Heckington Fen Solar Park

ENO10123

Chapter 9 – Hydrology, Hydrogeology, Flood Risk and Drainage

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CHAPTER 9: HYDROLOGY, HYDROGEOLOGY, FLOOD RISK AND DRAINAGE

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Table of Contents:

List of Tables:

9 HYDROLOGY, HYDROGEOLOGY, FLOOD RISK AND DRAINAGE

9.1 EXECUTIVE SUMMARY

9.1.1 This Chapter sets out the assessment of likely significant effects of the Proposed Development upon hydrology, hydrogeology, flood risk and drainage arising from the construction, operation and decommissioning of the Proposed Development.

9.1.2 It is concluded that potential effects arising from construction of the Proposed Development are likely to be localised and temporary and controlled by embedded mitigation measures. The residual effects are therefore **Minor/Negligible** and **Not Significant.**

9.1.3 With the implementation of embedded mitigation measures, the residual effects associated with operation of the Energy Park are **Negligible** and **Not Significant**. The electrical connection to the National Grid Bicker Fen Substation comprises an underground cable that would not give rise to impacts upon hydrology, hydrogeology, flood risk and drainage during the operational phase.

9.1.4 The assessment concludes that there is no requirement for additional mitigation measures and that there will be no cumulative effects within the wider catchment of the principal watercourses in the area.

9.2 INTRODUCTION

9.2.1 This chapter presents the assessment of likely significant effects of the Proposed Development upon hydrology, hydrogeology, flood risk and drainage arising from the construction, operation (including maintenance) and decommissioning of a ground mounted solar photovoltaic (PV) electricity generation and energy storage facility on land at Six Hundreds Farm, Six Hundreds Drove, East Heckington, Sleaford, Lincolnshire (hereafter referred to as "the Energy Park"), together with the cable route to, and above and below ground works at, the National Grid Bicker Fen Substation (hereafter referred to as "the Proposed Development" (inclusive of Energy Park)). This chapter summarises the assessment methodology, the relevant legislation, policy, guidance and standards, the consultation undertaken to support and inform the assessment, and the baseline conditions both at and in the vicinity of the Proposed Development. It then considers the mitigation measures required to prevent, reduce or offset effects.

9.3 ASSESSMENT APPROACH

Study Area

9.3.1 The study area has been defined to reflect the nature and extent of activities associated with the construction, operation and decommissioning of the Proposed Development. It extends to include the reaches of watercourse and surface water drainage infrastructure shown in **Figure 9.1: Hydrology and drainage** (document reference 6.2.9), as (in the professional opinion of the assessor) these have the potential for significant interaction with the Proposed Development. The study area has also been defined following consultation with stakeholder organisations.

Methodology

9.3.2 The assessment in relation to the water environment is predominantly desk-based but also included an Energy Park site walkover. The most up-to-date information available on publicly accessible websites and mapping has been used to determine the

existing baseline conditions at the Energy Park site and in the immediate vicinity. This has allowed identification of the receptors in both the surface water and groundwater environments, which will need consideration during the design of the Proposed Development.

9.3.3 A walkover survey has been undertaken to facilitate an understanding of the baseline water environment and the general landform of the Proposed Development and surrounding area and to define the scope/specifications of technical assessments and surveys. This survey included the Off-site Cable Route Corridor and extension works at National Grid Bicker Fen Substation.

9.3.4 The assessment also includes information from the Ground Investigation Report (**Appendix 9.2** – Document reference number 6.3.9.2) which details the results of the ground investigation completed at the Energy Park site.

9.3.5 The assessment is supported by the collection and interpretation of data and information requested from the Environment Agency (EA), Black Sluice Internal Drainage Board (BSIDB) and the Environmental Health department at North Kesteven District Council (NKDC). These organisations provided flood risk data and hydrological information for a 2km radius around the boundary of the Proposed Development (Energy Park, Off-site Cable Route Corridor and National Grid Bicker Fen Substation extension) including groundwater abstractions, surface water abstractions, water quality data, discharges and private water supply records. This information has been used to characterise the baseline water environment and identify receptors.

9.3.6 In addition, the EA, BSIDB and the Environmental Health department at NKDC have been consulted to agree the methodology for the technical assessments and analysis required to inform the EIA process.

9.3.7 The key data and sources of information collected are listed in **Table 9.1**.

Table 9.1 Sources of Information

Source	Data
Ordnance Survey mapping at 1:50,000 and 1:25,000 scales:www.multimap.com	Topography: elevation, relief.
Cranfield University's National Soils Resources Institute Soilscapes website: http://www.landis.org.uk/soilscapes/	Soil type and land use.
Magic Map: https://magic.defra.gov.uk/magicmap.aspx Natural England website: https://designatedsites.naturalengland.org.uk/	Nature Conservation Sites: Special Areas of Conservation (SACs). Special Protection Areas (SPAs). Sites of Special Scientific Interest (SSSI).
The National River Flow Archive: www.nwl.ac.uk/ih/nrfa/index.htm	Climate: rainfall.
https://flood-map-for-planning.service.gov.uk/ https://flood-warning-information.service.gov.uk/long-term-flood-risk/ EA: http://environment.data.gov.uk/catchment-planning/ EA South Forty Foot 1 Dimensional Hydraulic Model (2016) The National River Flow Archive: www.nwl.ac.uk/ih/nrfa/index.htm	Surface Water. Surface watercourses and flood risk. Water quality. River flows.
British Geological Survey GeoIndex: http://www.bgs.ac.uk/geoindex/	Solid and drift geology.

Source	Data
Data requested from the EA. https://data.gov.uk/dataset/f3684ee9-4c81-4ccd-a658-7f8d9dc70706/environment-agency-register-licence-abstracts https://data.gov.uk/dataset/55b8eaa8-60df-48a8-929a-060891b7a109/consented-discharges-to-controlled-waters-with-conditions http://www.environment-agency.gov.uk/maps/ EA Source Protection Zones and 2009 River Basin Management Plans (Groundwater): http://www.environment-agency.gov.uk/maps/	Groundwater levels. Groundwater vulnerability. Groundwater quality. Abstractions and discharges.
Data requested from NKDC.	Private water supplies.
Grange GeoConsulting Limited – Heckington Fen Solar Farm, Heckington Fen, Sleaford, Lincolnshire, Factual Ground Investigation Report (November 2022)	Ground conditions. Contamination/chemical analysis.

Assessment of Significance

9.3.8 The methodology for the assessment of potential impacts follows the generic EIA methodology guided by IEMA (2016) and current government guidance, and is based on the following principles:

- The type of effect (long-term, short-term, or intermittent; positive, negative or neutral);
- The probability of the effect occurring:
- Receptor sensitivity (see **Table 9.2**); and
- The magnitude (severity) of the effect (see **Table 9.3**).

9.3.9 The assessment methodology identifies the significance of an effect by firstly considering the sensitivity of the receptor (i.e. its importance and ability to tolerate and recover from change) and, secondly, by considering the likely magnitude of the impact (i.e. its spatial extent and duration). By combining sensitivity and magnitude, the significance of the effect is established. Where significant negative effects are identified, mitigation measures are proposed to reduce the significance.

9.3.10 The sensitivity of receptors has been assessed using the criteria set out in **Table 9.2**.

Table 9.2: Receptor Sensitivity

Sensitivity	Criteria	Examples
High	Feature with a high yield and / or quality and rarity at a national or international scale, with a limited potential for substitution. Attribute highly sensitive to change.	Conditions supporting sites with international conservation designations (SAC, SPA, Ramsar sites), where the designation is based specifically on aquatic features. Highly productive aquifers and surface water resources typically used for public water supplies. Public water supplies. Conditions supporting a SSSI. Sites with freshwater fish protected areas. Water quality of receptor water body: Supporting WFD element type (e.g.

Sensitivity	Criteria	Examples
		Priority Substances) classified as 'High', ''Good' or Pass'. NPPF PPG Flood Risk Vulnerability Classification "Essential Infrastructure" or "Highly Vulnerable".
Medium	Feature with a medium yield and/or quality at a regional scale, or good quality at a local scale, with some limited potential for substitution. Attribute tolerant of some degree of change.	Medium productivity aquifer and surface water resources typically used for smaller public water supplies or industrial water supplies. Industrial water supplies. Conditions supporting local nature conservation interest (e.g. National Nature Reserve [NNR]), where the interest features are water-dependent. Water quality of receptor water body: Supporting WFD element classified as at least 'Good' in all cases. NPPF PPG Flood Risk Vulnerability Classification "More Vulnerable".
Low	Feature with variable yield and/or quality at a local scale, with potential for substitution. Attribute tolerant of modest change.	Low productivity aquifer and surface water resources typically used for private water supplies or not utilised. Private water supplies; livestock supplies; springs; ponds/lagoons; non-statutory groundwater-dependent conservation sites. Water quality of receptor water body: Supporting WFD element type classified as less than 'Good' in any situation (any supporting element). NPPF PPG Flood Risk Vulnerability Classification "Less Vulnerable".
Negligible	Feature with poor yield and / or quality at a local scale, with good potential for substitution. Attribute tolerant of substantial change.	Unproductive strata. Water quality of receptor water body: Supporting WFD element type classified as 'Poor' or 'Bad', with severely restricted ecosystems and pollution. Small surface water bodies such as drainage ditches and ephemeral ponds that are too small to be classified under WFD and have limited ecological potential due to being artificial or heavily-modified. NPPF PPG Flood Risk Vulnerability Classification "Water Compatible".

9.3.11 The magnitude of change arising as a result of the Proposed Development has been assessed using the criteria set out in **Table 9.3**.

Table 9.3: Magnitude of Change

Magnitude of Change	Criteria	Examples
Large	Results in a loss of feature/attribute and/or quality and integrity of the attribute. Following development, the baseline situation is fundamentally changed.	Major reduction in groundwater levels, flow or quality, reducing use and water body status. Major reduction in groundwater levels or water quality leading to a marked deterioration in conditions that support Groundwater Dependent Terrestrial Ecosystems (GWDTE) features. Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant SSSI conservation objectives (Cos), or downgrading of WFD status (deterioration in current thresholds as defined by current WFD status, including supporting WFD elements). Complete loss of resource or severely reduced resource availability to other water users. Change in flood risk resulting in potential loss of life or damage to nationally critical infrastructure.
Moderate	Results in impact on integrity of feature/attribute, or loss of part of feature/attribute. Following development, the baseline situation is noticeably changed.	Moderate reduction in groundwater levels, flow or quality, reducing use and water body status in some circumstances. Moderate reduction in groundwater levels or water quality leading to some deterioration in conditions that support GWDTE features. Deterioration in river flow regime, morphology or water quality, leading to periodic, short-term and reversible breaches of relevant SSSI conservation objectives, or downgrading of WFD status (deterioration in current thresholds as defined by current WFD status, including supporting WFD elements). Water quality status may impact upon potential future thresholds in relation to objective WFD status – potential for prevention of waterbody reaching its future WFD objectives. Minor reduction in resource availability for other water users. Change in flood risk resulting in potential for major damage to property and infrastructure.
Small	Results in minor impact on feature, of insufficient magnitude to affect its use/integrity in most circumstances. Following development, the baseline situation is largely unchanged with barely discernible differences.	Measurable reduction in groundwater levels, flow or quality, but with limited consequences in terms of use and water body status. Measurable reduction in groundwater levels or water quality, leading to a minimal change in conditions that support GWDTE features. Measurable deterioration in river flow regime, morphology or water quality, but remaining generally within SSSI Cos, and with no change of WFD status (of overall status or supporting element status) or compromise of Environmental Quality Standards (EQSs).

Magnitude of Change	Criteria	Examples
		No change in resource availability for other water users. Increase in flood hazard in areas with no flood risk receptors e.g. increased flooding of agricultural land. Change in flood risk resulting in potential for minor damage to property and infrastructure.
Negligible	Results in little or no impact on feature, with insufficient magnitude to affect its use / integrity. The impacts are unlikely to be detectable or outside the norms of natural variation.	No measurable reduction in groundwater levels or flow. Any change to water quality will be quickly reversed once activity ceases with no consequence in terms of use, water body status (of overall status or supporting element status) or compromise of Environmental Quality Standards (EQSs). No measurable reduction in groundwater levels or water quality, leading to no change in conditions that support GWDTE features. No measurable deterioration in river flow regime, morphology or water quality, and no consequences in terms of SSSI conservation objectives, WFD designations, water resources or flood risk. Change in flood risk causes more frequent inconvenience and triggering of emergency response measures, but does not result in increased risk of damage to property and infrastructure.

9.3.12 The significance of a potential effect is determined using the matrix presented at **Table 9.4**. The significance of an effect can be beneficial, neutral or adverse. For the purpose of undertaking the assessment in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, effects determined to be moderate or greater are considered significant in EIA terms.

9.3.13 Those levels of effect which are shaded in **Table 9.4** equate to those considered significant under the EIA Regulations with the others constituting no effect or an insignificant effect.

Table 9.4: Determining Significance of Effect

Magnitude of change	Receptor sensitivity			
	High	**Medium**	**Low**	**Negligible**
Large	Substantial	Major	Moderate	Minor
Moderate	Major	Moderate	Minor	Negligible
Small	Moderate	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Legislative and Policy Framework

9.3.14 The planning policy context is summarised in **Chapter 5** (document reference 6.1.5). The policy, legislation and guidance relevant to the assessment of the potential effects of the Proposed Development on hydrology, hydrogeology, flood risk and drainage is summarised below and in **Table 9.5**.

National Policy Statements

9.3.15 The relevant National Policy Statements (NPS) provide the primary basis for decisions by the Secretary of State on development consent applications for Nationally Significant Infrastructure Projects (NSIPs).

9.3.16 The Overarching National Policy Statement for Energy (NPS EN-1)[1] identifies both water quality and resources and flood risk as topics requiring consideration/assessment as part of energy related projects and requires that:

- **"Where the Project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the Project on, water quality, water resources and physical characteristics of the water environment"** (Paragraph 5.15.2)
- **"An application should be accompanied by a Flood Risk Assessment (FRA) for energy projects of 1ha or greater in Flood Zone 1 and all energy projects in Flood Zones 2 and 3"** (Paragraph 5.7.4)
- **"Where a project may be affected by or may increase flood risk, pre-application discussions should be undertaken with the Environment Agency (EA) and other bodies"** (Paragraph 5.7.7)
- **"Any requirements for sequential testing are satisfied"** (Paragraph 5.7.9); and
- **"Priority is given to the use of Sustainable Drainage Systems"** (SuDS) (Paragraph 5.7.9)

9.3.17 NPS EN-3[2] for Renewable Energy Infrastructure addresses climate change adaptation and requires that applicants set out how proposals would be resilient to rising sea levels and increased risk of flooding. In respect of water quality and resources, NPS EN-3 refers to the assessment requirements set out in NPS EN-1.

9.3.18 NPS EN-5[3] provides the primary basis for decisions taken by the Secretary of State on applications received for electricity networks infrastructure and sets out the factors influencing route selection and the impacts that may arise from such development. However, NPS EN-5 refers back to NPS EN-1 regarding the assessment of flood risk and consideration of resilience to climate change and does not therefore set out additional policy in respect of flood risk.

9.3.19 The National Policy Statements were first published in 2011. The Energy White Paper (Powering our Net Zero Future, December 2020)[4] announced that the government would review the NPS to reflect the policies and broader strategic approach set out in the White Paper.

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

[2] Department of Energy and Climate Change (2011) National Policy Statement for Renewable Energy (EN-3). [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf

[3] Department of Energy and Climate Change (2011) National Policy Statement for Renewable Energy (EN-5). [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en5.pdf

[4] Department for Business, Energy and Industrial Strategy (2020): Energy White Paper. [Online] Available at: https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future

9.3.20 The requirements and criteria regarding flood risk set out in Draft NPS EN-1[5], published in March 2023, are consistent with those set out in the NPS originally published in 2011. Draft NPS EN-1, Paragraph 5.8.16 refers applicants to the National Planning Policy Framework and the associated Flood Risk and Coastal Change Planning Practice Guidance for further details regarding the minimum requirements for Flood Risk Assessments.

9.3.21 Paragraph 5.8.6 of Draft NPS EN-1 states that **"The aims of planning policy on development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to steer new development to areas with the lowest risk of flooding."** Paragraph 5.8.7 states that "**Where new energy infrastructure is, exceptionally, necessary in flood risk areas (for example where there are no reasonably available sites in areas at lower risk), policy aims to make it safe for its lifetime without increasing flood risk elsewhere and, where possible, by reducing flood risk overall. It should also be designed and constructed to remain operational in times of flood."**

9.3.22 Draft NPS EN-3[6] (March 2023) refers to Draft NPS EN-1 regarding the considerations that applicants and the Secretary of State should take into account to help ensure that renewable energy infrastructure is safe and resilient to climate change. Paragraph 3.4.10 notes that "**solar PV sites may be proposed in low lying, exposed sites"** and that **"applicants should consider how plant will be resilient to the increased risk of flooding**."

9.3.23 Paragraph 3.10.75 of Draft NPS EN-3 notes that "**Where a Flood Risk Assessment has been carried out this must be submitted alongside the applicant's ES. This will need to consider the impact of drainage. As solar PV panels will drain to the existing ground, the impact will not, in general, be significant.**" Paragraph 3.10.76 states that **"Where access tracks need to be provided, permeable tracks should be used, and localised Sustainable Drainage Systems (SuDS), such as swales and infiltration trenches, should be used to control any run-off where recommended."**

9.3.24 Draft NPS EN-5[7] (March 2023) refers back to Draft NPS EN-1 regarding considerations relating to flood risk and resilience to the effects of climate change and does not therefore set out additional policy in respect of flood risk.

National Planning Policy Framework

[5] Department for Business, Energy and Industrial Strategy (2023) Draft National Policy Statement for Energy (EN-1). [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015238/en-1-draft-for-consultation.pdf

[6] Department for Business, Energy and Industrial Strategy (2023) Draft National Policy Statement for Renewable Energy Infrastructure (EN-3). [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015238/en-3-draft-for-consultation.pdf

[7] Department for Business, Energy and Industrial Strategy (2023) Draft National Policy Statement for Electricity Networks Infrastructure (EN-5). [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015238/en-5-draft-for-consultation.pdf

9.3.25 The National Planning Policy Framework (NPPF)[8], as revised 20th July 2021, sets out national planning policy with regards to development and flood risk. The accompanying Planning Practice Guidance (PPG) 'Flood Risk and Coastal Change' (discussed below) provides local planning authorities with guidance on implementation of the planning policy as set out in the NPPF.

9.3.26 The NPPF (Paragraphs 161-163) advocates use of the risk-based, sequential approach (which recognises that risk is a function of probability and consequence), in which new development is preferentially steered towards areas at the lowest probability of flooding. It also requires that new development should be planned to avoid increased vulnerability to the range of impacts arising from climate change.

9.3.27 In respect of flood risk, paragraph 159 states that: "**Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere**".

9.3.28 Paragraph 162 requires that the "**sequential approach is applied to steer new development to areas with the lowest risk of flooding."** However, Paragraph 166 confirms that the "**sequential test does not need to be undertaken for planning applications that come forward on sites allocated in the development plan through the sequential test**."

9.3.29 According to Annex 3 of the NPPF, solar farms are categorised as Essential Infrastructure. In addition to application of the Sequential Test, Table 3 of the NPPF PPG 'Flood risk and coastal change' requires that the Exception Test is applied for proposals comprising Essential Infrastructure in Flood Zone 3. Full details are set out in the FRA supporting the ES (document reference 6.3.9.1).

National Planning Practice Guidance

9.3.30 The PPG (Ministry of Housing, Communities and Local Government, 25th August 2022)[9] defines the Flood Zones that provide the basis for application of the Sequential Test. The Flood Zones are defined as follows (PPG Table 1 Paragraph: 078 Reference ID: 7-078-20220825):

- Flood Zone 1: Low probability of flooding - less than 0.1% (1 in 1,000) annual probability of river or sea flooding in any year;
- Flood Zone 2: Medium probability of flooding - between 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of river flooding and between 0.5% and 0.1% (1 in 200 and 1 in 1000) annual probability of sea flooding in any year;
- Flood Zone 3a: High probability of flooding - 1% (1 in 100) or greater annual probability of river flooding or 0.5% (1 in 200) or greater annual probability of sea flooding in any year; and
- Flood Zone 3b: The functional floodplain - where water from rivers or the sea has to flow or be stored in times of flood. The functional floodplain will normally comprise land having a 3.3% or greater annual probability of

[8] Department of Levelling Up, Housing and Communities (2021) National Planning Policy Framework (NPPF). [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

[9] Department of Levelling Up, Housing and Communities (2021) National Planning Policy Framework (NPPF). [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

flooding, with any existing flood risk management infrastructure operating effectively; or land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

9.3.31 It should be noted that Flood Zones 1, 2 and 3a definitions ignore the presence of flood defences.

9.3.32 The 'Flood Risk and Coastal Change' PPG advocates the use of sustainable drainage systems (SuDS) to reduce the overall level of flood risk. SuDS can reduce the causes and impacts of flooding, remove pollutants from urban run-off at source and combine water management with green space providing benefits for amenity, recreation and wildlife.

9.3.33 The NPPF (Paragraphs 153 and 154) and the 'Flood Risk and Coastal Change' PPG require that the spatial planning process should consider the possible impacts of climate change and contingency allowances are provided to enable impacts to be considered over the lifetime of the development.

Table 9.5: Policy, legislation and guidance

Legislation	Description
Water Environment (Water Framework Directive) (England and Wales) Regulations 2017[10]	The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 ('WFD Regulations 2017') consolidate, revoke and replace the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, which transpose the European Union (EU) Water Framework Directive (WFD) into national law. The WFD is a wide-ranging piece of European legislation that establishes a new legal framework for the protection, improvement and sustainable use of surface waters, coastal waters and groundwater across Europe in order to: • Promote sustainable water use; • Contribute to the mitigation of floods and droughts; • Prevent deterioration and enhance status of aquatic ecosystems, including groundwater; and • Reduce pollution Water management has historically been co-ordinated according to administrative or political boundaries. The WFD promotes a new approach based upon management by river basin - the natural geographical and hydrological unit. River basin management plans, published by the Environment Agency (EA) and the Department for Environment Food & Rural Affairs (Defra), include clear objectives in respect of water quality and pollution control and a detailed account of how objectives are to be met within a prescribed timeframe.
The Flood Risk Regulations 2009[11]	The Flood Risk Regulations 2009 transpose the European Commission (EC) Floods Directive (Directive 2007/60/EC) into domestic law. The regulations require that Preliminary Flood Risk Assessments (PFRAs) are prepared by the EA and Unitary/County Authorities (Lead Local Flood Authorities

[10] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (legislation.gov.uk)
[11] The Flood Risk Regulations 2009 (legislation.gov.uk)

Legislation	Description
	(LLFA)) that identifies areas at significant potential risk of flooding. For these "significant risk" areas, hazard maps must be produced, and flood risk management plans developed, to reduce flood risk.
Water Act 2003[12]	This Act was a revision of the Water Resources Act (WRA) (1991) which stated that it is an offence to cause or knowingly permit polluting, noxious, poisonous or any solid waste matter to enter controlled waters. The Act sets out regulatory controls for water abstraction, discharge to water bodies, water impoundment and protection of water resources. Elements of the WRA 1991 have now also been superseded by the Environmental Permitting (England and Wales) Regulations 2010.
Environmental Permitting (England and Wales) Regulations 2016[13]	The Environmental Permitting Regulations 2016 consolidate and replace the 2010 Regulations and the 15 associated amendments. The permitting regime covers a range of activities that release emissions to land, air or water or that involve waste. The regime covers facilities previously regulated under the Pollution Prevention and Control Regulations 2000 and Waste Management Licensing and exemptions schemes, some parts of the WRA 1991 and the Groundwater Regulations 2009. Schedule 21 relates to water discharge activities and Schedule 25 relates to flood risk activities. Schedule 22 to the Regulations relates to Groundwater activities and the regulations place a duty on regulating authorities to implement the Water Framework Directive and the Groundwater Daughter Drainage Directive and exercise their relevant function to ensure all necessary measures are taken to: (a) prevent the input of any hazardous substance to groundwater; and (b) limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater" (Paragraph 6, Schedule 22).
The Groundwater (England and Wales) Regulations 2009[14]	The regulations aim to prevent the entry into groundwater of hazardous substances (such as mercury, cadmium and polyaromatic hydrocarbons) and the pollution of groundwater by non-hazardous pollutants.
The Land Drainage Act 1991 & 1994[15]	The Land Drainage Act 1991 consolidates various enactments relating to Internal Drainage Boards and the functions of these Boards and local authorities, including Lead Local Flood Authorities, in relation to land drainage. Amongst other matters, the Act sets out provisions and powers in respect of the control of flow of watercourses and watercourse restoration/improvement works.
The Water Resources Act 1991[16]	The WRA 1991 sets out the responsibilities of the EA in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The WRA 1991 regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and

[12] Water Act 2003 (legislation.gov.uk)
[13] The Environmental Permitting (England and Wales) Regulations 2016 (legislation.gov.uk)
[14] The Groundwater (England and Wales) Regulations 2009 (legislation.gov.uk)
[15] Land Drainage Act 1991 (legislation.gov.uk)
[16] Water Resources Act 1991 (legislation.gov.uk)

Legislation	Description
	groundwater. Discharge to controlled waters is only permitted with the consent of the EA. Similarly, a licence is required to abstract from controlled waters.
Flood and Water Management Act 2010 & Sustainable Drainage Systems: Written Statement – HCWS161[17]	The Flood and Water Management Act (FWMA) 2010 takes forward some of the proposals set out in three previous strategy documents published by the UK Government: Future Water, Making Space for Water and the UK Government's response to the Sir Michael Pitt Review of the summer 2007 floods. In doing so, it gives the EA a strategic overview of flood risk and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas. The FWMA 2010 (Schedule 3) proposed the establishment of Sustainable drainage systems (SuDS) Approval Bodies (the SAB) at county or unitary local authority levels. The role of the SAB was envisaged as implementing the recommendations of the Pitt Review (2008) in promoting the use of SuDS within future development. Following a period of consultation, the proposed role of the SAB has been amended, with the promotion of SuDS being incorporated into the planning process. This has been achieved by designating LLFA's as statutory consultees with regards to 'local' sources of flood risk and surface water management. The Ministerial Written Statement HCWS161 details this change in policy, which came into effect in April 2015. The FWMA 2010 also amends Section 106 of the Water Industry Act 1991 (WIA) in respect of the right of connection to a public sewer. As the role of the SAB has been removed following HCWS161, this process is now subsumed into the planning process under the purview of the LLFA.
Flood Risk Assessments: climate change allowances[18]	This guidance was published by the EA in February 2016 (last updated in May 2022) and should be used as the basis for preparing FRAs. The guidance sets out the climate change allowances for peak river flow, peak rainfall intensity, sea level rise, offshore wind speeds and extreme wave height. Allowances in respect of peak river flow vary according to River Basin District, flood zone and proposed land-use (and therefore the lifetime of the development). The Proposed Development lies within the Anglian River Basin District.
Non-statutory Technical Standards for Sustainable Drainage Systems[19]	This document contains non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems serving housing, non-residential or mixed-use developments and was published by Defra in March 2015.
The SuDS Manual (C753)[20]	The SuDS Manual (2015) expands upon the framework set out by the Government's Non-Statutory Technical Standards for SuDS and sets out the latest industry practice and

[17] Flood and Water Management Act 2010 (legislation.gov.uk)
[18] Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)
[19] Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems (publishing.service.gov.uk)
[20] SuDS Manual C753 Chapter List (ciria.org)

Legislation	Description
	guidance regarding the planning, design, construction, management and maintenance of SuDS.
Rainfall Runoff Management for Developments (Report SC030219/R, October 2013)[21]	This document advises regulators, developers and local authorities on the requirements for storm water drainage design for new developments and sets out recommended methods for the sizing of storage measures for the control and treatment of storm water runoff.

[21] https://assets.publishing.service.gov.uk/media/602e7158d3bf7f7220fe109d/_Rainfall_Runoff_Management_for_Developments_-_Revision_E.pdf

Limitations to the Assessment

9.3.34 In the absence of observed/recorded data, the hydraulic model used to assess floodplain extents is uncalibrated and therefore based upon a number of assumed parameters. As a result, there is a degree of uncertainty associated with the design flood levels. However, the modelling analysis has been undertaken in accordance with guidelines set out by the EA and using industry-standard methods. A modelling method statement was drafted and subsequently approved by the EA in April 2022 (**Appendix 9.1: Flood Risk Assessment** - document reference 6.3.9.1). In addition, model sensitivity testing has been undertaken to understand the potential impact upon design flood levels caused by variation of model input parameters. On this basis, the flood levels estimated using the model are considered to be sufficiently robust to inform the FRA and preparation of this chapter of the ES.

9.3.35 Recent ground investigation data (**Appendix 9.2: Ground Investigation Report** - document reference 6.3.9.2) has been used in combination with the mapping descriptions presented by the British Geological Surveys and Defra (2021) Soilscapes online soil map to assess soils and geology types present at the Proposed Development. Also it is assumed, that locally, both the superficial deposits and bedrock are low permeability, unproductive aquifers as inferred by the EA's aquifer designation mapping.

9.4 CONSULTATION

9.4.1 In January 2022 the Applicant submitted an EIA Scoping Report (**Appendix 1.1** (document reference 6.3.1.1) to the Planning Inspectorate and requested a Scoping Opinion (**Appendix 1.2** (document reference 6.3.1.2) under Regulation 10 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. The Inspectorate consulted a number of 'consultation bodies', statutory undertakers and local authorities and published a Scoping Opinion on 17th February 2022.

9.4.2 A summary of consultation prior to issue of the Preliminary Environmental Assessment Report (PEIR) in June 2022 outlines matters raised within the Scoping Opinion and how these have been addressed through the ES in relation to hydrology, hydrogeology, flood risk and drainage.

Table 9.6: Summary of Scoping Opinion Responses

PINS Reference	Comment	ES Response
3.3.2	Where relevant, the ES should provide information for the whole of the Proposed Development, being clear when information relates to certain components.	The assessment considers all aspects of the Proposed Development, comprising the Energy Park, off-site cable route and above ground works at the National Grid Bicker Fen Substation.
3.3.3	The ES should clearly explain and justify the study area used in the assessment.	The study area is explained and justified in **Chapter 3- Site Description, Site Selection and Iterative Design Process** (document reference 6.1.3), **Chapter 4- Proposed Development** (document reference 6.1.4) and Section 9.3 of this chapter.
3.3.4	The ES should include a FRA based on the requirements of the Environment Agency standing advice. This should include a	An FRA has been prepared in accordance with requirements set out by both the EA and BSIDB. The FRA addresses the sequential test

PINS Reference	Comment	ES Response
	description of how the Proposed Development satisfies the requirements of the sequential and exception test, where relevant. The FRA should demonstrate the Proposed Development including flood suitable mitigation measures and flood resilient construction that will allow the development to remain operational for its 40-year lifespan. This includes confirming that all the flood sensitive equipment associated with the Proposed Development remains operational during a 0.1% event. Furthermore, the FRA should consider the surface water drainage/flood risk impacts that may occur off site and the potential of increased flood risk beyond the site boundary. This should include consideration of the potential for the solar installation to increase the rate of runoff from the site.	and exception test and is included as Appendix 9.1 (document reference 6.3.9.1).
3.3.5	Paragraph 3.6 of the Project Description states that steel poles will be driven into the ground to support each row of modules. Although the Project Description does not indicate the number of modules, given the area of the 'solar development area' in Figure 3, there is likely to be a high number of steel poles required. The baseline identifies that there is a naturally high ground water level and that in most fields, the soils drain into marginal ditches. This aspect chapter should consider the cumulative effects of these poles across the entirety of the developable area on the drainage patterns within the site and the study area.	The assessment considers the impact of steel poles upon hydrogeology/groundwater aquifers (Section 9.6 of this chapter).
3.3.6	The baseline identifies that the site is underlain by tidal flat deposits which include layers of peat. Considering the potential need for piled steel poles, as stated in paragraph 3.6, there is potential to disturb peat deposits. The ES should demonstrate how effects on peat deposits have	The assessment considers the potential to disturb peat deposits based upon the information set out in **Appendix 9.2- Ground Investigation Report** (December 2022) (document reference number 6.3.9.2) prepared by Grange GeoConsulting Limited.

PINS Reference	Comment	ES Response
	been avoided and where this is not possible, the ES should assess likely significant effects due to peat disturbance.	

9.4.3 In addition, **Table 9.7**, outlines a summary of Section 42 consultation responses since the PEIR.

Table 9.7: Summary of Section 42 Consultation Responses since PEIR

Consultee	Details of Consultee response	How is matter addressed	Location of response
Lincolnshire County Council	LCC, as the Highway & Lead Local Flood Authority, has commented that there will need to be a standard Flood Risk Assessment and Drainage Strategy for surface water flood risk, keeping run off to greenfield rates and using SUDs techniques, submitted as part of the final ES. Whilst the PEIR confirms one will be produced a copy of the FRA does not appear to have been provided at this stage. One will therefore be required as part of the final ES.	FRA has been prepared.	**Appendix 9.1 - Flood Risk Assessment** (document reference 6.3.9.1)
North Kesteven District Council	The flood risk sequential test is still applicable in our interpretation of Table 2 of the NPPF PPG.	FRA has been prepared, including application of the flood risk sequential test.	**Appendix 9.1 - Flood Risk Assessment** (document reference 6.3.9.1)
	There is no information in the PEIR regarding slab levels for substations, the BESS or other elements of critical infrastructure that	FRA has been prepared, setting out design levels.	**Appendix 9.1 - Flood Risk Assessment** (document reference 6.3.9.1)

Consultee	Details of Consultee response	How is matter addressed	Location of response
	need to be elevated above flood levels		
	We note that paragraph 9.3.3 references potential adverse effects resulting from compaction of the ground caused by construction plant and an increase in the extent of impermeable surfaces associated with access roads and compound areas. Paragraph 9.4.34 considers embedded mitigation and references 'best practice working methods to prevent both water pollution and adverse impacts upon the surface water drainage regime' however this does not specifically refer to whether and how soil compaction stemming from vehicle tracking across the site can be mitigated/remedied to avoid the localised surface water incidents evidenced by Landscope (see below) on solar parks elsewhere.	oCEMP prepared.	**Outline Construction and Environmental Management Plan** (document reference 7.7)
	The ES should confirm whether panel rows will have dedicated soakaways to the front of the panels or whether rainfall will infiltrate without	FRA has been prepared, setting out details of surface water drainage strategy.	**Appendix 9.1 - Flood Risk Assessment** (document reference 6.3.9.1)

Consultee	Details of Consultee response	How is matter addressed	Location of response
	dedicated formation of soakaways. This should also take into account the issue of soil compaction associated with construction.		
Boston Borough Council	The proposed route of the cable would cross or be within proximity to South Forty Foot Drain Local Wildlife Site, listed buildings and Conservation Area within Bicker, along with a number of undesignated watercourses, drains and verges. Works to watercourses may require the consent of the Internal Drainage Boards.	The assessment of likely significant effects on the assets listed are contained in the relevant chapters of this ES. Protective provisions for the IDB in relation to crossing watercourses.	**Chapter 8 – Ecology and Ornithology** (document reference 6.1.8) and **Chapter 10 – Cultural Heritage** (document reference 6.1.10). The **Draft Development Consent Order** (document reference 3.1).
Canal and River Trust	The location of the project and associated cable-line area has been compared with our network, and we do not believe that the proposals as shown in consultation documents would cross land owned or operated by the Trust. Our closest waterway is the River Witham and we therefore have no comment to make on the scheme. The South Forty Foot Drain is neither owned nor operated by the Trust and we are not Navigation Authority on that waterway.	Advisory – no action required.	N/A

Consultee	Details of Consultee response	How is matter addressed	Location of response
Environment Agency	We are in discussions with the developer and consultants regarding this development and so are well aware of the detail. The submission has included some detail regards the flood risk in Chapter 9 of the PEIR but not in the form of a flood risk assessment (FRA). Our discussion with the consultants regarding Breach Analysis will inform the submission of a FRA. We will likely have more comments to make once this has been agreed. Accordingly, we have no comments to make on the PEIR and will continue to discuss flood risk with the consultants other than to repeat our previous advice to the applicant is aware of the flood risk permitting requirements.	FRA has been prepared.	**Appendix 9.1 - Flood Risk Assessment** (document reference 6.3.9.1)
	We request early engagement with ourselves should the underground cable to Bicker Fen Sub Station go under the South Forty Foot Drain. We do have certain exemptions where service crossings are completed by means of horizontal directional drilling	Protective provisions for the EA in relation to crossing the South Forty Foot Drain.	The **Draft Development Consent Order** (document reference 3.1).

Consultee	Details of Consultee response	How is matter addressed	Location of response
	not using an open cut technique – known as Exemption FRA 3.		
Environment Agency (targeted consultation under Section 42 and Section 44 of the Planning Act 2008)	Where the cable is to cross the South Forty Foot Drain close to Swineshead Bridge a Flood Risk Environmental Permit is required. Under the Environmental Permitting (England and Wales) Regulations 2016, permission must be obtained from the Environment Agency for any proposed activities which will take place: • in, over, under or within 8 metres of a main river (16 metres if tidal) • on or within 8 metres of a flood defence structure or culvert (16 metres if tidal) • on or within 16 metres of a sea defence • within 16 metres of any main river, flood defence (including a remote defence) or culvert for quarrying or excavation • in a floodplain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if tidal) having the potential to divert flood flows to third parties, if	Advisory – no action required.	N/A

Consultee	Details of Consultee response	How is matter addressed	Location of response
	planning permission has not already been granted for the works Note an exemption may be suitable for the works if certain criteria is met. Please review the exemption known as FRA 3. Service Crossing below the bed of a main river not involving an open cut technique. This exemption can be found at Exempt flood risk activities: environmental permits - GOV.UK (www.gov.uk).		
Black Sluice Internal Drainage Board (targeted consultation under Section 42 and Section 44 of the Planning Act 2008)	If you want to carry out any works in any watercourse, including the replacement of existing culvert structures, then you need the prior written consent of the Board under Section 23 Land Drainage Act 1991 (which will be covered by the Protective Provisions within the DCO). This is mandatory. Regarding the focused enquiry regarding access off the A17: as per the Land Registry details, the Board have an agreed right of access with the landowner to be able to use the	Advisory – no action required.	N/A

Consultee	Details of Consultee response	How is matter addressed	Location of response
	existing access track to the level crossing to be able to get to our Pumping Station. This access which should not be hindered in any way at any time by your project, particularly during short duration severe storm events or periods of prolonged heavy rainfall.		
Network Rail	The scheme will intersect the operational railway at Swineshead (the GRS2 line at approximately 129m 900yds to 130m 400yds). Key concerns will be ……the management of construction works around the operational railway and details such as drainage schemes that may impact on the operational railway.	FRA (setting out details of surface water drainage strategy) and oCEMP have been prepared.	**Appendix 9.1 - Flood Risk Assessment** (document reference 6.3.9.1) **Outline Construction and Environmental Management Plan** (document reference 7.7)
South Kesteven District Council	We defer to Lincolnshire County Council (as local highway authority and lead local flood authority) in respect of any comments in relation to highways and flood risk impacts.	Advisory – no action required.	N/A
Member of the public	There is consideration of a 1:1000 year flood. What about sea level rise?	The Environment Agency has confirmed that the Proposed Development is not affected by tidal flooding.	**Appendix 9.1 - Flood Risk Assessment** (document reference 6.3.9.1)

Consultee	Details of Consultee response	How is matter addressed	Location of response
Member of the public	During the operational phase of the Proposed Development, the assessment finds that an increase in the impermeable area within the Energy Park Site has the potential to increase surface water run-off to the adjacent drains, potentially increasing flood risk elsewhere. Please consider mitigating this by improving surface water/flood attenuation and also summer water retention for a wide area through incorporating fenland restoration in the landscape scheme. Developing fenland habitat would also significantly enhance biodiversity and increase carbon storage potential.	Both the Black Sluice Internal Drainage Board and Lincolnshire County Council (as Lead Local Flood Authority) have been consulted regarding drainage and proposals for managing surface water run-off have been incorporated into the proposals.	**Appendix 9.1 - Flood Risk Assessment** (document reference 6.3.9.1)

9.5 BASELINE CONDITIONS

Site Description and Context

9.5.1 The Proposed Development is situated on the Lincolnshire Fens, a coastal plain in the east of England which comprises a large area of broad, flat marshland supporting a rich biodiversity. The proposed Energy Park is located within Heckington Fen, approximately 5km east of the village of Heckington and 11km west of Boston. The Off-site Cable Route Corridor extends across Great Hale Fen, West Low Grounds and Bicker Fen, connecting to the National Grid Bicker Fen Substation approximately 6km to the south of the proposed Energy Park (as the crow flies).

9.5.2 Topography across the Proposed Development is a few metres above sea level and the land generally slopes very gently towards the north/north-east. The lowest point within the proposed Energy Park is 0.77m Above Ordnance Datum (AOD) along the northern boundary, while the highest point is 3.3mAOD along the southern boundary. Levels at National Grid Bicker Fen Substation are approximately 2mAOD.

9.5.3 The principal watercourses in the area are the River Witham and South Forty Foot Drain, located approximately 4km and 1.5km to the east and south of the proposed Energy Park respectively (**Figure 9.1: Hydrology and drainage -** document reference 6.2.9). Both are classified as 'Main River' and therefore under the jurisdiction of the EA. The Energy Park itself is bound along the northern boundary by the Head Dike/Skerth Drain (which is also classified as Main River) and the Energy Park area is bisected by a number of ditches/drains, some of which are operated and maintained by the Black Sluice Internal Drainage Board. Water levels within the network of ditches/drains are managed through pumping to the Head Dike/Skerth Drain.

9.5.4 The Energy Park is currently in agricultural use and therefore comprises permeable surfaces, such that surface water run-off generally infiltrates into the ground or is routed to the various ditches/drains that bisect the site. Similarly, the Off-site Cable Route Corridor traverses an area characterised by agriculture.

Baseline Survey Information

Tidal/Fluvial Flood Risk

9.5.5 The EA publishes online floodplain maps (https://flood-map-for-planning.service.gov.uk). These maps show the possible extent of fluvial flooding for a 1 in 100 year flood (1% probability of occurrence) and the possible extent of tidal flooding associated with a 1 in 200 year event (0.5% probability of occurrence), ignoring the presence of flood defences. Also shown is the possible extent of flooding arising from a 1 in 1,000 year event (0.1% probability).

9.5.6 The flood map indicates that the majority of the Energy Park is located within Flood Zone 3 (High Probability – land having a 1 in 100 or greater annual probability of fluvial flooding). Limited areas along the southern fringe of the Energy Park are located within Flood Zone 2 (Medium Probability – land having between a 1 in 100 and 1 in 1,000 annual probability of flooding) and Flood Zone 1 (Low Probability – land having a less than 1 in 1,000 annual probability of flooding)- see **Figure 3.6- Environmental Designations Plan** (document reference 6.2.3) for the extent of flood zones.

9.5.7 The Environment Agency (EA) has confirmed that the source of flooding is Main River (the Head Dike and Skerth Drain). These watercourses are characterised by fluvial defences (comprising earth embankments) and the EA has advised that the defences are in fair condition and reduce the risk of flooding (at the defence) to a 10% (1 in 10) chance of occurring in any year.

9.5.8 The Off-site Cable Route Corridor and National Grid Bicker Fen Substation are also shown to lie within Flood Zone 3 associated with fluvial flooding arising from the South Forty Foot Drain (SFFD). The SFFD is also classified as Main River and benefits from flood defences comprising earth embankments.

Surface Water Flood Risk

9.5.9 The EA 'Flood Risk from Surface Water Map' (https://flood-warning-information.service.gov.uk/long-term-flood-risk) shows areas that may be susceptible to surface water flooding following an extreme rainfall event. The mapping shows that the majority of the Energy Park is at 'Very Low' risk of surface water flooding. The map highlights a number of isolated and very localised areas within and adjacent to the Energy Park at high, medium and low risk of surface water flooding. These areas generally coincide with watercourses/ditches/drains and topographical 'low' points across the terrain (i.e. areas where surface water would naturally accumulate following rainfall).

9.5.10 The EA mapping also shows that the majority of the Off-site Cable Route Corridor and National Grid Bicker Fen Substation is at 'Very Low' risk of surface water flooding, with only very localised areas at high, medium and low risk of flooding.

Reservoir Flood Risk

9.5.11 The EA 'Flood Risk from Reservoirs Map' shows the area that may be affected by flooding as a result of a breach of a large, raised reservoir i.e. capable of storing over 25,000 cubic metres of water above the natural level of any part of the surrounding land.

9.5.12 According to EA records the nearest reservoir is located approximately 8km to the west of the Energy Park, between Heckington and Sleaford. The EA's map shows that, when river levels are normal, only limited and localised areas along the northern boundary of the Energy Park adjacent to Head Dike are affected by reservoir flooding. The mapping shows that under conditions when there is also flooding from rivers, the majority of the Energy Park may be affected by reservoir flooding.

9.5.13 The EA mapping shows that the Off-site Cable Route Corridor and National Grid Bicker Fen Substation is only affected by reservoir flooding under conditions when there is also flooding from rivers.

Groundwater Flood Risk

9.5.14 As set out in Paragraphs 9.5.19 to 9.5.24, BGS mapping indicates that the Energy Park, Off-site Cable Route Corridor and National Grid Bicker Fen Substation are entirely underlain by Tidal Flat (superficial) deposits comprising predominantly low permeability clay, with a thickness of approximately 4m.

9.5.15 The BGS mapping also shows that the bedrock comprises a thick layer (up to 160m) of low permeability, unproductive mudstones and siltstones of the Ancholme Group. The Energy Park comprises the West Walton Formation and the Ampthill Formation of the Jurassic Period. The northern area of the Off-site Cable Route Corridor is underlain by bedrock comprising the West Walton Formation and the southern area of the Off-site Cable Route Corridor and the National Grid Bicker Fen Substation are underlain by bedrock comprising the Oxford Clay Formation.

9.5.16 EA aquifer designation maps at https://magic.defra.gov.uk categorise both the superficial deposits and bedrock deposits as 'unproductive' (i.e. areas comprised of rocks that have negligible significance for water supply or baseflow to rivers, lakes and wetlands).

9.5.17 Geological data therefore suggests that groundwater emergence is unlikely due to the thick layers of low permeability superficial and bedrock deposits that underlie the Energy Park, Off-site Cable Route Corridor and National Grid Bicker Fen Substation.

9.5.18 Neither the Central Lincolnshire SFRA Level 1 or SFRA Level 2 identify groundwater flooding as an issue across the North Kesteven District. The South East Lincolnshire SFRA, covering Boston Borough, does not present information regarding groundwater flood risk.

Water Framework Directive

9.5.19 The Proposed Development falls within the area administered by the Anglian River Basin Management Plan. The relevant Management Catchment is the Witham and the Operational Catchment is the South Forty Foot Drain. According to the EA's Catchment Data Explorer (https://environment.data.gov.uk/catchment-planning), the Proposed Development lies within the '*Black Sluice IDB draining to the South Forty Foot Drain Water*

Body' (Water Body ID GB205030051515). This water body is designated as 'heavily modified', which denotes that it has been substantially changed in character as a result of physical alterations by human activity. It cannot therefore achieve 'good ecological status' and the environmental (Water Framework Directive) objective for the water body is to achieve 'good ecological potential'. The overall water body classification is currently 'Moderate' potential (Cycle 2, 2019).

Geology and Soils

9.5.20 The geological environment, which controls the behaviour and quality of the groundwater and potential pathways to receptors, is described as part of the baseline conditions at the Proposed Development. Stratigraphy of the lithologies underlying the Proposed Development is shown in **Table 9.8** and geological mapping is presented in **Figure 9.2: Superficial geology** and **Figure 9.3: Bedrock geology** (document reference 6.2.9).

9.5.21 Soils are described as loamy and clayey floodplain soils of coastal flats with the potential for perched groundwater tables, which sit above the low permeability superficial deposits (Soilscapes (DEFRA), 2022). Any perched groundwater is contained within the thin soil layer, is not laterally continuous and does not form an aquifer. Fertility is lime-rich to moderate, and the soils are mostly drained into marginal ditches in most fields.

9.5.22 Made Ground refers to lithology that is made up of artificial material, or the reworking of natural material used to create a new landform. Due to the greenfield nature of the site, it is unlikely that Made Ground exists beneath the Energy Park Site.

9.5.23 The BGS 1:50000 mapping indicates that the Energy Park, Off-site Cable Route Corridor and National Grid Bicker Fen Substation extension (which comprise the EIA assessment area, see **Figure 1.1 – Order Limits** (document reference 6.2.1)) are entirely underlain by tidal flat deposits comprising a consolidated soft silty clay, with layers of peat, sand and basal gravel, see **Figure 9.2 – Superficial Geology** (document reference 6.2.9). Approximately 500m to the west of the EIA assessment area, deposits of glacial till overly the tidal flats and extend 7km to the south-west. A BGS borehole record (BGS Ref: TF24SW2) located approximately 1.5km east of the EIA assessment area documented the tidal flat deposits as comprising 2.6m of grey clay underlain by black silt and gravels. Located on the Energy Park Site's southern boundary, another BGS borehole (BGS Ref: TF14SE2) recorded 2.44m of silt underlain by 1.27m of sands and gravels. The thickness of the deposits increases from ~4m on the southern boundary of the Energy Park Site, to 13m at a location 3.4km to the east, and up to 16m thick some 4km to the north. Therefore, from the borehole records it is anticipated that the tidal flat deposits within the south-west part of the Energy Park Site are around 4m thick and increase in thickness towards the north-east of the Energy Park Site.

9.5.24 The BGS geology mapping shows that the bedrock underlying the Energy Park Site comprises the Jurassic age West Walton Formation in the south-west half of the Energy Park and the Ampthill Clay Formation in the north-east half. The north-eastern part of the Off-site Cable Route Corridor comprises the West Walton Formation, while in the south-west, the Oxford Clay Formation, which underlies the West Walton Formation, is exposed.

9.5.25 The Oxford Clay Formation comprises a silicate mudstone with limestone nodules, with a typical thickness of 50–70m. The West Walton Formation, which overlies the Oxford Clays, is described by the BGS as comprising calcareous mudstones, silty mudstone and siltstones, with subordinate fine-grained sandstones and argillaceous limestones. It is estimated to be 20-40m in thickness and dips approximately 5 degrees to the east. Conformably overlying the West Walton Formation, the Ampthill Clay Formation consists of smooth or slightly silty mudstone with grey argillaceous limestone

nodules and is estimated to be up to 50m in thickness. BGS borehole records (BGS Ref: TF14SE2; TF14SE4/A) located on the West Walton Formation, documented the bedrock as comprising brown-grey clay, with sporadic argillaceous limestone nodules down to 135 metres below ground level (mbgl). At depths greater than 100mbgl, the records noted the clay becoming slightly sandy with stone beds present. However, the borehole records did not distinguish the West Walton Formation from the underlying Oxford Clay Formation. Hence, the thickness of West Walton at the site is unknown. Groundwater was encountered in the West Walton Formation at 71 mbgl (Ref: TF14SE4/B). Two borehole records located on the Ampthill Formation approximately 4 km to north of the site (BGS Ref: TF15SE28; TF25SW14) described the bedrock as comprising hard, dark olive grey, laminated silty clays with shell fragments.

9.5.26 A ground investigation comprising 46 window sample locations and 5 cable percussion boreholes was completed at the Energy Park in September 2022 (**Appendix 9.2: Ground Investigation Report** - document reference 6.3.9.2). The geology encountered was logged to BS5930 standards and the completed logs provided for review.

9.5.27 In general the investigation locations encountered topsoil overlying clays (soft-stiff, often silty, gravelly or sandy) overlying sands and/or gravels. Some of the clay layers were recorded as containing organic fragments.

9.5.28 Strata interpreted as representing the tidal flat deposits were described as being complex and variable, but generally defined as forming part of a sequence of predominantly cohesive and predominantly granular horizons.

9.5.29 Layers of peat were encountered across the majority of the Energy Park site as part of the tidal flats sequence, although peat was not recorded in all investigation locations. The thickness of peat (where present) varied from 0.05-0.55m. The depth at which peat was encountered varied from approximately 1.2 – 3.9mbgl.

9.5.30 The deeper cable percussion locations which were drilled in a cluster near the middle of the Energy Park site encountered sands, sands and gravels and gravels from approximately 3-5mbgl extending up to 10mbgl.

9.5.31 In several investigation locations, gravelly clays were encountered beneath the tidal flat deposits, and these were interpreted as representing the West Walton formation.

Table 9.8: Stratigraphy of lithologies underlying the Proposed Development

Age	Formation/Group	Description	Thickness
Quaternary Period	Tidal flats	Clay underlain by layers of peat, sands, sands and gravels and gravels***. Peat recorded in majority of ground investigation locations though also absent in some locations.	~3m - >10m increasing towards the north-east*
Jurassic	Ampthill Clay Formation (Ancholme Group)	Mudstone, mainly smooth or slightly silty, pale to medium grey with argillaceous limestone	Up to 50m**

Age	Formation/Group	Description	Thickness
		(cementstone) nodules; some rhythmic alternations of dark grey mudstone in the lower part; topmost beds are typically pale grey marls with cementstone.**	
	West Walton Formation (Ancholme Group)	Brown-grey clay, with sporadic argillaceous limestone nodules. Clay becoming slightly sandy at greater depths, with stone beds present.**	20-40m**
	Oxford Clay Formation (Ancholme Group)	Calcareous mudstone, silty mudstone and siltstone, with subordinate fine-grained sandstones and argillaceous limestone (cementstone) or siltstone nodules;	50-70m**
Sources: *BGS borehole log records **BGS Online Lexicon of Named Rock Units ***Completed Ground Investigation 2022			

Hydrogeology and Groundwater Vulnerability

9.5.32 The superficial tidal flat deposits are classified as 'unproductive' by the EA in terms of the aquifer designation and vulnerability. However, the completed ground investigation did encounter water strikes in the majority of borehole locations, with water present within the sands and gravels of the tidal flat deposits. As noted above there was a substantial thickness of sands and gravels towards the centre of the site recorded in the deeper cable percussive borehole locations, with standing water recorded at approximately 2.5-3.0mbgl. The other investigation locations would indicate that these sands and gravels are not particularly laterally extensive, and as such would not support a large volume of groundwater.

9.5.33 Both the West Walton and Ampthill Clay Formations are also classified as 'unproductive'. Most BGS borehole records did not encounter any groundwater. However, one borehole (Ref: TF14SE4/B), located 1.6km south-west of the Energy Park found a small quantity of water at a depth of 71mbgl within a thin limestone bed. In addition, the EA's Catchment Data Explorer shows that the Proposed Development does not lie within a groundwater management catchment and there are no Source Protection Zones (SPZs) recorded within 2km of the Proposed Development.

9.5.34 Since both the superficial deposits and bedrock lithologies underlying the Proposed Development are designated as 'unproductive', there is negligible groundwater flow down to depths of at least 70-100 mbgl. At this depth, the Kellaways Formation, which underlies the Oxford Clay Formation, forms a confined Secondary A aquifer below the off-site cable route section of the Proposed Development.

Table 9.9: Aquifer designations

Group	Formation	Aquifer classification
Superficial	Tidal flats	Unproductive
Bedrock	Ampthill Clay Formation	Unproductive
	West Walton Formation	Unproductive

Abstractions and discharges

9.5.35 Information provided by the EA and North Kesteven District Council indicates there are 41 surface water abstractions and 54 discharge locations within 5km of the Proposed Development. However, there are no licensed or private groundwater abstractions within 5km of the proposed development.

Implications of Climate Change

9.5.36 The UK Climate Change Projections 2018 (UKCP18) project the following:

- temperatures are projected to increase, particularly in summer;
- winter rainfall is projected to increase and summer rainfall is most likely to decrease;
- heavy rain days (rainfall greater than 25mm) are projected to increase, particularly in winter;
- near-surface wind speeds are expected to increase in the second half of the 21st century with winter months experiencing more significant effects of winds; however, the increase in wind speeds is projected to be modest;
- the frequency of winter storms over the UK is projected to increase; and
- changes in seasonal aquifer recharge rates as a response to variations in rainfall patterns.

9.5.37 The baseline hydrological regime may change as a result of the predicted impacts of climate change, irrespective of any development. River flows, tide levels and rainfall intensities are predicted to increase as a result of climate change. Should such changes materialise, rates of surface water run-off, flood flows within watercourses and flood levels associated with a breach of flood defences would increase. In addition, the seasonality of rainfall and river flows is likely to become more pronounced. This ES chapter is supported by **Appendix 9.1- Flood Risk Assessment** (document reference 6.3.9.1) that takes account of the potential future changes in the hydrological regime by incorporating appropriate allowances for climate change, as published by the EA (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances).

9.5.38 The baseline hydrogeological regime is unlikely to change as a result of the predicted impacts of climate change, given the unproductive nature of the geology and absence of aquifers that would be affected by changing recharge rates.

Receptors

9.5.39 Based upon review and characterisation of baseline conditions, the principal receptors that may be affected by the Proposed Development have been identified. Their sensitivity (defined based upon a combination of the methodology outlined in Section 9.3 above and professional judgement) is summarised in **Table 9.10** below:

Table 9.10: Receptor sensitivity

Receptor	Rationale	Sensitivity
Surface Water		
Head Dike/Skerth Drain	The Dike is categorised as Main River under the jurisdiction of the EA. It drains a predominantly rural catchment and inflows to the system are controlled by pumping. Based upon the criteria set out in Table 9.2, the Dike is categorised as medium sensitivity.	Medium
Head Dike/Skerth Drain flood defences	The defences comprise earth embankments and the EA has advised that the defences are in fair condition and are inspected regularly.	Medium
Surface water drains	The drains currently cater for run-off from the wider catchment within which the Proposed Development will be located and are the subject of routine maintenance by the BSIDB. In addition, the BSIDB has confirmed that improvement works and the provision of additional pumping station capacity will be implemented in the longer term. The drains are therefore regarded as being of medium sensitivity.	Medium
The 'Black Sluice IDB draining to the South Forty Foot Drain Water Body'	The 'Black Sluice IDB draining to the South Forty Foot Drain Water Body' is designated as a 'heavily modified' water body and the classification is currently 'Moderate Potential'. Based upon the criteria set out in Table 9.2, the water body is categorised as low sensitivity.	Low
Existing development/ infrastructure/ third party assets/land in the vicinity and downstream of the proposed development	Land use in the vicinity of the site is generally categorised as 'Less Vulnerable' (in accordance with the NPPF PPG Flood Risk Vulnerability Classification). Based upon the criteria set out in Table 9.2, 'Less Vulnerable' uses are considered to be of low sensitivity.	Low
Groundwater		
Superficial tidal flat deposits	Unproductive aquifer with very limited groundwater flow. Any groundwater present will be locally perched.	Negligible
Peat within tidal flat deposits	Limited thicknesses of peat identified during ground investigation (0.03m minimum thickness recorded, 0.55m maximum thickness recorded, not present in all ground investigation locations).	Medium
West Walton Formation and Ampthill Clay Formation	Unproductive aquifer with very limited groundwater flow. Any groundwater present will be locally perched.	Negligible

9.5.40 The assessment relating to hydrology, hydrogeology, flood risk and drainage considers the following potential effects:

Construction Phase

- Potential adverse effects on drainage patterns, surface water flows and aquifer recharge;
- Potential pollution of watercourses and underlying aquifers resulting from spilled hydrocarbons/petrochemicals from construction plant and the mobilisation of silts and contaminants during earthworks operations;
- Potential to disturb peat deposits if foundations are piled into any underlying layer of peat;
- Potential adverse effects upon the Head Dike/Skerth Drain flood defences;
- Potential adverse effects upon flood storage and flood flows/flood routing processes as a result of works within watercourses/drains and the floodplain; and
- Potential adverse effects resulting from compaction of the ground caused by construction plant and an increase in the extent of impermeable surfaces associated with access roads and compound areas.

Operational Phase

- Potential adverse effects on drainage patterns, surface water flows and aquifer recharge;
- Potential pollution of watercourses and underlying aquifers resulting from the flushing of silts and hydrocarbons from areas of hardstanding; and
- Potential adverse effects upon flood storage and flood flows/flood routing processes as a result of buildings/infrastructure within the floodplain.

Decommissioning Phase

- At the end of its operational life, the decommissioning of the Energy Park is considered to have similar effects upon the water environment as those during the construction stage; and
- At the end of its operational life, it is anticipated that any above ground works for the electrical connection will be removed and all below ground off-site cabling would be left *in situ*. As such, the decommissioning works would be minimal, such that significant effects would be unlikely.

Embedded Mitigation Measures Incorporated into the Proposed Development

9.5.41 The design philosophy that underpins the Proposed Development includes measures to prevent, reduce and offset significant adverse effects upon hydrology, hydrogeology, flood risk and drainage. Being 'built-in' to the proposals from the outset, the assessment of the significance of effects includes consideration of these embedded mitigation measures.

9.5.42 The Heckington Fen Solar Park DCO is accompanied by an **Outline Construction Environmental Management Plan (oCEMP)** (document reference 7.7), the implementation of which is secured through a DCO requirement. Mitigation measures in respect of impacts on hydrology, hydrogeology, flood risk and drainage during the construction phase will be secured through implementation of the final CEMP (under Requirement 13 of the DCO), following the measures set out in the oCEMP. Details of the likely mitigation are outlined below:

Construction Phase

- A management system would be in place to adequately manage works within watercourses/drains and the floodplain;
- Best practice working methods to prevent both water pollution and adverse impacts upon the surface water drainage regime;
- Appropriate storage of hydrocarbons and petrochemicals in accordance with Control of Substances Hazardous to Health (COSHH) Regulations 2002 and Control of Pollution (Oil Storage) (England) Regulations 2001;
- Any surface water potentially contaminated by hydrocarbons would be passed through oil interceptors prior to discharge;
- Precautions would be in place to prevent silt laden run-off, arisings or chemicals entering watercourses; and
- Where required, cables would be laid at a sufficient depth beneath watercourses/drains to avoid causing damage to the integrity of embankments during installation.

Operational Phase

- Surface Water Management infrastructure would be designed in accordance with CIRIA C753 and guidance set out by both the BSIDB and LLFA, such that the surface water run-off regime replicates that existing prior to development;
- Implementation of SuDS (i.e. swales);
- Elevated floor levels and flood resilient construction measures. Building floor levels will be set at an appropriate freeboard above the modelled breach flood level of the Head Dike, with flood sensitive equipment further raised compared to floor levels (as per parameters set out in the FRA supporting the ES);
- The Solar Panels have a leading edge set at between 1m and 1.5m Above Ground Level (AGL). This design level has been defined based upon site-specific hydraulic modelling of a breach of the Head Dike/Skerth Drain embankment during the 1 in 1,000 year plus climate change flood event. The modelling has been undertaken in accordance with a methodology agreed with the EA;
- The preliminary design of the Energy Park site has ensured that there are no panels expected to be within 9m of any surface water drain operated by the Black Sluice Internal Drainage Board (BSIDB) and 8m for all other drainage ditches. In any event, protective provisions are included within the DCO for the benefit of drainage authorities (including the BSIDB) to govern the procedure to follow for specified works in proximity to BSIDB/drainage authority drainage assets.

Decommissioning Phase

- A management system would be in place to adequately manage works within the floodplain;
- Best practice working methods to prevent both water pollution and adverse impacts upon the surface water drainage regime;
- Appropriate storage of hydrocarbons and petrochemicals in accordance with Control of Substances Hazardous to Health (COSHH) Regulations 2002 and Control of Pollution (Oil Storage) (England) Regulations 2001;
- Any surface water potentially contaminated by hydrocarbons would be passed through oil interceptors prior to discharge; and

- Precautions would be in place to prevent silt laden run-off, arisings or chemicals entering watercourses.

9.6 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

9.6.1 This section describes the findings of the assessment of likely significant effects associated with the Proposed Development, prior to the implementation of any mitigation measures additional to those incorporated into the design (Paragraph 9.5.41). The assessment methodology is outlined in Section 9.3. As set out in paragraph 9.5.41, the assessment of the significance of effects includes consideration of 'mitigation by design'/embedded mitigation measures. The potential effects considered are outlined in 9.5.40 and effects for the construction, operational and decommissioning phases are considered separately.

Energy Park

Construction

Surface Water Drainage – Flows

9.6.2 Development works, including earthworks operations, have the potential to impact upon the surface water drainage regime which, in turn, may impact upon sensitive receptors in the vicinity of the Energy Park.

9.6.3 Construction activities will include the clearance of vegetation, topsoil stripping and stockpiling, establishment of compound areas, excavation and site re-profiling to create construction platforms, preparation of site access tracks and construction of foundations. Compaction of the ground caused by construction plant and an increase in the extent of impermeable surfaces associated with access roads and compound areas has the potential to impact upon the surface water drainage regime and increase surface water run-off from the Energy Park Site. However, such effects would be localised and temporary and controlled using measures set out within the **Outline Construction and Environmental Management Plan** (oCEMP) (document reference 7.7). The surface water drains and the Head Dike are considered to be of Medium sensitivity and, following implementation of the oCEMP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Surface Water Drainage – Water Quality

9.6.4 Construction activities also have the potential to give rise to the contamination of surface water resulting from spilled hydrocarbons/petrochemicals from construction plant and the mobilisation of silts and contaminants during soil stripping and earthworks operations, potentially leading to increased silt loading in watercourses.

9.6.5 However, such effects would be localised and temporary and controlled using measures set out within the **Outline Construction and Environmental Management Plan** (document reference 7.7). The surface water drains, the Head Dike and the WFD Water Body are considered to be of Medium/Low sensitivity and, following implementation of the oCEMP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Flood Defences

9.6.6 Construction works in close proximity to the flood defences have the potential to affect the stability of the embankment and therefore the structural integrity of the defences. The implementation of embedded mitigation measures, including those within the **Outline Construction and Environmental Management Plan** (document reference 7.7)and other measures which may be required by conditions imposed by the relevant authority upon approvals under the protective provisions within the DCO for works in close

proximity to flood defences, would control the potential impacts of construction works. The flood defences are noted to be in fair condition (see Section 9.5.7) and are considered to be of Medium sensitivity. Following implementation of the **Outline Construction and Environmental Management Plan** (document reference 7.7), the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Flood Storage, Flood Flows and Flood Routing Processes

9.6.7 Construction works have the potential to affect flood storage and flood flows/flood routing processes as a result of construction activities and earthworks operations within the floodplain. Construction works therefore have the potential to increase flood risk locally and downstream.

9.6.8 The implementation of measures set out in the **Outline Construction and Environmental Management Plan** (document reference 7.7) and as required by conditions imposed via Permits/Consents for works within watercourse corridors will facilitate control of the potential impacts of construction works upon flood storage and flood flows/flood routing processes such that flood risk locally and downstream is not increased. The receptors are considered to be of Medium/Low sensitivity and, as a result of the implementation of measures in the oCEMP and the requirements of conditions imposed upon Permits/Consents, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Groundwater aquifer – flows

9.6.9 For the anticipated construction activities, as detailed in **Chapter 4 – Proposed Development** of this ES (document reference 6.1.4), the ground surface is expected to remain above the groundwater. The completed ground investigation did encounter shallow groundwater perched within sands and gravels of the tidal flat deposits at depths of 2.5-3.0mbgl, however, these groundwater bodies are considered to be limited in extent and volume. It is unlikely that substantial groundwater would be encountered for the majority of the works as the main groundwater body is anticipated to be >70 metres below ground level (mbgl) within the confined Kellaways Formation Aquifer.

9.6.10 Compaction of the ground caused by construction and an increase in the extent of impermeable surfaces associated with access roads and compound areas, have the potential to impact upon the rate of surface water infiltration. However, given that the underlying superficial deposits and bedrock largely constitute low permeability, unproductive aquifers, infiltration rates are not expected to be significantly affected by areas of increased hardstanding across the site.

9.6.11 The superficial and bedrock aquifers are deemed to have negligible sensitivity. The magnitude of the effect of construction activities on groundwater flow is deemed to be negligible and the significance of effect is therefore **Negligible Adverse** and **Not Significant.**

Groundwater aquifer – water quality

9.6.12 Effects on groundwater quality could result from excavations and earthworks as well as spillages and leaks of fuels, oils and chemicals. This could result in potential pollution to any underlying aquifers. This may arise from runoff associated with construction activities (e.g. through generation of silt borne run-off during groundworks and accidental spills and leaks from construction plant).

9.6.13 During future piling activities associated with the Proposed Development (standard depth of 3m assumed), groundwater quality of the aquifer units may be affected where there is potential to generate viable pollutant pathways between the superficial deposits and bedrock groundwater.

9.6.14 Shallow soft clays have been identified across much of the site which would seal around the piled steel poles and reduce the potential for them to act as a vertical pathway to the underlying aquifers.

9.6.15 The potential impacts of spillages of fuels, oils and chemicals or sediment run off during construction would be controlled by the **Outline Construction and Environmental Management Plan** (document reference 7.7)for the site, and as such the magnitude of any effect would be negligible.

9.6.16 The superficial and bedrock aquifers are deemed to have negligible sensitivity. The magnitude of the effect of construction activities on groundwater quality is deemed to be negligible and the significance of effect is therefore **Negligible Adverse** and **Not Significant.**

Peat deposits

9.6.17 Peat deposits were encountered across the Energy Park during the ground investigation with the exception of investigation locations completed adjacent to the western boundary. The peat was encountered at a range of depths, with deposits generally thinner in the western half of the site and thicker and deeper in the eastern half. The thicker peat along the eastern boundary (up to 0.55m thick) was largely encountered at depths that exceed the likely depth of the piled steel poles (~3m). Where the peat is shallower than 3.0mbgl, the deposits are largely thin (<0.3m thick) and overlain by soft clays, which would seal around the piled steel poles and reduce the potential for them to act as a vertical pathway to the peat. As such any impact upon the peat is likely to be limited to localised disturbance where deposits are <3mbgl, with no change to wider groundwater flows within the peat. On this basis the magnitude of the effect of construction activities on the peat is deemed to be minor and the significance of effect is therefore **Minor Adverse** and **Not Significant.**

Operation

Surface Water Drainage – Flows

9.6.18 The Energy Park will give rise to an increase in the impermeable area within the catchment, thereby increasing surface water run-off to the adjacent drains. This has the potential to increase flood risk to existing development/infrastructure/third party assets/land downstream. However, such effects would be controlled by the embedded mitigation measures outlined above, specifically a drainage strategy that controls surface water flows such that the surface water run-off regime replicates that existing prior to development. Full details of provisions for surface water drainage are set out in the FRA (**Appendix 9.1 – Flood Risk Assessment** (document reference 6.3.9.1)) and Requirement 11 of the DCO (document reference 3.1) secures a surface water drainage strategy and (if any) foul water drainage system to be approved prior to commencement by Lincolnshire County Council in consultation with both relevant planning authorities, the relevant Internal Drainage Board, and Anglian Water.

9.6.19 The surface water drains and existing development/infrastructure/third party assets/land downstream of the Energy Park are considered to be of Medium/Low sensitivity and the magnitude of impact will be Negligible following the implementation of embedded mitigation measures. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant.**

Surface Water Drainage – Water Quality

9.6.20 There is the potential for the contamination of surface water entering the local surface water drains, resulting from the flushing of silts and hydrocarbons from areas of hardstanding. However, the implementation of pollution control measures as part of the drainage strategy will facilitate the control of diffuse pollution. The surface water drains and WFD water body are considered to be of Medium/Low sensitivity and the magnitude of impact will be Negligible following the implementation of embedded mitigation measures. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Flood Storage, Flood Flows and Flood Routing Processes

9.6.21 Elements of the Energy Park, such as the energy storage facility and onsite substation, will be elevated above the peak water level associated with a breach of the Head Dike flood defences during a 1 in 1,000 year plus climate change flood event (as set out in the FRA supporting the ES - **Appendix 9.1 – Flood Risk Assessment** (document reference 6.3.9.1)). This will necessitate the localised raising of ground levels which has the potential to reduce the volume of storage available within the floodplain. The receptors are considered to be of Low sensitivity and the magnitude of impact will be Negligible (on account of the significant expanse of floodplain relative to the small and localised scale of any ground raising). On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Groundwater aquifer – flows

9.6.22 The collection of surface water from the Energy Park Site using the new drainage system (comprising swale-type features and balancing ponds) that is proposed potentially limits the volume of direct recharge to the aquifers. However, neither the superficial deposits or the bedrock constitute a viable resource for abstraction and are of limited potential.

9.6.23 Similarly, groundwater flow paths are unlikely to be affected by piling due to the overall low permeability and absence of significant groundwater within the superficial or bedrock units. It is noted that the cross-sectional area of the piles relative to the size of the development will be extremely small, and therefore will not impact any groundwater flows present.

9.6.24 The peat deposits identified at the Energy Park are considered unlikely to be affected during the operational phase, as changes in the groundwater flows (which may affect the peat by allowing it to dry out) are considered unlikely. The peats are largely overlain by soft clays, which would seal around the piled steel poles and reduce the potential for them to act as a vertical pathway to the peat.

9.6.25 The superficial and bedrock aquifers are deemed to have negligible sensitivity. The magnitude of the effect of activities during operation on groundwater flows is deemed to be negligible and the significance of effect is therefore **Negligible Adverse** and **Not Significant.**

Groundwater aquifer – water quality

9.6.26 The collection of surface water from the Energy Park Site using the proposed drainage system minimises the potential for any contaminated surface runoff to reach the superficial or bedrock aquifers during the operational stage. In addition, control of replacement material in the construction phase means that rainfall-infiltration through the new fill material is unlikely to introduce potential contaminants.

9.6.27 The superficial and bedrock aquifers are deemed to have negligible sensitivity. Completed ground investigation found little evidence of contamination sources that might be mobilised by the piling works. The magnitude of the effect of activities during operation on groundwater quality is deemed to be negligible and the significance of effect is therefore **Negligible Adverse** and **Not Significant**.

Decommissioning

9.6.28 At the end of its operational life, the decommissioning of the Energy Park is considered to have similar effects upon the water environment as those during the construction stage and, therefore, similar measures to reduce effects are likely to be proposed. The potential effects of the decommissioning phase in respect of hydrology, hydrogeology, flood risk and drainage are therefore anticipated to be **Not Significant**.

Off-site Cable Route Corridor and above and below ground works at the National Grid Bicker Fen Substation

9.6.29 The Proposed Development would require a new electrical connection to the National Grid Bicker Fen Substation to export power to the electricity network. The electrical connection will be routed predominantly underground, such that potential effects along the cable route would be associated with installation of the cable by either standard open-cut, cross-country construction techniques or trenchless techniques.

9.6.30 To facilitate the connection, National Grid has advised that it will be necessary to provide additional electricity transmission infrastructure, thereby necessitating an extension to the existing substation. National Grid has identified two locations for substation works – one to the south-west (AW1) and one to the west (AW2), as shown on Figure 3.9. The infrastructure solution to be provided within AW1 is subject to further engineering appraisal and detailed design, but will comprise either an Air Insulated Switchgear (AIS) or Gas Insulated Switchgear (GIS) solution. An AIS solution would occupy an area of up to 145m x 45m x 15m, to include a new control room (8m x 5m x 4m) and access road (4.5m wide), and would comprise equipment similar to that currently installed at the Substation. A GIS solution would occupy an area of up to 75m x 75m and would also include a new control room and access road. Part of the infrastructure required for a GIS solution would be housed within a building of up to approximately 30m x 20m x 15m. Area AW2 would comprise a Cable Sealing End (CSE) compound, which is a connection point to transition between an underground cable and above ground apparatus. The AW2 area will be required regardless of whether the design solution is AIS or GIS.

9.6.31 In terms of the assessment relating to hydrology, hydrogeology, flood risk and drainage, the potential effects arising from works at AW1 are associated with the installation of a new concrete pad and the culverting or diversion of the small surface water drain that currently flows along the southern boundary of the Substation. The potential effects arising from works at AW2 are associated with the installation of a new concrete pad.

Construction

Surface Water Drainage – Flows

9.6.32 The laying of temporary surfacing material for access purposes, establishment of temporary construction compounds, stockpiling areas and compaction of the ground due to construction plant has the potential to reduce the permeability of the ground, leading to increased surface water run-off to nearby watercourses. Similarly, the installation of temporary drainage/de-watering measures could potentially increase flows in nearby drains/ditches/watercourses. These activities have the potential to increase run-

off and impact upon the surface water drainage regime. The receptors are considered to be Medium sensitivity and the effects would be localised and temporary and controlled using measures set out within the **Outline Construction Environmental Management Plan (oCEMP)** (document reference 7.7). As a result, the magnitude of impact during installation of the underground cable would be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

9.6.33 Construction activities at the National Grid Bicker Fen Substation will comprise localised and small-scale, above ground engineering works associated with installation of the AIS or GIS infrastructure (AW1) and the CSE compound (AW2), which will include laying of new concrete pads.

9.6.34 These works have very minor potential to impact upon the surface water drainage regime at the substation. The local surface water drains are considered to be Medium sensitivity and any effects would be localised and temporary and controlled using measures set out within the oCEMP. As a result, the magnitude of impact associated with works at the substation would be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Surface Water Drainage – Water Quality

9.6.35 Construction activities have the potential to give rise to the contamination of surface water resulting from spilled hydrocarbons/petrochemicals from construction plant and the mobilisation of silts and contaminants during engineering, earthworks and open-cut trenching operations, potentially leading to increased silt loading in watercourses. However, such effects would be localised and temporary and controlled using measures set out within the **Outline Construction Environmental Management Plan (oCEMP)** (document reference 7.7). The surface water drains and the WFD Water Body are considered to be of Medium/Low sensitivity and, following implementation of the oCEMP, the magnitude of impact is considered to be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant.**

9.6.36 Construction activities at the National Grid Bicker Fen Substation will comprise localised and small-scale, above ground engineering works associated with installation of the AIS or GIS infrastructure (AW1) and the CSE compound (AW2), which will include laying of new concrete pads. These works have very minor potential to give rise to the contamination of surface water, thereby affecting the water quality of nearby drains. The local surface water drains are Low sensitivity and any effects would be localised and temporary and controlled using measures set out within the oCEMP. As a result, the magnitude of impact associated with works at the substation would be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Flood Storage, Flood Flows and Flood Routing Processes

9.6.37 The crossing of ditches, drains and watercourses using open-cut techniques has the potential to reduce the flow capacity and/or change the flow regime, thereby leading to a temporary and localised increase in flood risk. Similarly, the culverting or diversion of the small surface water drain that currently flows along the southern boundary of the Substation has the potential to reduce the flow capacity and/or change the flow regime, thereby potentially leading to a temporary and localised, minor increase in flood risk. However, flows will be managed in accordance with the methodologies set out in the **Outline Construction Environmental Management Plan (oCEMP)** (document reference 7.7) (e.g. over-pumping or the creation of flow diversion channels). The implementation of these and other measures as required by conditions imposed via Permits/Consents for works within watercourse corridors (secured through protective provisions within the DCO) will facilitate control of the potential impacts of construction

works upon flood storage and flood flows/flood routing processes, such that flood risk locally and downstream is not increased.

9.6.38 The receptors are considered to be of Medium/Low sensitivity and the effects would be localised and temporary and controlled by measures in the oCEMP. As a result, the magnitude of impact during installation of the underground cable and the Substation extension works would be Negligible. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant**.

Groundwater aquifer – flows

9.6.39 For the anticipated construction activities, as detailed in **Chapter 4 – Proposed Development** of this ES (document reference 6.1.4), the ground surface is expected to remain above the groundwater. The completed ground investigation at the Energy Park site did encounter shallow groundwater perched within sands and gravels of the tidal flat deposits at depths of 2.5-3.0mbgl, however, these groundwater bodies are considered to be limited in extent and volume. It is unlikely that substantial groundwater would be encountered for the majority of the works as the main groundwater body is anticipated to be >70 metres below ground level (mbgl) within the confined Kellaways Formation Aquifer. It is noted that no ground investigation was carried out beyond the Energy Park, but BGS mapping indicates that the stratigraphy is similar beneath the cable route and substation site. On this basis the proposed works are unlikely to cause any changes to groundwater flows, as the construction activities are not anticipated to impose any barriers to groundwater flows.

9.6.40 The laying of temporary surfacing material for access purposes, establishment of temporary construction compounds, stockpiling areas and compaction of the ground due to construction plant has the potential to impact the rate of surface water infiltration. However, given that the underlying superficial deposits and bedrock constitute low permeability, unproductive aquifers, infiltration rates are not expected to be significantly affected by areas of increased hardstanding.

9.6.41 The superficial and shallow bedrock aquifers are deemed to have negligible sensitivity. The magnitude of the effect of construction activities on groundwater flow is deemed to be negligible and the significance of effect is therefore **Negligible Adverse** and **Not Significant.**

Groundwater aquifer – water quality

9.6.42 Effects on groundwater quality could result from excavations and earthworks as well as spillages and leaks of fuels, oils and chemicals. This could result in potential pollution to any underlying aquifers. This may arise from run-off associated with construction activities (e.g. through generation of silt borne run-off during groundworks) and accidental spills and leaks from construction plant.

9.6.43 The potential impacts of spillages of fuels, oils and chemicals or sediment run off during construction would be controlled by the **Outline Construction Environmental Management Plan (oCEMP)** (document reference 7.7) for the Proposed Development, and as such the magnitude of any effect would be negligible.

9.6.44 The superficial and bedrock aquifers are deemed to have negligible sensitivity. The magnitude of the effect of construction activities on groundwater quality is deemed to be negligible and the significance of effect is therefore **Negligible Adverse** and **Not Significant.**

Operation

9.6.45 The electrical connection to the National Grid Bicker Fen Substation comprises an underground cable. During the operational phase, it would not therefore give rise to impacts upon hydrology, hydrogeology, flood risk and drainage.

9.6.46 The Substation extension works will give rise to an increase in the impermeable area within the catchment, thereby increasing surface water run-off to the adjacent drains. This has the potential to increase flood risk to existing development/infrastructure/third party assets/land downstream. However, such effects would be controlled by the embedded mitigation measures outlined above, specifically a drainage strategy that controls surface water flows such that the surface water run-off regime replicates that existing prior to development.

9.6.47 The surface water drains and existing development/infrastructure/third party assets/land downstream of the Substation are considered to be of Medium/Low sensitivity and the magnitude of impact will be Negligible following the implementation of embedded mitigation measures. On this basis, the significance of the effect would be **Negligible** and therefore **Not Significant.**

9.6.48

Decommissioning

9.6.49 At the end of its operational life, it is anticipated that the assigned generator bay that will be installed at the National Grid Bicker Fen Substation for the Proposed Development will be removed as part of the decommissioning process. The Substation Extension at Bicker Fen would remain the responsibility of National Grid. There may be potential for the components of the Bicker Fen Extension within the assigned generator bay to remain after 40yrs and be utilised for further electrical connections, subject to agreement with National Grid. It is expected that the new building needed for the GIS solution would remain post decommissioning of the Heckington Fen site as later electrical connections to Bicker Fen will be housed within it. All below ground off site cabling would be left *in situ* as it will be 1m or more below surface level. As such, the decommissioning works along the Off-site Cable Route and at Bicker Fen Substation would be minimal, such that significant effects upon hydrology, hydrogeology, flood risk and drainage would be unlikely.

9.7 MITIGATION AND ENHANCEMENT

Additional Mitigation

Construction and Decommissioning

9.7.1 Potential effects arising from construction of the Energy Park, Off-site Cable Route Corridor and works at the Bicker Fen Substation are likely to be localised and temporary and controlled by embedded mitigation measures delivered through the CEMP. The effects are therefore Negligible and Not Significant. On this basis, there is no requirement for additional mitigation measures over and above those already identified.

9.7.2 At the end of its operational life, the decommissioning of the Energy Park is considered to have similar effects upon the water environment as those during the construction stage and, therefore, similar measures to reduce effects are likely to be proposed. On this basis, there is unlikely to be a requirement for additional mitigation measures.

9.7.3 At the end of its operational life, it is anticipated that the below ground electrical cabling within the limits of the Off-site Cable Route Corridor associated with the off-site substation connection would be left *in situ*, such that there would be no decommissioning

works and therefore no potential effects upon hydrology, hydrogeology, flood risk and drainage.

Operation

9.7.4 As noted above, the off-site electrical connection comprises an underground cable within the limits of the Off-site Cable Route Corridor which would not require water, nor be sensitive to flood risk. During the operational phase, it would not therefore give rise to impacts upon hydrology, hydrogeology, flood risk and drainage.

9.7.5 With the implementation of embedded mitigation measures as set out above, including the elevation of energy generation infrastructure above the breach flood level, the effects associated with operation of the Energy Park and National Grid Bicker Fen Substation are Negligible and therefore Not Significant. On this basis, there is no requirement for additional mitigation measures over and above those identified.

Table 9.11: Mitigation

Ref	Measure to avoid, reduce or manage any adverse effects and/or to deliver beneficial effects	How measure would be secured	
		By Design	By DCO Requirement
1	Outline Construction Environmental Management Plan (oCEMP), setting out various measures to control impacts upon watercourses, flood defences, surface water drainage, water quality and floodplain storage/flows/routing processes		X
2	Surface water management strategy		X
3	Design levels elevated above breach flood level and flood resilient construction	X	

9.8 CUMULATIVE AND IN-COMBINATION EFFECTS

9.8.1 Construction and operation of the Proposed Development could occur simultaneously with 'Other Developments' located in the vicinity of the Proposed Development. The 'Other Developments' are identified within **Chapter 2 – EIA Methodology and Consultation** of this ES (document reference 6.1.2). Other proposed development will be subject to compliance with local and national planning policy and the Water Environment (WFD) regulations. Other proposals will therefore be required to demonstrate (amongst other matters) that flood risk is not increased, that the surface water drainage regime and water quality are not adversely affected and that groundwater aquifers are not affected. Without demonstrating compliance, DCO consent or planning permission would not be granted and construction could not commence for those projects.

9.8.2 The 'Other Developments' are therefore likely to be subject to embedded mitigation and additional mitigation, where applicable, as required by the specifics of the proposed schemes. This would result in the residual effects of the construction and operational phases being classified as Not Significant or Beneficial. When combined with the Not Significant residual effects of the Heckington Fen Solar Park construction and operational phases, the cumulative effects are likely to be **Not Significant** or Beneficial, depending on the extent of mitigation measures implemented as part of 'Other Developments'.

9.9 SUMMARY

Introduction

9.9.1 This Chapter has set out the assessment of likely significant effects of the Proposed Development upon hydrology, hydrogeology, flood risk and drainage arising from the construction, operation and decommissioning of the Proposed Development.

9.9.2 The assessment was supported by the collection and interpretation of data and information requested from the Environment Agency (EA), Black Sluice Internal Drainage Board (BSIDB) and North Kesteven District Council (NKDC). This information has been used to characterise the baseline water environment and identify receptors.

Baseline Conditions

9.9.3 The Proposed Development is situated on the Lincolnshire Fens, a coastal plain in the east of England which comprises a large area of broad, flat marshland.

9.9.4 The principal watercourses in the area are the River Witham and South Forty Foot Drain, located approximately 4km and 1.5km to the east and south of the proposed Energy Park respectively. Both are classified as Main River and therefore under the jurisdiction of the EA. The Energy Park itself is bound along the northern boundary by the Head Dike/Skerth Drain (which is also classified as Main River) and the Energy Park site area is bisected by a number of ditches/drains, some of which are operated and maintained by the BSIDB. Water levels within the network of ditches/drains are managed through pumping to the Head Dike/Skerth Drain.

9.9.5 The Energy Park Site is currently in agricultural use and therefore comprises permeable surfaces, such that surface water run-off generally infiltrates into the ground or is routed to the various ditches/drains that bisect the site. Similarly, the Off-site Cable Route Corridor traverses an area characterised by agriculture.

9.9.6 According to the EA's flood map, the majority of the Energy Park Site is located within Flood Zone 3 (High Probability – land having a 1 in 100 or greater annual probability of fluvial flooding) and benefits from flood defences offering a 1 in 10-year standard of protection.

9.9.7 The Off-site Cable Route Corridor and National Grid Bicker Fen Substation are also shown to lie within Flood Zone 3.

9.9.8 The EA 'Flood Risk from Surface Water Map' shows that the majority of the Energy Park and the Off-site Cable Route Corridor and National Grid Bicker Fen Substation are at 'Very Low' risk of surface water flooding.

9.9.9 The EA 'Flood Risk from Reservoirs Map' shows the area that may be affected by flooding as a result of a breach of a large, raised reservoir i.e. capable of storing over 25,000 cubic metres of water above the natural level of any part of the surrounding land. According to EA records, the nearest reservoir is located approximately 8km to the west of the Energy Park, between Heckington and Sleaford. The EA's map shows that, when river levels are normal, only limited and localised areas along the northern boundary of the Energy Park adjacent to Head Dike are affected by reservoir flooding. The Off-site Cable Route Corridor and National Grid Bicker Fen Substation are unaffected by reservoir flooding when river levels are normal.

9.9.10 British Geological Survey mapping indicates that the Energy Park, Off-site Cable Route Corridor and National Grid Bicker Fen Substation are entirely underlain by superficial and bedrock deposits comprising predominantly low permeability clay. EA aquifer

designation maps categorise both the superficial deposits and bedrock deposits as 'unproductive' (i.e. areas comprised of rocks that have negligible significance for water supply or baseflow to rivers, lakes and wetlands). The completed ground investigation did encounter layers of granular material within the tidal flat deposits which contained groundwater, however these layers are limited in extent and unlikely to contain significant volumes of groundwater.

9.9.11 The Proposed Development lies within the '*Black Sluice IDB draining to the South Forty Foot Drain Water Body*', which is designated as 'heavily modified' (substantially changed in character as a result of physical alterations by human activity). The environmental (Water Framework Directive) objective for the water body is to achieve 'good ecological potential'. The overall water body classification is currently 'Moderate' potential (Cycle 2, 2019).

Likely Significant Effects

9.9.12 The assessment finds that construction activities have the potential to impact upon the surface water drainage regime and increase surface water run-off from the Proposed Development. Similarly, the assessment identifies the potential for construction activities to give rise to the contamination of surface water resulting from spilled hydrocarbons/petrochemicals from construction plant and the mobilisation of silts and contaminants during soil stripping and earthworks operations, potentially leading to increased silt loading in watercourses.

9.9.13 The assessment also notes that construction works in close proximity to the flood defences have the potential to affect the stability of the embankment and therefore the structural integrity of the defences. Also, floodplain storage and flood flows/flood routing processes may be affected as a result of construction activities and earthworks operations within the floodplain, such that there is potential to increase flood risk locally and downstream.

9.9.14 However, the assessment finds that these likely effects are **Not Significant**, on account of 'mitigation by design'/embedded mitigation measures that are either 'built-in' to the proposals from the outset or secured through a DCO requirement.

9.9.15 Potential construction phase effects upon groundwater aquifers are found to be **Not Significant**, principally on account of the low permeability of the ground and the unproductive nature of the superficial and shallow bedrock aquifers.

9.9.16 During the operational phase of the Proposed Development, the assessment finds that an increase in the impermeable area within the Energy Park Site has the potential to increase surface water run-off to the adjacent drains, potentially increasing flood risk elsewhere. Similarly, the assessment identifies the potential for the contamination of surface water entering the local surface water drains, resulting from the flushing of silts and hydrocarbons from areas of hardstanding. However, the assessment finds that these likely effects are **Not Significant**, on account of 'mitigation by design'/embedded mitigation measures that are either 'built-in' to the proposals from the outset or secured through a DCO requirement.

9.9.17 The assessment also notes that the raising of ground levels to locate flood-sensitive infrastructure above the flood level has the potential to reduce the volume of storage available within the floodplain. However, the assessment notes that any such ground raising would be very small scale and localised and located within a significant expanse of floodplain. On this basis, it is concluded that the likely effects are **Not Significant.**

9.9.18 Potential operational phase effects upon groundwater aquifers are found to be Not Significant, principally on account of the low permeability of the ground and the unproductive nature of the aquifers.

9.9.19 The electrical connection to the National Grid Bicker Fen Substation comprises an underground cable that would not require water, nor be sensitive to flood risk. The assessment therefore concludes that, during the operational phase, it would not give rise to impacts upon hydrology, hydrogeology, flood risk and drainage. The assessment notes that the Substation extension works will give rise to an increase in the impermeable area within the catchment, potentially increasing surface water run-off to the adjacent drains and increasing flood risk to existing development/infrastructure/third party assets/land downstream during operation. However, the assessment finds that these likely effects are **Not Significant**, on account of 'mitigation by design'/embedded mitigation measures that are either 'built-in' to the proposals from the outset or secured through a DCO requirement.

Mitigation and Enhancement

9.9.20 Potential effects arising from construction of the Energy Park, off-site cable route and works at the Bicker Fen Substation are likely to be localised and temporary and controlled by embedded mitigation measures. The effects are therefore Not Significant and there is no requirement for additional mitigation measures.

9.9.21 With the implementation of embedded mitigation measures the effects associated with operation of the Energy Park and National Grid Bicker Fen Substation are Not Significant. On this basis, there is no requirement for additional mitigation measures over and above those identified.

9.9.22 The electrical connection within the limits of the Off-site Cable Route Corridor comprises an underground cable such that, during the operational phase, it would not give rise to impacts upon hydrology, hydrogeology, flood risk and drainage.

9.9.23 At the end of its operational life, the decommissioning of the Energy Park is considered to have similar effects upon the water environment as those during the construction stage and, therefore, similar measures to reduce effects are likely to be proposed. On this basis, it is concluded that there is unlikely to be a requirement for additional mitigation measures.

9.9.24 At the end of its operational life, it is anticipated that the off-site electrical cabling within the limits of the Off-site Cable Route Corridor would be left *in situ*, although all above ground works would be removed. As such there would be limited decommissioning works and therefore limited or no potential effects upon hydrology, hydrogeology, flood risk and drainage.

Cumulative and In-combination Effects

9.9.25 The assessment notes that construction and operation of the Proposed Development could occur simultaneously with 'Other Developments' located in the vicinity. Other proposed development will be subject to compliance with local and national planning policy and therefore required to demonstrate (amongst other matters) that flood risk is not increased, that the surface water drainage regime and surface water quality are not adversely affected and that groundwater aquifers are not affected. Without demonstrating compliance, DCO consent (or planning permission, as relevant) would not be granted and construction could not commence. On this basis, these committed development schemes will not give rise to any significant effects and there will be no cumulative effects within the wider catchment.

Conclusion

9.9.26 It is concluded that potential effects arising from construction of the Proposed Development are likely to be localised and temporary and controlled by embedded mitigation measures. The residual effects are therefore **Negligible** and **Not Significant.**

9.9.27 With the implementation of embedded mitigation measures, the residual effects associated with operation of the Energy Park are **Negligible** and **Not Significant**. The electrical connection to the National Grid Bicker Fen Substation comprises an underground cable that would not give rise to impacts upon hydrology, hydrogeology, flood risk and drainage during the operational phase.

Table 9.12: Summary of Effects, Mitigation and Residual Effects

Receptor/ Receiving Environment	Description of Effect	Nature of Effect *	Sensitivity Value **	Magnitude of Effect **	Geographical Importance ***	Significance of Effects ****	Mitigation/ Enhancement Measures	Residual Effects ****
Construction								
Aquifers and groundwater abstractions	Change in flows	Permanent Direct	Negligible	Negligible	Borough / District	Negligible	None required	Negligible (Not Significant)
Aquifers and groundwater abstractions	Change in quality	Temporary Direct	Negligible	Negligible	Borough / District	Negligible	None required	Negligible (Not Significant)
Surface water drains	Change in flow regime	Temporary Direct	Medium	Negligible	Local	Negligible	CEMP	Negligible (Not Significant)
Surface water drains	Change in water quality	Temporary Direct	Low	Negligible	Local	Negligible	CEMP	Negligible (Not Significant)
Flood defences	Impact upon stability and structural integrity	Permanent Direct	Medium	Negligible	Local	Negligible	CEMP	Negligible (Not Significant)
Floodplain	Impact upon flood storage, flood flows and flood routing processes	Temporary Direct	Medium	Negligible	Local	Negligible	CEMP	Negligible (Not Significant)
Peat deposits	Disturbance of deposits	Permanent Direct	Medium	Minor	International	Negligible	None required	Negligible (Not Significant)
Operation								

Receptor/ Receiving Environment	Description of Effect	Nature of Effect *	Sensitivity Value **	Magnitude of Effect **	Geographical Importance ***	Significance of Effects ****	Mitigation/ Enhancement Measures	Residual Effects ****
Aquifers and groundwater abstractions	Change in flows	Permanent Direct	Negligible	Negligible	Borough / District	Not Significant	None required	Negligible (Not Significant)
Aquifers and groundwater abstractions	Change in quality	Temporary Direct	Negligible	Negligible	Borough / District	Not Significant	None required	Negligible (Not Significant)
Surface water drains	Change in flow regime	Permanent Direct	Medium	Negligible	Local	Negligible	Provision of drainage/SuDS measures to capture run-off from solar panels. No Panels or equipment planned to be within 9m of IDB drains and 8m of other drainage ditches on Energy Park Site	Negligible (Not Significant)
Surface water drains	Change in water quality	Permanent Direct	Low	Negligible	Local	Negligible	None required	Negligible (Not Significant)
Floodplain	Impact upon flood storage, flood flows and flood routing processes	Permanent Direct	Medium	Negligible	Local	Negligible	Leading edge of solar panels to be elevated above 1 in 1,000 year plus climate change flood level	Negligible (Not Significant)
Decommissioning								

Receptor/ Receiving Environment	Description of Effect	Nature of Effect *	Sensitivity Value **	Magnitude of Effect **	Geographical Importance ***	Significance of Effects ****	Mitigation/ Enhancement Measures	Residual Effects ****
Aquifers and groundwater abstractions	Change in flows	Permanent Direct	Negligible	Negligible	Borough / District	Negligible	None required	Negligible (Not Significant)
Aquifers and groundwater abstractions	Change in quality	Temporary Direct	Negligible	Negligible	Borough / District	Negligible	None required	Negligible (Not Significant)
Surface water drains	Change in flow regime	Temporary Direct	Medium	Negligible	Local	Negligible	Similar to operational phase	Negligible (Not Significant)
Surface water drains	Change in water quality	Temporary Direct	Low	Negligible	Local	Negligible	Similar to operational phase	Negligible (Not Significant)
Flood defences	Impact upon stability and structural integrity	Permanent Direct	Medium	Negligible	Local	Negligible	Similar to operational phase	Negligible (Not Significant)
Floodplain	Impact upon flood storage, flood flows and flood routing processes	Temporary Direct	Medium	Negligible	Local	Negligible	Similar to operational phase	Negligible (Not Significant)
Cumulative and In-combination								
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a