution, which is not currently present in the catchment.

8.94 In absence of mitigation, and based on professional judgment of the size and environmental setting of the watercourses, the effects to ordinary watercourses would be temporary, (with small magnitude of change) adverse and of **minor to moderate** significance (**not significant**) as the Site predominantly drains into the River Trent (medium sensitivity) with a minimal area flowing into the River Mease catchment (high sensitivity).

8.95 The construction phase will involve the use of heavy machinery and plant within the agricultural fields on Site which could lead to soil compaction reducing surface water infiltration and hence increasing flood risk (C3 – **Table 8.7**).

8.96 Whilst this will represent an intensive period of trafficking on the soil, it is not considered that this is any greater in magnitude than would occur from use of heavy agricultural plant and machinery in a typical growing season for arable crops. The potential magnitude of this change is therefore considered to be minor. Based on professional judgment of the size and environmental setting of the watercourses, the overall effect on ordinary watercourses and groundwater would be **minor** adverse (**not significant**).

8.97 The proposed construction method for the solar panel arrays uses driven steel tube or ‘H’ piles to form their foundations (C4 – **Table 8.7**) within the shallow soils/ superficial deposits/ weathered bedrock. These may disturb or break up land drains buried within the Site, however the number of land drains affected is expected to be minimal. This would slow down the transport of water that has infiltrated into the soil and reduce peak run-off in local watercourses. Occasional periods of increased surface water ponding may occur having no effect on the operation of the Site and reduced peak run-off in local watercourses reducing the risk of flooding downstream. Based on professional judgment due to the size and environmental

setting of land drains, the magnitude of change is considered to be small and the overall effect would therefore be **minor** adverse (**not significant**). The proposed underground routing of cables between the Proposed Development and its connection with the National Grid Drakelow substation will cause additional disturbance to shallow soils with potential methods including trenching, culverting or stopping of watercourse (C6 – **Table 8.7**) however this would be along a very narrow/ discrete route. The potential magnitude of this change is therefore assessed to be **negligible** and the potential effects to ordinary watercourses from this would be temporary, **adverse** and of **minor** significance (**not significant**).

8.98 There are potential point sources of contamination (C5 – **Table 8.7**) on the Site associated with areas of made ground where former pits/ reservoir/ ponds may have been filled in and in the area of former buildings at New Barn as identified in **Chapter 9: Ground Conditions**. Potential contaminants associated with Made Ground vary depending on the location and history of the Site but could include heavy metals or polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) and asbestos. If encountered, the extent of the Made Ground is likely to be minimal based on the footprint of historical former pits, therefore the magnitude of change is thought to be negligible based on the surrounding groundwater and surface water regime. The overall effect would therefore be **negligible** (**not significant**).

8.99 There is a risk of potential additional disturbance to shallow soils from the creation of underground cabling (C6 – **Table 8.7**) during the construction phase through trenching, and culvert creation, however this disturbance would be short-term and temporary. It is not considered that disturbance would be any greater in magnitude than that currently caused by use of heavy agricultural plant and machinery. The potential magnitude of this change is therefore assessed to be minor. Based on professional judgment of the size and environmental setting of the watercourses, the overall effect on ordinary watercourses and groundwater would be **minor adverse** (**not significant**).

8.100 These predicted construction effects are summarised in **Table 8.7**.

Table 8.7: Summary of construction phase effects prior to mitigation

Ref. No.	Predicted effect	Magnitude of change	Receptors (sensitivity)	Significance of effect
C1	Pollution from fuels, oils and other chemicals	Small	Groundwater (medium) Watercourses (medium) River Trent (medium) River Mease (high)	Minor to moderate adverse
C2	Erosion of sediment/ silt created by exposed soils	Small		Minor to moderate adverse (as the Site predominantly drains into the River Trent (medium sensitivity) with a minimal area flowing into the River Mease catchment (high sensitivity)).
C3	Soil compaction from heavy plant/ machinery	Negligible		Minor adverse
C4	Alteration to existing land drainage (e.g. by foundations)	Small		Minor adverse
C5	Interaction of Proposed Development with contaminated made ground causing mobilisation of contaminants and effect on receptors	Negligible		Negligible

Ref. No.	Predicted effect	Magnitude of change	Receptors (sensitivity)	Significance of effect
C6	Additional disturbance to shallow soils from underground cabling	Minor		Minor adverse

Proposed Mitigation

8.101 In relation to land drains (C4 in **Table 8.7**), if required, the Applicant will replace or repair any land drains found to be damaged during construction.

8.102 There is no further requirement for additional water resources mitigation measures other than those requirements of the drainage strategy (see **Appendix 8.1: Flood Risk Assessment and Outline Drainage Strategy**) and CEMP listed above (for example, following CIRIA guidance on the management of water quality and surface water runoff during construction projects and the inclusion of a construction phase Soil Management Plan).

8.103 If, as reported in **Chapter 9: Ground Conditions**, post consent a pre-construction site investigation will be undertaken following development consent to further inform the design of the Proposed Development. If this assessment determines that remediation or risk mitigation is required in order to address potential risks posed by made ground, a process of remediation options appraisal, remediation strategy, remediation implementation and verification shall be entered into to ensure risks to the wider hydrological environment are reduced to acceptable levels.

Residual Construction Effects

8.104 For pollution from fuels, oils and other chemicals (C1), erosion of sediment/ silt (C2), and additional disturbance to shallow soils from underground cabling (C6), the mitigation measures within the CEMP are considered sufficient to reduce the potential magnitude of these changes to negligible. The significance of the residual effect would be reduced to **negligible** (**not significant**).

8.105 For C3-C4 the residual construction effects would reduce to **negligible** to **minor beneficial** (**not significant**).

8.106 For C5, the mitigation measures outlined above for remediating potential made ground are considered to be sufficient to reduce the magnitude of changes to negligible. The significance of the residual effect would improve to **minor beneficial** (**not significant**).

Assessment of Operational Effects

Predicted Operational Effects

8.107 The operation of the Proposed Development has the potential to cause changes to the local hydrological regime. These impacts could take the form of:

- Pollution from fuels, oils and other chemicals that are being used and/ or stored onsite entering the soils and groundwater following spills, leaks or accidental releases (O1 – Summary of operational phase effects).
- Change in land use from intensive agriculture to low-intensity grazing (O2 - Summary of operational phase effects).
- Changes to water quality and drainage from operational infrastructure (O3 - Summary of operational phase effects).
- Erosion of sediment/ silt due to change of surface water flow paths eroded by rainfall (O4 - Summary of operational phase effects).
- Diversion or alteration of overland flow paths due to the construction of structures (O5 - Summary of operational phase effects).
- Pollution from contaminated firefighting water (O6 – Summary of operational phase effects).

8.108 As discussed in paragraphs 8.67, critical infrastructure has been positioned outside of fluvial and surface water flood risk areas. In addition, the design and construction of all onsite infrastructure will be undertaken in line with SUDS best practice ensuring no increased rate of run-off. Any minor alterations of surface water flow paths will be accommodated by alternate flow paths.

8.109 During operation, there will be no significant use of fuels, oils or other chemicals (O1). Where required, cooling media for the Proposed Development's substation, inverters and BESS

will be within fully insulated and bunded structures with a minimum 110% capacity to prevent accidental leaks and spills. Therefore the magnitude of change would be small and the overall effect on groundwater and ordinary watercourses would be **negligible to minor adverse** (**not significant**).

8.110 Conversion of much of the area of the Site from intensive arable production to low-intensity grazing is considered likely to reduce both the pesticide and nutrient load (O2) and the potential for eroded sediment/ silt from entering groundwater and surface water receptors. This is considered to be a small beneficial magnitude of change of the Proposed Development. The magnitude of change would be minor beneficial and the overall effect on groundwater and watercourses would be **minor beneficial** (**not significant**).

8.111 In its scoping response SDDC indicated that intensification of the run-off into small channels could occur beneath the lower end of the panels, and that this could increase run-off above that associated with the undeveloped site (O3). The potential for this effect has been considered. However, the proposed change in land use from intensive agricultural use (including rotational arable farming) with periods of exposed bare soil to low-intensity grazing around the panels reduces the potential for 'run off channels' to be created by run-off from the solar panels. This is as a result of having a year round grass sward beneath the panels which will prevent the presence of bare earth and provide additional filtration to surface water which may run overland in a similar manner to the existing greenfield setting. Further to the above, it is considered that the Proposed Development offers a small beneficial magnitude of change due to the reduction in silt mobilisation associated with vegetated land, increased water demand and subsequent infiltration rate. The proposed drainage strategy uses source control measures which have been demonstrated to be highly effective on other solar parks in similar settings. Therefore, the magnitude of change would be negligible and the overall effect would be **negligible to minor beneficial** (**not significant**).

8.112 The surface water drainage across the Site (O4) will largely remain unchanged, as overland flow routes will not be significantly altered by the solar panels. The BESS and the Proposed Development's substation compounds are the largest impermeable areas in the development, with surface water runoff routed to the nearby drainage ditch. Existing surface water flows would flow overland towards the drainage ditch, and therefore this will remain unchanged. The magnitude of change would be negligible and the overall effect on ordinary watercourses would be **negligible** (**not significant**).

8.113 Whilst surface water flow paths may locally be slightly diverted, these diversions will be temporary and minor away from fluvial flood risk zones. Overall they shall not be affected and therefore flood risk off Site (O5) will not be increased by the Proposed Development. The magnitude of change will be negligible and the overall effect on ordinary watercourse and groundwater would be **negligible** (**not significant**).

8.114 In the unlikely event of a fire at the BESS and the Proposed Development's substation compounds, chemicals from the equipment may contaminate firefighting water. To mitigate the risk of water contamination (O6) entering the environment storage tanks, to capture runoff, will be constructed within the subgrade of these areas which can be isolated if required. The magnitude of change will be negligible and the overall effect on ordinary watercourse and groundwater would be **negligible** (**not significant**).

8.115 The predicted operational effects are summarised in **Table 8.8**.

Table 8.8: Summary of operational phase effects

Ref. No.	Change	Magnitude of change	Receptors (sensitivity)	Significance of effect
O1	Pollution from fuels, oils and other chemicals	Negligible	Groundwater (medium). Watercourses (medium) River Trent (medium) River Mease (high)	Negligible to minor adverse
O2	Reduction in nutrient and pesticide load entering aquifer	Small beneficial		Minor beneficial
O3	Erosion of sediment/silt via surface water flow	Negligible		Negligible to minor beneficial
O4	Alteration to existing land drainage regime by development	Negligible		Negligible
O5	Alteration to surface water flow paths (potential for off Site flood risk)	Negligible		Negligible

Ref. No.	Change	Magnitude of change	Receptors (sensitivity)	Significance of effect
O6	Pollution from contaminated firefighting water	Negligible		Negligible

Additional Proposed Mitigation

8.116 No additional mitigation is necessary.

Residual Operational Effects

8.117 Residual effects would remain as **negligible** to **minor beneficial** (**not significant**), as set out above.

Cumulative Effects

8.118 **Table 8.9** summarises the developments that have been identified in Chapter 2: The Environmental Impact Assessment to have the potential for cumulative effects with the Proposed Development (due to their geographic proximity <1km), together with a commentary on the likelihood that the effects on the local hydrological regime will be cumulative. It has been assumed that all other developments will adhere to planning conditions and legislation to mitigate against their specific on-site flood risk.

Table 8.9: Comment on likelihood of cumulative effect with other planned schemes

Planned scheme	Comment
DMOT/2023/0621 development of an Energy Storage System (ESS) and substation development on Land at Barr Hall Farm, Drakelow, South Derbyshire.	This battery site is approximately 1km west of the Site and will be designed according to current best practice which will legislate that no increased run-off volumes or reduction in flood storage areas are permitted. Therefore, no significant cumulative impacts are considered to be likely.

Planned scheme	Comment
DMPA/2021/1221 Installation of a battery storage facility on land to the north of Royle Farm Business Park, Drakelow	This substation and battery site is approximately 2.5km north east of the Site and will be designed according to current best practice which will legislate that no increased run-off volumes or reduction in flood storage areas are permitted. Therefore, no significant cumulative impacts are considered to be likely.
20/01245/FULM ground-mounted solar farm on land south of Main Road, Haunton, Tamworth	This scheme is approximately 6km south of the Site and is similar in nature to the Proposed Development. However, this scheme is south of and within the catchment of the River Mease. This scheme will be designed according to current best practice which will legislate that no increased run-off volumes or reduction in flood storage areas are permitted. The distance from the Site and the fact that the vast majority of the Proposed Development lies outside of the catchment of the River Mease with no direct pathway no significant cumulative effects are considered likely.
CW9/1022/22 Application for proposed construction of Swadlincote Resource recovery park	This scheme is approximately 5km east of the Site and will be designed according to current best practice which will legislate that no increased run-off volumes or reduction in flood storage areas are permitted. Therefore, no significant cumulative impacts are considered to be likely.

Planned scheme	Comment
CW9/0420/7 seeking permission for the construction and operation of an 18MW Renewable Energy Centre and associated infrastructure on land at the former Drakelow C Power Station, Walton Road, Drakelow	This scheme lies adjacent (20m north) of the Proposed Development. This scheme will be designed according to current best practice which will legislate that no increased run-off volumes or reduction in flood storage areas are permitted. Although this scheme does drain to the River Trent, due to the inbuilt mitigation through design for the renewable energy centre, no significant cumulative effects are considered likely.
DMPA/2020/0542 Construction of a 40MW energy storage scheme with 1 building at Breach Farm, Caldwell.	This scheme lies approximately 3km east of the Proposed Development. This scheme will be designed according to current best practice which will legislate that no increased run-off volumes or reduction in flood storage areas are permitted. Although this scheme does drain to the River Trent, due to the inbuilt mitigation through design no significant cumulative effects are considered likely.

Predicted Cumulative Effects

8.119 Table 8.10 below summarises the cumulative construction and operational phase effects considered to arise from the contemporaneous development of the Proposed Development and the other identified cumulative schemes. In assessing these cumulative effects, it has been assumed that other schemes will be subject to the same good practice and mitigation through design as is being employed for the Proposed Development.

Table 8.10: Summary of cumulative construction and operational phase effects

Ref. No.	Change	Magnitude of effect	Cumulative change	Significance of cumulative effect
C1	Pollution from fuels, oils and other chemicals	Small	Groundwater bodies unlikely to be in connectivity. Distance between projects inhibits potential for cumulative effect.	Minor adverse
C2	Erosion of sediment/ silt created by exposed soils	Small		Minor adverse
C3	Soil compaction from heavy plant/ machinery	Negligible		Negligible
C4	Alteration to existing land drainage (e.g. by foundations)	Negligible to small beneficial		Negligible to minor beneficial
C5	Interaction of Proposed Development with contaminated made ground causing effect on receptors	Negligible to small beneficial		Negligible to minor beneficial
O1	Pollution from fuels, oils and other chemicals	Negligible	Potential small beneficial impact from reduction in nutrient load	Negligible
O2	Reduction in nutrient and pesticide load entering aquifer	Small beneficial		Minor beneficial

Ref. No.	Change	Magnitude of effect	Cumulative change	Significance of cumulative effect
O3	Erosion of sediment/silt via surface water flow	Negligible	entering watercourses	Negligible to minor beneficial
O4	Alteration to existing land drainage regime by development	Negligible		Negligible
O5	Alteration to surface water flow paths	Negligible		Negligible
O6	Pollution from contaminated firefighting water	Negligible		Negligible

Proposed Mitigation

8.120 The Applicant is committed to implementing the construction phase works in accordance with the Outline CEMP, as discussed above. The final detailed CEMP will be submitted to the LPA for approval prior to commencement of development and be secured by a DCO requirement. It is assumed that the cumulative schemes will have their own CEMP.

Residual Cumulative Effects

8.121 For pollution from fuels, oils and other chemicals (C1) and erosion of sediment/ silt (C2), the mitigation measures within the Outline CEMP are considered sufficient to reduce the potential magnitude of these changes to negligible. The significance of the residual effect would be reduced to **negligible** (**not significant**).

8.122 For all other potential cumulative effects, the residual construction effects would remain **negligible** (**not significant**), **minor beneficial** (**not significant**) or **negligible** to **minor beneficial** (**not significant**) as presented above.

Combined Effects

8.123 The effects of the Proposed Development associated with hydrology are associated with receptors that are particular to the surface water and watercourse receptors and to flooding. There is an interaction between these receptors and those considered in **Chapter 9: Ground Conditions** (as groundwater may provide baseflow to the surface water features). In theory, there are scenarios where a water quality impact on groundwater may have an additive effect (via groundwater flow) on surface water. For example, mobilisation of groundwater contamination from project earthworks, might lead to a water quality impact on surface water also experiencing direct impacts from surface runoff. However, the combination of embedded and additional mitigation set out within both Chapters are considered sufficient to address any such combined effects, such that they remain of a similar significance to those posed individually. There is an interaction between the hydrology receptors assessed in this Chapter and aquatic ecosystem receptors assessed in **Chapter 6: Ecology**. Combined effects could arise from water quality reductions to ordinary watercourses effecting the overall health of ecology within or adjacent to the rivers. However, mitigation set out in both chapters is considered sufficient to address this combined effect.

Further Survey Requirements and Monitoring

8.124 As mentioned in **Chapter 9: Ground Conditions** a site investigation, assessment and (if necessary) remediation of made ground soils within areas of filled ground on Site (pits, reservoir and ponds) and areas of former buildings (New Barn) shall be undertaken as part of the construction phase of the Proposed Development. Further investigative works will be secured by means of a DCO requirement, however this is to be confirmed. No other field survey or monitoring are considered warranted.

Summary of Effects

8.125 **Table 8.11** summarises the predicted effects of the Proposed Development on water resources, drainage and flood risk.

Table 8.11: Summary of Effects

Ref No.	Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Construction				
C1	Pollution from fuels, oils and other chemicals	Minor to moderate adverse	Measures within the CEMP	Negligible
C2	Erosion of sediment/ silt created by exposed soils	Minor to moderate adverse	Measures within the CEMP	Negligible
C3	Soil compaction from heavy plant/ machinery	Minor adverse	N/A	Negligible to minor beneficial
C4	Alteration to existing land drainage (e.g. by foundations)	Minor adverse	N/A	Negligible to minor beneficial
C5	Interaction of Proposed Development with contaminated made ground causing effect on receptors	Negligible	N/A	Minor beneficial
C6	Additional disturbance to shallow soils from underground cabling	Minor adverse	Measures within the CEMP	Negligible
Operation				
O1	Pollution from fuels, oils and other chemicals	Negligible to minor adverse	N/A	Negligible
O2	Reduction in nutrient and pesticide load entering aquifer	Minor beneficial	N/A	Minor beneficial

Ref No.	Predicted Effect	Significance	Mitigation	Significance of Residual Effect
O3	Erosion of sediment/silt via surface water flow	Negligible to minor beneficial	N/A	Negligible to Minor beneficial
O4	Alteration to existing land drainage regime by development	Negligible	N/A	Negligible
O5	Alteration to surface water flow paths	Negligible	N/A	Negligible
O6	Pollution from contaminated firefighting water	Negligible	N/A	Negligible
Cumulative Construction				
C1	Pollution from fuels, oils and other chemicals	Minor adverse	Measures within the CEMP	Negligible
C2	Erosion of sediment/ silt created by exposed soils	Minor adverse	Measures within the CEMP	Negligible
C3	Soil compaction from heavy plant/ machinery	Negligible	N/A	Negligible
C4	Alteration to soil structure/ geology (e.g. by foundations)	Negligible to minor beneficial	N/A	Negligible to minor beneficial
C5	Interaction of Proposed Development with contaminated made ground causing effect on receptors	Negligible to minor beneficial	N/A	Negligible to minor beneficial

Ref No.	Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Cumulative Operation				
O1	Pollution from fuels, oils and other chemicals	Negligible	N/A	Negligible
O2	Reduction in nutrient and pesticide load entering aquifer	Minor beneficial	N/A	Minor beneficial
O3	Erosion of sediment/silt via surface water flow	Negligible to minor beneficial	N/A	Negligible to minor beneficial
O4	Alteration to existing land drainage regime by development	Negligible	N/A	Negligible
O5	Alteration to surface water flow paths	Negligible	N/A	Negligible
O6	Pollution from contaminated firefighting water	Negligible	N/A	Negligible
Combined Effects				
None predicted				