Riverside Energy Park

Preliminary Environmental Information Report

CHAPTER:

12

PLANNING INSPECTORATE REFERENCE NUMBER:

EN010093

HYDROLOGY, FLOOD RISK AND WATER RESOURCES

June 2018 | Revision 0

Planning Act 2008 | Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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RIVERSIDE ENERGY

Contents

Tables

Appendix H

12 Hydrology, Flood Risk and Water Resources

12.1 Introduction

12.1.1 This chapter presents the preliminary findings of the assessment of the potential effects of the Proposed Development upon hydrology, flood risk and water resources. It summarises the relevant policy, guidance and legislation, the consultation undertaken to support and inform the assessment, the assessment methodology and the baseline conditions both at and in the vicinity of the Riverside Energy Park (REP) site, the Main Temporary Construction Compounds and the Electrical Connection. It then considers the potential effects of the construction and operational phases of the Proposed Development and the mitigation measures required to prevent, reduce or offset the effects and the residual effects. It has been written by Peter Brett Associates LLP (PBA) and a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this chapter is provided in **Appendix A.3**.

12.2 Policy Context, Legislation, Guidance and Standards

12.2.1 As outlined in **Chapter 2**, the relevant National Policy Statements (NPS) provide the primary basis for decisions by the Secretary of State on Nationally Significant Infrastructure Projects (NSIPs).

National Planning Policy

NPS EN-1

12.2.2 The principal planning policy for the determination of Development Consent Order (DCO) applications for energy-related NSIPs is provided by the National Policy Statements issued by the Government. The Overarching National Policy Statement for Energy (NPS EN-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).

NPS EN-3

12.2.3 NPS EN-3 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 assessment requirements set out in NPS

EN-1 and highlights the requirement to identify measures to avoid or minimise the adverse impacts of abstraction and discharge of cooling water.

NPS EN-5

12.2.4 NPS EN-5 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.

National Planning Policy Framework (2012) and Planning Practice Guidance

12.2.5 The National Planning Policy Framework (NPPF) sets out national planning policy with regards to development and flood risk. The accompanying 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.

12.2.6 The NPPF (Paragraphs 100-103) 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.

Planning Practice Guidance (PPG)

12.2.7 The PPG (DCLG, 2014) 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: 065 Reference ID: 7-065-20140306):

- *"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 has to flow or be stored in times of flood, including flood conveyance routes and areas designed to flood as part of a flood defence scheme."*

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

12.2.9 The '*Flood Risk and Coastal Change*' PPG (Paragraph: 050 Reference ID: 7-050-20140306) 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.

12.2.10 The NPPF (Paragraph 99) 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.

National Planning Policy for Waste

12.2.11 The National Planning Policy for Waste (DCLG, 2014) sets out detailed waste planning policies and provides the framework for the implementation of The Waste Management Plan for England (2013). The Policy includes 'locational criteria' that should be applied by waste planning authorities in testing the suitability of sites and areas for new or enhanced waste management facilities. This includes "*protection of water quality and resources and flood risk management*" and the Policy also refers to the NPPF.

Legislation

The Flood Risk Regulations 2009

12.2.12 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 are prepared by the Environment Agency (EA) and Unitary/County Authorities (Lead Local Flood Authorities (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.

Flood and Water Management Act 2010 & Sustainable Drainage Systems: Written Statement – HCWS161

12.2.13 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 Environment Agency 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.

12.2.14 The FWMA 2010 (Schedule 3) proposed the establishment of 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.

12.2.15 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.

12.2.16 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. The relevant provisions that would have revoked the automatic right of connection and required all new connections to be made via a Section 104 Agreement for foul sewers, following the consent of the SAB for surface water connections, have not been brought in to force. 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.

Water Environment (Water Framework Directive) (England and Wales) Regulations

12.2.17 The Water Environment (Water Framework Directive) (England and Wales) 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.

12.2.18 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 EA and 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 Environmental Permitting (England and Wales) Regulations

12.2.19 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 Water Resources Act 1991 (WRA) and the Groundwater Regulations 2009.

12.2.20 Schedule 21 relates to water discharge activities and Schedule 25 relates to flood risk activities. Schedule 22 of 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 Water Resources Act

12.2.21 The WRA 1991 replaced the corresponding sections of the Water Act 1989.

12.2.22 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 groundwater. Discharge to controlled waters is only permitted with the consent of the Environment Agency. Similarly, a licence is required to abstract from controlled waters.

Land Drainage Act

12.2.23 The Land Drainage Act 1991 consolidates various enactments relating to Internal Drainage Boards and the functions of these Boards and local 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 Building Regulations

12.2.24 The Building Regulations Requirement H3 (The Building Regulations 2010, Drainage and waste disposal, 2015 edition) stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- an adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable;
- a watercourse; or where that is not practicable; and
- a sewer.

Guidance and Standards

Sewers for Adoption 7th Edition

12.2.25 'Sewers for Adoption' is the standard in England and Wales for the design and construction of sewers to adoptable standards. It is a guide to assist developers in preparing their submission to a Sewerage Undertaker prior to entering an Adoption Agreement under Section 104 of the Water Industry Act 1991.

Non-statutory Technical Standards for Sustainable Drainage Systems

12.2.26 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.

Rainfall Runoff Management for Developments (Report SC030219/R, October 2013)

12.2.27 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.

The SuDS Manual

12.2.28 The SuDS Manual (C753) expands upon the framework set out by the Government's Non-Statutory Technical Standards for SuDS and sets out the latest industry practice and guidance regarding the planning, design, construction, management and maintenance of SuDS.

Flood Risk Assessments: climate change allowances

12.2.29 This guidance was published by the Environment Agency in February 2016 and should be used as the basis for preparing Flood Risk Assessments. The guidance sets out the climate change allowances for peak river flow, peak rainfall intensity, sea level rise, off-shore wind speeds and extreme wave height.

12.2.30 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 Application Site lies within the Thames River Basin District.

Emerging National Planning Policy

Draft National Planning Policy Framework

12.2.31 The draft revised NPPF was published for consultation by the Ministry of Housing, Communities and Local Government (MHCLG) on 5th March 2018.

12.2.32 From a flood risk perspective, the draft essentially mirrors established principles and requirements, but with a greater emphasis upon (i) consideration of the impacts of climate change and (ii) incorporation of sustainable drainage systems within major development.

Regional Planning Policy

The London Plan

12.2.33 The London Plan provides the over-arching framework for the development and use of land in London, helping to ensure joined-up policy delivery by the Greater London Authority (GLA) and the 32 London boroughs and the Corporation of London.

12.2.34 Policy 5.12, regarding flood risk management, requires that development proposals comply with the flood risk assessment and management requirements set out in the NPPF and associated guidance and have regard to measures proposed in the Thames Estuary 2100 and Catchment Flood Management Plans. The policy sets out criteria in respect of the Exception Test and development adjacent to flood defences, requiring that development is set back from defences to allow their management, maintenance and upgrading.

12.2.35 Policy 5.13 addresses sustainable drainage and outlines a drainage hierarchy for the control and disposal of surface water run-off, requiring that SuDS are used unless there are practical reasons for not doing so.

12.2.36 Policy 5.14 addresses water quality and wastewater infrastructure and requires that water quality is protected and improved, having regard to the Thames River Basin Management Plan.

12.2.37 Policy 5.15 addresses water use and supplies and requires, inter alia, that development minimises the use of mains water and that rainwater harvesting is promoted.

The London Plan – Sustainable Design and Construction Supplementary Planning Guidance (SPG)

12.2.38 The London Plan sets environmental targets for developers to meet and the SPG provides guidance for developers and local planning authorities on how to achieve the London Plan objectives. As part of the London Plan Implementation Framework, the SPG is a material planning consideration when determining planning applications.

12.2.39 The SPG provides guidance on flooding/flood risk management, sustainable drainage and flood defences and requires that surface water run-off from developments is limited to greenfield rates. In respect of previously developed sites the SPG states that "…*run-off rates should not be more than three times the calculated greenfield rate*". The SPG notes that greater discharge rates may be acceptable where a pumped discharge is required or where surface water outfalls to tidal waters, in which case the discharge may be unrestricted.

12.2.40 In respect of flood defences, the SPG states that development should be set back 16 metres (m) from flood defences (in accordance with Thames Region Flood Defence Byelaws) and that development must make provision for the future raising of tidal flood defences in accordance with the requirements of the Thames Estuary 2100 Plan.

Thames Estuary 2100 Plan

12.2.41 The Plan sets out a strategy for managing flood risk on the Thames Estuary area throughout this century.

12.2.42 The REP site lies within the Thamesmead Policy Unit and the recommended flood risk management policy for this area is to take further action to keep up with climate and land use change so that flood risk does not increase.

12.2.43 The Thamesmead Policy Unit lies within Action Zone 4, which includes recommendations to maintain, enhance and improve or replace the river defence walls over the plan period up to 2034 and to implement the 'end of the century' option between 2050 and 2070 (potentially comprising improvements to the Thames Barrier and associated defence raising down river of the barrier or a new barrier at Long Reach).

London's Wasted Resource, The Mayor's Municipal Waste Management Strategy

12.2.44 The Strategy (GLA, 2011) identifies six policies to facilitate achievement of the Mayor's objectives and targets for municipal waste management. However, the Strategy does not set out policy in respect of hydrology, flood risk and water resources.

Managing Risks and Increasing Resilience, The Mayor's Climate Change Adaptation Strategy

12.2.45 The Strategy (GLA, 2011) assesses the consequences of climate change and sets out a framework and strategic process by which London can put in place the measures necessary to adapt to future climate change.

12.2.46 The Strategy addresses flooding and sets out over-arching policy that requires the Mayor to "*…work with partners to reduce and manage current and future flood risk in London…*". However, the Strategy does not set out site or catchment specific policy of relevance to REP.

Emerging Regional Planning Policy

Draft London Plan

12.2.47 The Draft New London Plan has been published for consultation and will be subject to examination in Autumn 2018.

12.2.48 Policy SI5 regarding water infrastructure addresses water consumption and requires that the water environment is protected and improved in line with the Thames River Basin Management Plan.

12.2.49 Policy SI12 regarding flood risk management states *"Development proposals which require specific flood risk assessments should ensure that flood risk is minimised and mitigated, and that residual risk is addressed"*. It also requires that Development Plans and development proposals should contribute to the delivery of the measures set out in the Thames Estuary 2100 Plan and states that "*Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Where possible, development proposals should set permanent built development back from flood defences to allow for any foreseeable future upgrades*".

12.2.50 Policy SI13 regarding sustainable drainage states that '*Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible*' and sets out a hierarchy of measures for managing surface water run-off.

Draft London Environment Strategy

12.2.51 Published for consultation in August 2017, the strategy sets out a vision for London's environment in 2050 and a number of objectives, policies and proposals in respect of adapting to climate change. These include reducing the risk of flooding, ensuring London maintains its standard of protection from the increasing risk of tidal flooding and promoting sustainable drainage systems.

Local Planning Policy

London Borough of Bexley Core Strategy

12.2.52 The Core Strategy (adopted 2012) sets out the vision, objectives, spatial planning framework and overarching policies to guide development through to 2026.

12.2.53 Policy CS03 sets out the vision for the Belvedere geographic region and requires that new development mitigates against all types of flood risk, through flood resilience and resistance.

12.2.54 Policy CS08 addresses climate change and flood risk management and requires application of the sequential approach to flood risk management advocated in national planning policy and application of the recommendations set out in the London Borough of Bexley's (LBB) Strategic Flood Risk Assessment.

Bexley Growth Strategy

12.2.55 The Strategy was adopted in 2017 and sets out how the Council proposes to manage housing and economic growth and its associated supporting infrastructure. It sets out design principles and a strategy for growth in Bexley and the vision includes an objective "…*to take account of, adapt to, and mitigate the impacts of climate change and flood risk*...".

Dartford Borough Council Core Strategy

12.2.56 The Core Strategy (adopted 2011) sets out the vision, objectives, spatial planning framework and over-arching policies to guide development through to 2026. The Core Strategy is supported by the Development Policies Plan (adopted 2017).

12.2.57 Policy CS24 of the Core Strategy addresses flood risk and requires that the Sequential Test and Exception Tests are applied and that the SuDS management train is applied as part of new development proposals.

12.2.58 Policy CS25 addresses water supply, water quality and wastewater management and requires that all non-residential developments of 1,000 m^2 and above meet the BREEAM 'excellent' standards of water efficiency.

Dartford Borough Council Development Policies Plan

12.2.59 Policy DP2 in the Development Polices Plan (adopted 2017) requires "*early consideration should be given to the achievement of on-site flood alleviation*".

12.2.60 Policy DP11 requires that "*Development should be well located, innovatively and sensitively designed and constructed, to tackle climate change and minimise flood risk…*".

Kent Minerals and Waste Local Plan

12.2.61 The Kent Minerals and Waste Local Plan (adopted 2016) sets out the overarching strategy, objectives and planning policies for mineral extraction and the management of all waste streams generated or managed in Kent for the period from 2013 to 2030.

12.2.62 Policy CSW 6 regarding the location of built waste management facilities requires that proposals avoid Groundwater Source Protection Zone 1 and Flood Zone 3b.

12.2.63 Policy DM 1 regarding sustainable design requires that proposals incorporate measures for water recycling and utilise sustainable drainage systems wherever practicable.

12.2.64 Policy DM 10 regarding the water environment states that planning permission will be granted where waste development does not (i) result in the deterioration of any water resource and water body, (ii) have an unacceptable impact upon groundwater Source Protection Zones and (iii) exacerbate flood risk in areas prone to flooding and elsewhere.

12.3 Consultation

12.3.1 The following stakeholders have been consulted to acquire local/site-specific information on hydrology, flood risk and water resources, to assist with characterising the baseline water environment and to agree the methodology for the technical assessments/analysis required to inform the Environmental Impact Assessment (EIA) process:

- Environment Agency;
- London Borough of Bexley (as Lead Local Flood Authority);
- Dartford Borough Council (DBC); and
- Kent County Council (KCC) (as Lead Local Flood Authority).

12.3.2 The Applicant and PBA met with representatives from the Environment Agency in February 2018 to introduce REP, identify the principal issues requiring consideration/assessment from a hydrology, flood risk and water resources perspective and to define the broad scope of work to be undertaken in support of the EIA process.

Table 12.1 Summary of Consultee Comments

Reference	Comment	Response
SoS Scoping Opinion		
Section 4.9 – ID 1	The Inspectorate agrees that given the location and operational nature of the electrical connection, significant effects during operation are unlikely and this can be scoped out of the ES	Noted. The ES will be prepared accordingly.
Section 4.9 – ID 2	The Inspectorate requires that the source and quantity of all water required for the proposed development is identified within the ES. Similarly, the location of discharge points and the quantity and composition of the discharge must be detailed.	See response to 4.9.3 below.
Section 4.9 – ID 3	A draft version of the surface water strategy should be provided with the ES.	Details regarding proposals for surface water management will be set out in the Flood Risk Assessment that will form an appendix to the ES.
Section 4.9 – ID 4	The Applicant should consider the flood risk implications of the construction of the electrical connection within the ES.	The nature of flood risk impacts will be addressed within the Flood Risk Assessment.
Section 4.9 – ID 5	Impacts of climate change upon flood levels and surface water	The potential impacts of climate change will be

Reference	Comment	Response
	run-off should be considered. This should include the anticipated UKCP18 projections where appropriate.	addressed within the Flood Risk Assessment in accordance with guidance provided by the Environment Agency and Lead Local Flood Authority.
Section 4.9 – ID 6	The ES should include appropriate cross-referencing between the Ground Conditions and Hydrology, Flood Risk and Water Resources chapters.	Noted. Cross-referencing will be made as appropriate in respect of flood risk and water quality matters.
Section 4.9 – ID 7	The ES should assess the potential impacts of the Proposed Development on the existing flood defences, in particular any effects resulting from changes to the hydrodynamic and sedimentary regime from the temporary marine infrastructure.	As a result of design evolution, temporary works within the marine environment are no longer required. Consideration of potential effects upon the marine environment has therefore been scoped out of the ES (as agreed with the Port of London Authority). It is not anticipated that the Proposed Development will affect the existing flood defences. This is discussed in **Section 12.8.6** below.
Section 4.9 – ID 8	The study area should be described and justified within the ES.	The study area is identified in **Section 12.5**.
Section 4.9 – ID 9	The assessment should take into account emissions to air from the Proposed Development and the potential implications of deposition on the quality of watercourses.	The Applicant has consulted the Environment Agency (February 2018) and the Agency noted that emissions to air will be regulated in accordance with the Environmental Permitting Regulations. It has therefore been agreed that the impact of emissions upon water quality does not need to be assessed as part of the ES.
The Environment Agency		
Flood Risk	Any new development at this location is to have finished floor levels set no lower than the breach flood event at this site.	Noted. Design of the infrastructure is being prepared on this basis and details regarding breach flood levels and finished floor levels (FFL) will be set out in the Flood Risk Assessment.
Thames Tidal Flood Defences	The condition grade of the flood defence is currently 'fair' with some sections 'poor', as such a flood defence condition survey will be necessary to identify remedial works required to	Noted. A flood defence condition survey will be undertaken and details incorporated within the Flood Risk Assessment.

Reference	Comment	Response
	improve the condition of the flood defence.	
Thames Tidal Flood Defences	Development should be set back from the defences to allow for maintenance, emergency access and to allow for the defences to be raised in the future.	Noted. Design of the infrastructure is being prepared on this basis.
Thames Tidal Flood Defences	It will need to be demonstrated that the flood defence can be raised in line with the Thames Estuary 2100 Plan levels.	Noted. Details will be set out in the Flood Risk Assessment.
Thames Tidal Flood Defences	Due to the level of flood risk that the site faces and the proximity to the tidal flood defence, flood risk should be scoped into the EIA.	Noted. A Flood Risk Assessment is currently being prepared and will form an appendix to the ES.
Water Quality and the Water Framework Directive	The EA agreed that the 'Clearing the Waters for All' methodology should be used for the purposes of WFD Assessment.	Noted. The WFD compliance assessment will be prepared accordingly.
Water Quality and the Water Framework Directive	The EA agreed that scoping out shellfish and bathing waters from water quality assessment is appropriate.	Noted. The ES is being prepared accordingly.
Letter dated 11th April 2018	No development should be located over the defences with all new development including temporary structures being set back from the defences.	Noted. Design of the infrastructure is being prepared on this basis.
Letter dated 11th April 2018	A flood defence condition survey would have to be undertaken and remedial works identified carried out to improve the flood defences.	Noted. A flood defence condition survey will be undertaken and details incorporated within the Flood Risk Assessment.
Letter dated 11th April 2018	We are satisfied that emissions impacts to water quality will not need to form part of the WFD assessment as the potential emissions should be regulated to an acceptable level under the EPR.	Noted. Consideration of the impact of pollutant drop out upon the water and sediment environments is therefore scoped out of the ES.
Kent County Council		
Letter dated 21st December 2017, 7.10 Hydrology, Flood Risk and Water Resources	Notes that KCC should be consulted as Lead Local Flood Authority (for Dartford Borough)	KCC will be consulted as part of preparation of the Flood Risk Assessment.
Letter dated 21st December 2017, 7.10 Hydrology, Flood Risk and Water Resources	Consideration should be given to the Dartford Surface Water Management Plan, Stage 2 (November 2016)	Noted. Will be considered as part of the Flood Risk Assessment.

Reference	Comment	Response
Letter dated 21st December 2017, 7.10 Hydrology, Flood Risk and Water Resources	Reference should be made to the KCC Drainage and Planning Policy Statement (June 2017)	Noted. Will be considered as part of the Flood Risk Assessment.
London Borough of Bexley		
Letter dated 21st December 2017	Recommended that the EIA deals with flood risk assessment and that a SuDS hierarchy is brought forward for surface water run-off.	A Flood Risk Assessment is currently being prepared and will form an appendix to the ES. Details regarding proposals for surface water management will be set out in the Flood Risk Assessment.

12.4 Parameters Used for Assessment

12.4.1 The potential construction, operation and decommissioning effects of the Proposed Development have been considered on a reasonable worst-case basis.

12.4.2 In respect of hydrology, flood risk and water resources, the reasonable worst-case scenario for the Proposed Development relates to that associated with the maximum parameters of the Main REP Building envelope. The reason this represents the reasonable worst-case assessment scenario for hydrology, flood risk and water resources is that the largest building footprint will result in the greatest impermeable area and therefore the greatest impacts upon the surface water drainage regime.

12.5 Assessment Methodology and Significance Criteria

Study Area

12.5.1 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 12.1, Appendix H.1**, 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 the EA and LLFAs.

Baseline Data Collection

12.5.2 Existing studies/documents, including evidence base studies undertaken in support of the preparation of the LBB Core Strategy, the emerging LBB Local Plan and the DBC Core Strategy (e.g. Strategic Flood Risk Assessment and Preliminary Flood Risk Assessment), have been reviewed. In addition, the following sources of information have been used to assist with characterising the baseline water environment:

- https://flood-map-for-planning.service.gov.uk/
- https://flood-warning-information.service.gov.uk/long-term-flood-risk/
- http://maps.environment-agency.gov.uk/wiyby
- http://www.natureonthemap.naturalengland.org.uk/MagicMap.aspx
- http://environment.data.gov.uk/catchment-planning

12.5.3 As set out in **Section 12.3** above, the EA, LBB and KCC have been consulted to acquire local/site-specific information on hydrology, flood risk and water resources, to assist with characterising the baseline water environment and to agree the methodology for the technical assessments/analysis required to inform the EIA process. The EA provided 'Product 4' flood risk data, which includes flood zone maps, historic flood outlines and details regarding the location/alignment of flood defences.

12.5.4 A walkover survey has been undertaken (May 2018) to facilitate an understanding of the baseline water environment and the general landform of the REP site and surrounding area and to define the scope/specifications of technical assessments/surveys. This survey included the Electrical Connection route options to inform this assessment of potential construction phase effects.

12.5.5 A topographic survey was completed in February 2018 and this data confirms the crest level of tidal flood defences and the general landform of the REP site and surrounding area.

Assessment

12.5.6 In the absence of 'industry standard' significance criteria for the consideration of hydrology, flood risk and water resources impacts, a qualitative approach, based upon available knowledge, experience and professional judgement, is employed.

12.5.7 The EIA 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 can be established. Where significant negative effects are identified, mitigation measures can be proposed to reduce the significance.

12.5.8 The preliminary findings presented within this PEIR are based on a high level assessment of the significance of effects, and an assessment of receptor sensitivity and magnitude of impact has not been made at this early stage pending further analysis/appraisal. The preliminary findings are identified in **Section 12.8** below.

12.5.9 **Table 12.2** outlines the criteria used to determine receptor sensitivity, which as discussed in paragraph 12.5.6 is based on available knowledge and professional judgement.

Table 12.2 Sensitivity/Value of Receptor

Sensitivity/value of a Receptor	Description	Example
High	Attribute with a high quality and rarity, local scale and limited potential for substitution. Attribute with a medium quality and rarity, regional or national scale and limited potential for substitution. Attribute highly sensitive to change.	Examples include: Receiving watercourse classified as High or Good Ecological status/potential under WFD Site protected under EU or UK wildlife legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI)). Species protected under EU or UK wildlife legislation Site located within a Groundwater Source Protection Zone (SPZ) inner or outer protection zone (Zone 1), NPPF Flood Risk Vulnerability Classification "Essential Infrastructure" or "Highly Vulnerable" Environment Agency current groundwater quantitative and chemical qualities defined as Good Human receptors (construction workers and future residents)
Medium	Attribute with a medium quality and rarity, local scale and limited potential for substitution. Attribute reasonably tolerant of change.	Examples include: Floodplain providing a moderate volume of storage Receiving watercourse classified as Good or Moderate Ecological status/potential under WFD NPPF Flood Risk Vulnerability Classification "More Vulnerable"
Low	Attribute with a low quality and rarity, local scale and limited potential for substitution. Attribute tolerant of modest change.	Examples include: Environment Agency current river ecological quality defined as Poor / Bad and chemical quality defined as Fail Floodplain with limited existing development. Receiving watercourse classified as Poor Ecological status/potential under WFD NPPF Flood Risk Vulnerability Classification "Less Vulnerable"

Negligible	Attribute of very limited quality and tolerant of substantial change.	Examples include: Floodplain essentially rural in nature, characterised by agricultural land use NPPF Flood Risk Vulnerability Classification "Water Compatible"

12.5.10 The magnitude of change arising as a result of the Proposed Development has been assessed using the criteria set out in **Table 12.3.**

Table 12.3: Magnitude of impact

Magnitude of Impact	Description	Example
Large	Results in a loss of attribute and/or quality and integrity of the attribute. Following development, the baseline situation is fundamentally changed.	Examples include: Change in ecological and/or chemical qualities of the surface water. Loss of flood storage/increased flood risk. Large change in: ■ water quality of receiving watercourse; ■ NPPF Flood Risk Vulnerability Classification; ■ surface water flood risk; ■ fluvial flood risk; ■ water supply volume; and ■ foul drainage volume.
Moderate	Results in impact on integrity of attribute, or loss of part of attribute. Following development, the baseline situation is noticeably changed.	Examples include: Contribution of a significant proportion of the effluent in the receiving river, but insufficient to change its qualities. Moderate change in: ■ water quality of receiving watercourse; ■ NPPF Flood Risk Vulnerability Classification; ■ surface water flood risk; ■ fluvial flood risk; ■ water supply volume; and ■ foul drainage volume.
Small	Results in some measurable change in attribute's quality or vulnerability. Following development, the baseline situation is largely unchanged with barely discernible differences.	Examples include: Measurable changes in attribute, but of limited extent/duration. Small change in: ■ water quality of receiving watercourse; ■ NPPF Flood Risk Vulnerability Classification; ■ surface water flood risk; ■ fluvial flood risk; ■ water supply volume; and ■ foul drainage volume.
Negligible	The impacts are unlikely to be detectable or	

Magnitude of Impact	Description	Example
	outside the norms of natural variation.	

12.5.11 The significance of an effect is derived based upon the sensitivity of the receptor and the magnitude of the impact using the matrix presented at **Table 12.4.** The significance of an effect can be beneficial, neutral or adverse.

Table 12.4: Determining Significance of Effect

		Sensitivity of Receptor			
		High	**Medium**	**Low**	**Negligible**
Magnitude of Impact	**Large**	Substantial	Major	Moderate	Minor
	Moderate	Major	Moderate	Minor	Negligible
	Small	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

12.5.12 For the purpose of undertaking the assessment in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the Infrastructure EIA Regulations 2017), effects determined to be moderate or greater are considered significant in EIA terms.

12.5.13 The significance criteria used for the purposes of this chapter are set out in **Table 12.5.**

Table 12.5: Hydrology, Flood Risk and Water Resources Significance Criteria

Significance Level	Significance Level Criteria	Typical Examples
Substantial Beneficial	Substantial improvements at catchment scale associated with sites and features of national or regional importance	Fundamental changes to the regional hydrological regime. Fundamental reduction in volume and/or peak discharge of surface water runoff from the Site. Fundamental improvement in surface water quality. Fundamental changes to flow conveyance and floodplain storage.
Major Beneficial	Major improvements at catchment scale	Fundamental changes to the regional hydrological regime. Fundamental reduction in volume and/or peak discharge of surface water runoff from the Site.

Significance Level	Significance Level Criteria	Typical Examples
		Fundamental improvement in surface water quality. Fundamental changes to flow conveyance and floodplain storage.
Moderate Beneficial	Improvements at local scale	Moderate changes to the local hydrological regime. Moderate reduction in volume and/or peak discharge of surface water runoff from the Site. Moderate improvement in surface water quality. Moderate changes to flow conveyance and floodplain storage.
Minor Beneficial	Limited improvements at local scale	Some noticeable changes to the local hydrological regime. Some noticeable reduction in volume and/or peak discharge of surface water runoff from the Site. Some noticeable improvement in surface water quality. Some noticeable changes to flow conveyance and floodplain storage.
Negligible	No appreciable impact	No noticeable changes to the local hydrological regime. No noticeable change in volume and/or peak discharge of surface water runoff from the Site. No noticeable changes in surface water quality. No noticeable changes to flow conveyance and floodplain storage.
Minor Adverse	Limited detrimental effects at local scale	Some noticeable changes to the local hydrological regime. Some noticeable increase in volume and/or peak discharge of surface water runoff from the Site. Some noticeable deterioration in surface water quality. Some noticeable changes to flow conveyance and floodplain storage.
Moderate Adverse	Detrimental effects at local scale	Moderate changes to the local hydrological regime. Moderate increase in volume and/or peak discharge of surface water runoff from the Site. Moderate deterioration in surface water quality.

Significance Level	Significance Level Criteria	Typical Examples
		Moderate changes to flow conveyance and floodplain storage
Major Adverse	Important detrimental effects at catchment scale which may become key factors in the decision-making process	Fundamental changes to the regional hydrological regime. Pollution of potable sources of water abstraction. Fundamental increase in volume and/or peak discharge of surface water runoff from the Site. Fundamental deterioration in surface water quality. Fundamental changes to flow conveyance and floodplain storage.
Substantial Adverse	Substantial detrimental effects at catchment scale associated with sites and features of national or regional importance	Fundamental changes to the regional hydrological regime. Pollution of potable sources of water abstraction. Fundamental increase in volume and/or peak discharge of surface water runoff from the Site. Fundamental deterioration in surface water quality. Fundamental changes to flow conveyance and floodplain storage.

Limitations

12.5.14 As noted above, the EA provided 'Product 4' flood risk data, including flood levels derived through hydraulic modelling analysis. Although the hydraulic model has been calibrated using observed/recorded data, there is a degree of uncertainty associated with the flood levels. However, the modelling has been undertaken using industry-standard methods and the EA considers the data to be sufficiently robust to inform the Flood Risk Assessment and EIA process.

12.5.15 The Applicant is aware that new River Thames flood breach modelling is available. This data has been requested, and will be used to inform the Flood Risk Assessment which will support the ES.

12.6 Baseline Conditions and Receptors

12.6.1 This assessment is concerned with the (i) REP site which includes the site of permanent works in the area adjacent to Riverside Resource Recovery Facility north of Norman Road, (ii) the Main Temporary Construction Compounds and (iii) the construction of the Electrical Connection.

12.6.2 The REP site is currently used predominantly as an ancillary area for RRRF. Uses include ash container storage, compounds for operational plant maintenance activities, a non-designated Wasteland Habitat Area, circulation roads and car-parking. The REP site therefore comprises both permeable and impermeable surfaces and surface water run-off generally infiltrates into the ground or is routed to the watercourses located to the south and west.

12.6.3 The principal watercourse in the area is the River Thames which is tidally influenced along the reach adjacent to the REP site. The REP site is located on the south bank of the River Thames and occupies a river frontage position, being set back approximately 20 m from The Thames Path and the tidal flood defences.

12.6.4 According to topographic survey undertaken by Maltby Surveys Limited in February 2018, levels across the REP site generally vary between 1 m Above Ordnance Datum (AOD) along the southern boundary and 3 m AOD along the northern boundary adjacent to the toe of the flood defence embankment. The defence embankment rises to a level of approximately 6 m AOD and the Thames Path and River Thames tidal flood defence wall are located on the crest of the embankment.

12.6.5 The River Thames tidal defences comprise a wall of c. 1 m height and, according to the topographic survey, the crest level of the defence wall immediately to the north of the REP site is 7.05 m AOD. According to detailed flood risk information (known as 'Product 4') provided by the EA to the Applicant by way of email in March 2018, the defences currently offer a 1 in 1,000 year standard of protection and, following a visual inspection/condition survey undertaken in 2017, the defences have been assigned a condition grade of 'fair', with a localised section to the east of the RRRF categorised as 'poor'. A further flood defence condition survey is being undertaken, the scope of which has been defined through consultation with the EA.

12.6.6 Crossness Sewage Treatment Works is located approximately 200 m to the west of the REP site and the area to the east is characterised by warehousing and distribution. Crossness Nature Reserve, owned and managed by Thames Water, is located adjacent to both the REP site and the Offsite Temporary Construction Compounds. The reserve extends across approximately 25 ha and forms part of the Erith Marshes Site of Metropolitan Importance for Nature Conservation. The reserve is characterised by a number of surface water features, including the Great Breach Dyke, which is classified as Main River (under the jurisdiction of the Environment Agency) and receives surface water run-off from the Abbey Wood area to the south. Water levels in the dyke system are controlled by the Great Breach Pumping Station which is located just beyond the south-western corner of the REP site. A further drain/ditch is located immediately to the east of Norman Road and receives surface water run-off from a relatively localised catchment to the east of the REP site comprising warehousing and distribution uses.

12.6.7 The Electrical Connection route extends to the south-east of the REP site along the A2016 (Bronze Age Way) and subsequently the A206. It crosses over the River Cray and the River Darent approximately 3 kilometres (km) and 2 km to the west of the connection point at the Littlebrook substation respectively.

12.6.8 The connection point at Littlebrook substation is located approximately 10.5 km to the south-east of the REP site within the Borough of Dartford. The existing substation is set back approximately 500 m from the tidal flood defences which, according to data provided by the Environment Agency in February 2018, comprise an embankment with a crest level of 6.74 m AOD. The principal surface water features in the vicinity of the Littlebrook substation are the water bodies forming Littlebrook Nature Park, located approximately 300 m to the west of the substation.

Flood Map for Planning

12.6.9 The EA publishes floodplain maps on the internet (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).

12.6.10 The flood map indicates that the REP site is located within Flood Zone 3 (High Probability – land having a 1 in 200 or greater annual probability of sea flooding). However, the flood map also indicates that the REP site falls within an area that benefits from flood defences. In this instance, the standard of protection afforded by the defences is 1 in 1,000 years.

12.6.11 The north-western (between the REP site and Erith) and south-eastern (between Barns Cray and Littlebrook substation) parts of the Electrical Connection Route, together with the Electrical Connection Point at Littlebrook substation, are also shown to lie within Flood Zone 3. The central part of the Electrical Connection Route lies within Flood Zone 1 (Low Probability – land having less than a 1 in 1,000 annual probability of river or sea flooding).

Surface Water Flood Risk

12.6.12 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 map highlights a number of corridors within and adjacent to the REP site, along the Electrical Connection route and at the Electrical Connection Point at Littlebrook substation 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).

12.6.13 Flood risk associated with the surface water drainage system serving the Thamesmead, Abbeywood and Belvedere areas, and comprising piped drainage, ditches, drains and dykes, has been assessed as part of '*The Erith Marshes Ditches and Dykes Modelling Study*' (Phase 1, 2009 and Phase 2, 2010), undertaken on behalf of the London Borough of Bexley.

12.6.14 The study identified a number of locations where capacity constraints were likely to give rise to localised flooding, these generally being associated with the point at which the piped drainage network serving the urban area outfalls to the system of ditches and dykes. However, these locations are over 1 km to the south of the REP site, such that it is unaffected by such flooding mechanisms.

Reservoir Flood Risk

12.6.15 The Environment Agency provides maps showing the area that may be affected by flooding as a result of the breach of a large, raised reservoir (i.e. capable of storing over 25,000 m^3 of water above the natural level of any part of the surrounding land).

12.6.16 According to EA records there are no reservoirs located within close proximity to the REP site. The nearest reservoir is located approximately 4 km to the south of the REP site, in the Northumberland Heath area. The area shown at risk of flooding following a breach of the reservoir extends to the east, crossing the Electrical Connection route and passing through the Slade Green area.

Groundwater

12.6.17 According to the British Geological Survey 1:50,000 scale maps, the solid geology of the area generally consists of Alluvium overlying River Terrace Gravel and London Clay. Significant and highly varying thicknesses of made ground are also expected to overlie the natural strata across the majority of the Application Site.

12.6.18 Previous ground investigations (detailed within the report titled '*Riverside Energy Park, Belvedere – Phase 1 Ground Condition Assessment (April 2018)*' prepared by Peter Brett Associates) noted groundwater strikes at the top of the River Terrace Gravels (7-13 m depth) and recorded tidal variation in standing water levels. These ground investigations also recorded perched water within the made ground.

12.6.19 It is anticipated that groundwater flow across the REP site will be to the north and north-east, towards the River Thames. A programme of groundwater monitoring is to be undertaken and observations will be documented in the ES.

12.6.20 DEFRA publishes indicative Groundwater Source Protection Zones (SPZ's) for 2,000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. The zones define areas where a range of human activities may damage/pollute groundwater. The maps show three main zones (inner, outer and total catchment) and a fourth zone of special interest. Examination of the mapping shows that the REP site is not located within a SPZ. However, the Electrical Connection route passes through zones 1 (inner), 2 (outer) and 3 (total catchment), these zones being associated with groundwater abstractions in Crayford and Dartford.

Water Quality

12.6.21 A programme of groundwater and surface water quality monitoring is to be undertaken and the findings/observations documented in the ES.

Water Framework Directive

12.6.22 The REP site falls within the area administered by the Thames River Basin Management Plan (RBMP) and the relevant management catchments are the Thames Transitional and Coastal (TraC) Management Catchment and Thames Groundwater Management Catchment.

12.6.23 The principal water bodies within the vicinity of the REP site are as follows:

- Thames Middle transitional water body (water body ID GB530603911402) within the Tidal Thames Operational Catchment;
- Greenwich Tertiaries and Chalk groundwater body (water body ID GB40602G602500);
- South Essex Thurrock Chalk groundwater body (water body ID GB40601G401100); and
- West Kent Darent and Cray Chalk groundwater body (water body ID GB40601G501800).

12.6.24 According to the Thames RBMP (December 2015), there are three priority issues within the Thames Tidal operational catchment:

- The water (including habitat enhancement, water quality, and flood risk);
- The human element (education, access and public awareness); and
- Planning and economic development (including river traffic, commerce, fishing and riverside redevelopment).

12.6.25 The Thames Middle water body is designated as a heavily modified water body (HMWB). This denotes that it has been substantially changed in character as a result of physical alterations by human activity, such that it cannot achieve good ecological status. The environmental objective for the water body is therefore to achieve good ecological potential. The overall water body classification is currently 'Moderate' potential (Cycle 2, 2016), with 'Moderate' ecological potential, and 'Fail' chemical potential.

12.6.26 The 'Moderate' ecological potential is driven by the failures of Angiosperms, Dissolved Inorganic Nitrogen, Dissolved Oxygen, Zinc and Mitigation Measures Assessment. The reasons for these elements not achieving 'Good' potential are noted to include physical modification due to land drainage and flood and coastal protection and discharge from sewage treatment works.

12.6.27 The 'Fail' chemical potential is driven by the failure of the tributyltin compounds element. The reasons for not achieving 'Good' potential for this element include contaminated water body bed sediments, contaminated land, landfill leaching and discharge from sewage treatment works. According to data presented in the Environment Agency's Catchment Data Explorer (http://environment.data.gov.uk/catchment-planning/), the chemical status of the water body has improved for some elements between Cycle 1 (2009) and Cycle 2 (2016).

12.6.28 The overall water body WFD objective was to achieve 'Moderate' potential by 2015, therefore it is currently achieving its overall objective under the WFD.

12.6.29 The Greenwich Tertiaries and Chalk groundwater body is currently (Cycle 2, 2016) classified as 'Poor' status, driven by the poor status of both the Quantitative Status element (saline intrusion and water balance) and the Chemical Status element (saline intrusion). The reasons for not achieving 'Good' status include groundwater abstraction, natural conditions and saline or other intrusion.

12.6.30 The WFD objective for this groundwater body was to achieve 'Poor' by 2015, therefore the Greenwich Tertiaries and Chalk groundwater body is currently achieving its objectives under the WFD.

12.6.31 The West Kent Darent and Cray Chalk groundwater body is currently (Cycle 2, 2016) classified as 'Poor' status, driven by the Quantitative Status element (quantitative dependent surface water body status and quantitative water balance) and the Chemical Status element (chemical drinking water protected area and general chemical test elements). The reasons for not achieving 'Good' status include groundwater abstraction and surface water abstraction.

12.6.32 The WFD objective for this groundwater body is to achieve 'Poor' status by 2015, therefore the West Kent Darent and Cray Chalk groundwater body is currently achieving its objectives under the WFD.

12.6.33 The South Essex Thurrock Chalk groundwater body is currently (Cycle 2, 2016) classified as 'Good' status. The groundwater body is therefore currently achieving its objectives under the WFD.

12.6.34 The principal receptors that may be potentially affected by the Proposed Development are:

- The River Thames;
- The River Thames tidal flood defences;
- The Great Breach Dyke and associated drains/tributaries;
- Thames groundwater bodies;
- Crossness Nature Reserve;
- Future employees/operational staff; and
- Existing development/infrastructure/third party assets/land in the vicinity and downstream of the Proposed Development.

Baseline Evolution

12.6.35 The land-use balance across the REP site is unlikely to change in the absence of the Proposed Development and, on this basis, the hydrological regime is unlikely to change.

12.6.36 However, the 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 tidal flood defences would increase.

12.6.37 As noted above, a programme of groundwater and surface water quality monitoring is to be undertaken as part of the EIA process. The findings/observations will provide the basis for consideration of the evolution of the baseline in the absence of the Proposed Development.

12.7 Embedded Mitigation

12.7.1 The design philosophy that underpins the Proposed Development includes measures to prevent, reduce and offset significant adverse effects upon hydrology, flood risk and water resources. Being 'built-in' to the proposals from the outset, the assessment of the significance of effects includes consideration of these embedded mitigation measures. It is currently anticipated that the measures likely to be included in the FRA (which will be prepared to support the ES) will include:

- Surface water management infrastructure designed in accordance with CIRIA C753 and guidance set out by the Lead Local Flood Authority such that the surface water run-off regime replicates that existing prior to development;
- Implementation of SuDS 'treatment train' principles as set out in CIRIA C753 to provide pollution control;
- Setting finished levels of power generation and ancillary infrastructure above flood levels associated with a breach of the River Thames tidal flood defences; and
- Designing to accommodate the predicted impacts of climate change.

12.7.2 The REP DCO application will be accompanied by an outline Code of Construction Practice (CoCP). It is currently anticipated that mitigation measures in respect of impacts on hydrology, flood risk and water resources during the construction phase will therefore be secured through implementation of the measures set out in this document. Precise details regarding the mechanisms employed to secure mitigation are subject to further stakeholder consultation and will be set out in the ES.

12.7.3 In addition to the anticipated measures embedded within the design process and provisions to be set out within the outline CoCP, development activities and associated effects are also controlled through ensuring legislative compliance and applying industry standard/best practice. (i.e. ensuring that the proposals do not increase flood risk elsewhere, thereby complying with the requirements of the NPPF).

12.8 Assessment of Likely Effects

12.8.1 This section describes the preliminary findings of the assessment of potential effects of the Proposed Development upon hydrology, flood risk and water resources during the construction, decommissioning and operational phases. As noted in **Section 12.5** above, a full assessment of receptor sensitivity and magnitude of impact has not been made at this early stage pending further analysis/appraisal. The preliminary findings of the assessment are therefore presented below.

12.8.2 As noted above, the Proposed Development includes a number of embedded mitigation measures and these are taken into account as part of the assessment of significance of effects.

The REP Site and Main Temporary Construction Compounds

Construction and Decommissioning

12.8.3 Development works, including earthworks operations, have the potential to impact upon the surface water drainage regime which, in turn, may impact upon sensitive locations in the vicinity of the REP site and the Main Temporary Construction Compounds.

12.8.4 Construction activities at the REP site and the Main Temporary Construction Compounds will include the clearance of vegetation, topsoil stripping and stockpiling, establishment of compound areas, excavation and site levelling/re-profiling to create development platforms, preparation of site roads and construction of foundations (including piled 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 REP site and the Main Temporary Construction Compounds and potentially into nearby watercourses. However, such effects would be localised and temporary and controlled using measures anticipated to be set out within the outline CoCP. Amongst other measures, the outline CoCP may include the provision of temporary measures to intercept and control surface water run-off from worked areas. As a result of the implementation of such measures, it is anticipated that the effects of construction activities at the REP site and the Main Temporary Construction Compounds upon surface water drainage would be **Negligible** and therefore Not Significant.

12.8.5 Construction activities also have the potential to give rise to the contamination of surface water and groundwater 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 nearby watercourses. However, such effects would be localised and temporary and controlled using measures set out within the outline CoCP. Amongst other measures, the outline CoCP may include the provision of temporary measures such as routing surface water to sumps/silt traps prior to discharge to receiving waters. As a result of the implementation of such measures, the effects of construction activities at the REP site and the Main Temporary Construction Compounds upon water quality would be **Negligible** and therefore Not Significant.

12.8.6 Construction works in close proximity to the River Thames tidal flood defences have the potential to affect the stability of the embankment and therefore the structural integrity of the defences. Consultation with the EA regarding interaction between the Proposed Development and the flood defences is ongoing and details regarding design principles and the EA's requirements will be set out in the FRA. However, it is anticipated that the implementation of measures included in the outline CoCP (anticipated to be submitted as part of the REP DCO application) and other measures which may be required by conditions imposed by the relevant authority upon approvals for works in close proximity to flood defences will control the potential impacts of construction works, such that the effects of construction activities at the REP site and the Main Temporary Construction Compounds would be **Negligible** and therefore Not Significant.

12.8.7 At the end of its operational life, the decommissioning of REP is considered to have similar effects upon the environment as those during the construction stage and, therefore, similar measures to reduce effects are likely to be proposed.

Operation

12.8.8 REP will give rise to an increase in the impermeable area within the catchment of the Great Breach Dyke which, in the absence of mitigation, has the potential to increase surface water run-off to the dyke and associated drains/tributaries. This has the potential to increase flood risk to existing development/infrastructure/third party assets/land in the vicinity and downstream

of the REP site. However, such effects will be controlled by the embedded mitigation measures outlined above, specifically, a surface water management strategy that limits surface water outflows from the REP site to existing greenfield rates, thereby replicating the existing/prior to development surface water run-off regime. Details of the surface water management strategy will be set out in the Flood Risk Assessment supporting the REP DCO application. As a result of embedded mitigation measures, the effects of REP upon the surface water run-off regime during operation will be **Negligible** and therefore Not Significant.

12.8.9 There is the potential for the contamination of surface water entering the Great Breach Dyke and associated drains/tributaries, resulting from the flushing of silts and hydrocarbons from areas of hardstanding within the REP site. However, such effects will be controlled by the embedded mitigation measures outlined above, such that the effects of REP upon water quality during operation will be **Negligible** and therefore Not Significant.

12.8.10 There is the potential for emissions from REP to give rise to the drop out of organic pollutants and chemical compounds to the water and sediment environments. The EA was consulted in February 2018 and the EA noted that emissions to air will be regulated to an acceptable level as part of the Environmental Permitting process. On this basis, it was agreed that consideration of the impact of pollutant drop out upon the water and sediment environments may be scoped out of the Environmental Statement.

The Electrical Connection and the Cable Route Temporary Construction Compounds

Construction and Decommissioning

12.8.11 REP would require a new Electrical Connection (underground) to export power to the electricity distribution network. Construction activities associated with installation of the underground cable have the potential to impact upon surface water drainage and water quality as a result of earthworks operations and excavation of the cable trench. However, such effects would be localised and temporary and controlled using measures set out within the outline CoCP. As a result, the effects upon surface water drainage and water quality during construction of the Electrical Connection would be **Negligible** and therefore Not Significant.

12.8.12 At the end of its operational life, it is currently anticipated that the ducting for the Electrical Connection will be left in situ, such that there will be no decommissioning works and therefore no effects upon hydrology, flood risk and water resources.

Operation

12.8.13 As noted above, the Electrical Connection comprises an underground cable. During the operational phase, it will not therefore give rise to impacts upon hydrology, flood risk and water resources. As confirmed in the Scoping Opinion (see **Appendix A.2**) dated January 2018, consideration of operational impacts associated with the underground Electrical Connection is scoped out of the assessment.

Summary of Assessment

Construction and Decommissioning

12.8.14 Based upon this assessment of the potential effects of construction and decommissioning activities at the REP site and Main Temporary Construction Compounds and the Electrical Connection and Cable Route Temporary Construction Compounds upon hydrology, flood risk and water resources, it is concluded that effects are likely to be localised and temporary and controlled by embedded mitigation measures. On this basis, the preliminary conclusion is that the effects would be **Negligible** and therefore Not Significant.

Operation

12.8.15 As noted above, the Electrical Connection comprises an underground cable. During the operational phase, it will not therefore give rise to impacts upon hydrology, flood risk and water resources.

12.8.16 Based upon this assessment of the potential effects of REP upon hydrology, flood risk and water resources during the operational phase, it is concluded that effects are likely to be controlled by embedded mitigation measures. On this basis, the preliminary conclusion is that the effects would be **Negligible** and therefore Not Significant.

12.9 Cumulative Assessment

Construction/Decommissioning

12.9.1 Construction and decommissioning of REP could occur simultaneously with other projects located in the vicinity of the Application Site. The 'other developments' with the most potential for simultaneous construction effects are identified in **Chapter 4**. Significant adverse cumulative construction effects are not anticipated to be likely. However, further detailed assessment is being undertaken, the results of which will be detailed within the ES.

12.9.2 It is assumed for the purposes of this assessment that the REP generating equipment would be removed once the plant had ceased operations permanently. Any decommissioning phase is assumed to be of a similar or shorter duration to construction, and therefore environmental effects are considered to be of a similar level to those during the construction phase. It is assumed that the ducting for the Electrical Connection would remain in situ, but that the cables may be removed.

Operation

12.9.3 The operation of REP could occur simultaneously with other projects located in the vicinity of the Application Site. The 'other developments' with the most potential for simultaneous operational effects are identified in **Chapter 4**. Significant adverse cumulative operational effects are not anticipated to be likely. However, further detailed assessment is being undertaken, the results of which will be detailed within the ES.

12.10 Further Mitigation and Enhancement

Construction and Decommissioning

12.10.1 With the implementation of embedded mitigation measures and identified mitigation measures delivered through the outline CoCP as set out above, the preliminary conclusion is that the effects associated with construction and decommissioning of the Proposed Development are **Negligible** and therefore Not Significant. On this basis, there is unlikely to be any requirement for additional mitigation measures over and above those already identified.

Operation

12.10.2 With the implementation of embedded mitigation measures as set out above, the preliminary conclusion is that the effects associated with operation of REP are **Negligible** and therefore Not Significant. On this basis, there is unlikely to be any requirement for additional mitigation measures over and above those identified above.

12.11 Residual Effects and Monitoring

Construction and Decommissioning

12.11.1 With the implementation of embedded mitigation measures and identified mitigation measures delivered through the CoCP as set out above, the preliminary conclusion is that the residual effects associated with construction and decommissioning of REP are Not Significant. On this basis, there is unlikely to be any requirement for monitoring.

Operation

12.11.2 With the implementation of embedded mitigation measures as set out above, the preliminary conclusion is that the residual effects associated with operation of REP are Not Significant. On this basis, there is unlikely to be any requirement for monitoring.

12.12 Summary of Residual Effects

12.12.1 Residual effects are summarised in **Table 12.6** below:

Table 12.6: Residual Effects

	Receptor name and description	Potential mitigation	Preliminary Assessment of Residual Effects
The REP DCO			
Construction / decommissioning	The Great Breach Dyke and associated drains/tributaries – increased surface water run-off and water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation
Construction / decommissioning	Thames groundwater bodies – water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation
Construction / decommissioning	Crossness Nature Reserve - increased surface water run-off and water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation

	Receptor name and description	Potential mitigation	Preliminary Assessment of Residual Effects
Construction / decommissioning	The River Thames tidal flood defences – impact upon structural integrity	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation
Construction / decommissioning	Existing development/ infrastructure/ third party assets/ land in the vicinity and downstream – flood risk impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation
Operation	The Great Breach Dyke and associated drains/ tributaries – increased surface water run-off and water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation
Operation	Thames groundwater bodies – water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation
Operation	Crossness Nature Reserve - increased surface water run-off and water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation
Operation	Existing development/ infrastructure/ third party assets/ and in the vicinity and downstream – flood risk impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Effects are not anticipated to be significant following mitigation

12.13 Preliminary Conclusion and Further Assessment

12.13.1 The baseline conditions at the Application Site have been described and the principal receptors that may be affected by the Proposed Development identified.

12.13.2 Construction and decommissioning activities at the REP site and Main Temporary Construction Compounds and the Electrical Connection and Cable Route Temporary Construction Compounds have the potential to impact upon the surface water drainage regime and both groundwater and surface water quality. However, the effects are likely to be localised and temporary and controlled by embedded mitigation measures, such that effects would be **Negligible** and therefore Not Significant.

12.13.3 Similarly, the potential effects arising during the operational phase of the Proposed Development would be controlled by embedded mitigation measures, such that the effects are likely to be **Negligible** and therefore Not Significant. The Electrical Connection comprises an underground cable and will not therefore give rise to impacts upon hydrology, flood risk and water resources during the operational phase.

12.13.4 Significant adverse cumulative effects are not anticipated on account of construction phase and operational phase mitigation measures being employed. However, these preliminary findings are subject to further detailed assessment following stakeholder consultation, the results of which will be detailed within the ES.

12.14 References

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