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Bramford to Twinstead Reinforcement

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Document 5.5: Flood Risk Assessment

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Executive Summary

Purpose of this Report

National Grid Electricity Transmission plc (here on referred to as National Grid) is making an application for development consent to reinforce the transmission network between Bramford Substation in Suffolk, and Twinstead Tee in Essex. The Bramford to Twinstead Reinforcement ('the project') would be achieved by the construction and operation of a new electricity transmission line over a distance of approximately 29km (18 miles), the majority of which would follow the general alignment of the existing overhead line network.

The Order Limits cross the following main rivers; the Belstead Brook (at three locations including the tributary known as the Spring Brook), the River Brett, the River Box and the River Stour (including an unnamed tributary to the River Stour). The Order Limits also cross the Henny Meadow Fleet, which is not main river within the Order Limits but becomes main river approximately 750m downstream of the Order Limits.

The Environment Agency Flood Map for Planning (Rivers and Sea) shows that the majority of the project components are located in Flood Zone 1, whilst localised areas at some watercourse crossings, are in Flood Zones 2 and 3.

This Flood Risk Assessment (FRA) has been produced to support the application for development consent and the accompanying Environmental Statement under the Planning Act 2008. The FRA documents the assessment taken to understand whether the project is likely to be at risk of flooding or is likely to increase flood risk elsewhere in accordance with the requirements set out in relevant national policy.

Scope of the Assessment

Flooding from sewers and water mains, tidal and coastal sources and reservoirs and other artificial sources were scoped out of the assessment following publication of the project's Scoping Opinion. Therefore, the FRA focuses on fluvial, pluvial (surface water) and groundwater flood risk.

The assessment has used published data sources and detailed flood model results provided by the Environment Agency to identify the risks relevant to the project. National Grid has also undertaken consultation with relevant stakeholders, including the Environment Agency, Essex County Council and Suffolk County Council to help inform the report.

Results of the Assessment

A sequential approach has been taken in siting project infrastructure, particularly those elements that could be at risk of flooding. The grid supply point (GSP) substation and the cable sealing end (CSE) compounds are all located in Flood Zone 1. Due to its linear nature some components of the project must necessarily be located in areas with a medium or high likelihood of flooding (Flood Zones 2 and 3). However, evidence of passing the Sequential Test is presented and application of the Exception Test is unnecessary for this project.

Flood risk from fluvial and surface water sources during construction is mainly concentrated around working within the floodplain. This has been largely avoided through embedded measures, including the trenchless crossing at the River Stour and River Box, and also through good practice measures set out in the Code of Construction Practice. Good practice measures to

manage localised groundwater flood risks have also been made. With these measures in place, the residual risk during the construction phase has been assessed as low risk.

During operation, flood risk from fluvial, surface water and groundwater sources is assessed to be low due to locating key infrastructure (the GSP substation and the CSE compounds) in Flood Zone 1. The residual risk (associated with the pylons) is assessed as very low.

1. Introduction

1.1 Overview

1.1.1 National Grid Electricity Transmission plc (here on referred to as National Grid) is making an application for development consent to reinforce the transmission network between Bramford Substation in Suffolk, and Twinstead Tee in Essex. The Bramford to Twinstead Reinforcement ('the project') would be achieved by the construction and operation of a new electricity transmission line over a distance of approximately 29km (18 miles), the majority of which would follow the general alignment of the existing overhead line network.

1.1.2 This Flood Risk Assessment (FRA) has been produced to support the application for development consent and the accompanying Environmental Statement (ES) under the Planning Act 2008.

1.2 Purpose of this Report

1.2.1 This document includes a summary of flood risk from all relevant sources to the project and the predicted impact of the project on flood risk elsewhere.

1.2.2 This document also describes how the risk of flooding would be managed and includes the good practice measures that are proposed to reduce any potential residual impacts associated with the project. The good practice measures are documented within the Code of Construction Practice (CoCP) (**application document 7.5.1**) and have been given a code, e.g. GG01, to allow the measures to be easily cross referenced. The ones relevant to the FRA are outlined in Table 1.1 for ease of reference.

Table 1.1 – Good Practice Measures Relevant to the FRA taken from the CoCP

Ref	Good Practice Measure	Relevance to FRA
W02	For opencut watercourse crossings and installation of vehicle crossing points, good practice measures will include but not be limited to: • Where practicable, reducing the working width for opencut crossings of a main or ordinary watercourse whilst still providing safe working; • Installation of a pollution boom downstream of opencut works; • The use and maintenance of temporary lagoons, tanks, bunds, silt fences or silt screens as required; • Have spill kits, straw bales or other appropriate measures readily available for downstream emergency use in the event of a pollution incident; • The use of all static plant such as pumps in appropriately sized spill trays; • Prevent refuelling of any plant or vehicle within 15m of a watercourse (except for machinery associated with over-pumping); • Prevent storing of soil stockpiles within 15m of a main river; • Inspect all plant prior to work for leaks of fuel or hydraulic fluids; and • Reinstating the riparian vegetation and natural bed of the watercourse, using the material removed where appropriate, on completion of the works and compacting as necessary. If additional material is required, appropriately sized material of similar composition will be used.	The project crosses a number of watercourses and main rivers, so these measures would reduce flood risk during construction.

Ref	Good Practice Measure	Relevance to FRA
W04	Where watercourses are to be crossed by construction traffic using a culvert method, the area above the culvert will be backfilled to permit the passage of plant, equipment, materials and people. The culvert will be sized to reflect the channel width and the estimated flow characteristics of the watercourse under peak flow conditions and kept free from debris. These installation works would be timed to avoid flood flow conditions where practicable, or if periods of work were necessary when higher flow conditions could be expected, suitable pumping provision would be put in place, with standby pumps also made available.	By using appropriate-sized culverts and crossings, flood risk would not be increased unnecessarily during construction.
W06	There will be no permanent land raising undertaken in locations identified as Flood Zone 3.	This means that fluvial floodplain flow routes and storage within the Order Limits would not be impacted or lost.
W07	Where new or additional surfacing is required on any access tracks and compound areas, these will be permeable surfaces where ground conditions allow or will be designed to achieve green field rates. The project will incorporate appropriate surface water drainage measures into its final design for the temporary access routes so that they do not lead to a significant increase in flood risk. Temporary access routes within Flood Zone 3 and areas of high and medium risk of flooding from surface water will be removed at the end of the construction phase and the ground surface will be reinstated to pre-project levels. No construction materials or stockpiles of soils/arisings should be stored within Flood Zone 3 and areas of high and medium risk of flooding from surface water. Where this cannot be avoided, stockpiles would be aligned to avoid creating continuous barriers to floodplain flows (other measures will be included in the Construction Environmental Management Plan (CEMP)). All construction compounds will be located in Flood Zone 1. Where this is not practicable, additional measures will be identified within a flood risk action plan.	This would reduce the risk of surface water flooding during construction. This would avoid the risk that soil piles create an additional barrier to flow routes during construction, which may result in increased flood risk within the areas of construction.
W08	The contractor(s) will subscribe to the Environment Agency's Floodline service, which provides advance warning of potential local flooding events, and subscribe to the Met Office's Weather Warnings email alerts system and any other relevant flood warning information. The contractor(s) will implement a suitable flood risk action plan, which will include appropriate evacuation procedures should a flood occur or be forecast.	Severe weather warnings would support construction planning in terms of temporary works and activities to limit the impact of any severe rainfall events, both in terms of disruption to construction and potential environmental impacts
W11	Where the River Stour and River Box are crossed by a trenchless crossing, the cables will be laid at least 1m below the hard bed level of the river and will remain at or below this level for a distance of not less than 3m from the edge of the riverbank. Marker posts shall also be positioned on each bank of	This would reduce the risk that flood events and erosion expose underground cables in the future.

Ref	Good Practice Measure	Relevance to FRA
	the river to indicate the location of the under-crossing and the nature of the works.	
W12	Where new, permanent areas of impermeable land cover are created, the drainage design will be in accordance with the requirements of the Essex County Council Sustainable Drainage System (SuDS) Design Guide (2020) and the Suffolk County Council SuDS Palette (2021) and will include allowances for climate change in accordance with current (May 2022) Environment Agency requirements. The drainage infrastructure would provide the storage necessary to achieve discharges at greenfield rates and would not significantly alter groundwater recharge patterns by transferring a significant recharge quantity from one catchment to another. A specialised drainage contractor will review the designs and will provide advice to National Grid and its contractor during relevant construction and reinstatement activities.	This would reduce the risk of groundwater and surface water flows being impacted by above ground features.
W14	Pylons will not be constructed within 8m of the top of bank of main rivers (Belstead Brook and River Brett), in accordance with requirements for regulated activities set out in the guidance for environmental permits for flood risk activities (Environment Agency and Defra, 2019). New 400kV pylons would also not be located within 3m of an ordinary watercourse. This will also reduce disturbance to river channels, banks and riparian corridors. National Grid will seek to avoid situating pylons within Environment Agency Flood Zones 2 or 3. Where this is not practicable, a Flood Risk Activity Permit application would be submitted to the Environment Agency.	This would reduce the risk of impediment of floodplain flows during large flood events and maintain the integrity of riparian corridors.
W15	All main rivers and ordinary watercourses crossed by an opencut methodology will be designed to allow continued downstream flow during construction to reduce flood risk. The works will be timed to avoid flood flow conditions or additional measures will be required.	This would reduce restrictions to flood flows during construction which could increase flood risk upstream.
W16	Where appropriate, pre-construction field drainage would be installed within the working area to help prevent possible water-logging of the working area and therefore the need for temporary dewatering during construction. This will also enable current drainage systems to continue working throughout the period of construction. Landowners will be consulted on the design of the land drainage proposals. The design will pay particular attention to the need to reduce the risk so that the drains do not act as pathways for contamination or cause flooding off-site, consulting with the Lead Local Flood Authorities where necessary. A specialised drainage contractor will review the designs and provide advice to National Grid and its contractor during relevant construction and reinstatement activities.	This would reduce the risk of surface water flooding during construction.
W17	Temporary clear span bridge crossings (e.g. bailey bridge) will be used for the temporary access route crossing at the River Stour, River Box and the River Brett. These will be designed with soffits that are raised 600mm above the flood level in accordance with Environment Agency requirements and would be set back 8m (or distance otherwise agreed with the Environment Agency) from the river's edge. Appropriate flood levels will be agreed with	This would reduce restrictions to flood flows during construction which could increase flood risk upstream.

Ref	Good Practice Measure	Relevance to FRA
	the Environment Agency and specified in the Flood Risk Activity Permit applications for these structures. The temporary bridges will be designed specifically to consider the span length and the weight and size of plant and equipment that will cross the bridge. These installation works would be timed to avoid flood flow conditions where practicable, or if periods of work were necessary when higher flow conditions could be expected, suitable pumping provision would be put in place, with standby pumps also made available. In addition, the temporary bridge at the River Stour would be of sufficient size and design to allow existing navigation of the river by non-motorised vessels to continue during construction.	
W18	The temporary access route and underground cables will cross a flood defence embankment on the River Stour located off Bures Road (Grid reference TL 89599 36718). The crossing designs would avoid impacts on the defence foundations and construction works would be undertaken using methods that limit ground movement/settlement to reduce the potential to compromise the condition and stability of the embankment. In line with the requirements of the Environment Agency, should the potential for an impact to the flood defences be identified at the detailed design stage, then the flood defence would be monitored to establish a pre-construction baseline and for a period after completion of works to construct the crossings to enable detection of any effects on the structural integrity/condition of the assets during construction of the project. The requirement for any such monitoring will be discussed with the Environment Agency as part of the application for a Flood Risk Activity Permit.	This would safeguard the integrity of the existing flood defence, preventing an increase to fluvial flood risk.
GG06	A full record of condition will be carried out (photographic and descriptive) of the working areas that may be affected by the construction activities. This record will be available for comparison following reinstatement after the works have been completed to ensure that the standard of reinstatement at least meets that recorded in the pre-condition survey or as agreed in the Landscape and Ecological Management Plan (LEMP) or if the Development Consent Order (DCO) provides otherwise, then in accordance with the DCO.	Reinstating the land to its previous condition would avoid an increased flood risk compared to pre-construction conditions.
GG07	Land used temporarily will be reinstated where practicable (bearing in mind any restrictions on planting and land use) to its pre-construction condition and use. Hedgerows, fences and walls (including associated earthworks and boundary features) will be reinstated to a similar style and quality to those that were removed, in consultation with the landowner.	Reinstating the land to its previous condition would avoid an increased flood risk compared to pre-construction conditions.
GG15	Runoff across the site will be controlled through a variety of methods including header drains, buffer zones around watercourses, on-site ditches, silt traps and bunding. There will be no intentional discharge of silted or otherwise contaminated site runoff to ditches, watercourses, drains or sewers without appropriate treatment and agreement of the appropriate authority (except in the case of an emergency). Watercourses near work sites would be inspected daily where work activity is being carried out. Inspections will look for signs of siltation or other forms of pollution for the duration of the period of ground disturbance and work site drainage would be	This would reduce the risk of surface water flooding during construction.

Ref	Good Practice Measure	Relevance to FRA
	inspected and maintained as required, so that they continue to operate to their design standard, safeguarding surface and groundwater quality.	
AS08	Clay bungs or other vertical barriers will be constructed within trench excavations where deemed necessary by a suitably experienced person, to prevent the creation of preferential drainage pathways.	Underground cables trenches could act as a flow route for water if not managed.

1.2.3 The CoCP forms Appendix A of the CEMP (**application document 7.5**). The CEMP (and its appendices) are secured through Requirement 4 of the draft DCO (**application document 3.1**).

1.3 Consultation

1.3.1 The scope of this assessment has been agreed through engagement with the Environment Agency and Suffolk and Essex County Councils in their role as Lead Local Flood Authorities (LLFA). The Order Limits partially lie within the East Suffolk Internal Drainage Board (IDB) district at the eastern end of the reinforcement, in the vicinity of Hintlesham and Bramford. However, within this district the project only interacts with main rivers (which are under the jurisdiction of the Environment Agency) not IDB drains. Table 1.2 summarises the relevant consultation feedback.

Table 1.2 – Summary of Flood Risk Consultation

Stakeholder	Matter Raised	Project Response
Thematic Meeting 12 July 2021		
Environment Agency	Climate change allowances are being updated for peak river flows and these should be incorporated into future assessments as appropriate. No updates to current rainfall climate change allowances are planned*	Noted. As all flood vulnerable permanent above ground infrastructure would be located in Flood Zone 1 (e.g. the grid supply point (GSP) substation and cable sealing end (CSE) compounds), peak river flow allowances do not need to be applied. Current climate change allowances for rainfall would be adopted within the operational drainage design. These allowances were updated in May 2022.
Essex County Council Suffolk County Council	Ensure sufficient detail is submitted on proposals to manage all aspects of flood risk, both during operation and construction, including details on construction compounds, temporary access routes, etc.	This FRA addresses all relevant sources of flood risk and sets out proposals for flood risk management to safeguard the project during its construction and operation, and to avoid increases in flood risk from the project to third parties.
Thematic Meeting 3 March 2022		
Suffolk County Council and Essex County Council	Need for an FRA was stated and information about the drainage strategy was requested, in particular, details for the GSP substation.	This FRA presents information regarding the strategy for surface water management during construction and operation of the project.

Stakeholder	Matter Raised	Project Response
		Detailed designs for operational drainage will comply with SuDS guidance published by the LLFA. See W12 in the CoCP (**application document 7.5.1**).
Environment Agency	Temporary bridge design should include for 600mm freeboard above the flood levels.	Environment Agency requirements for temporary bridges will be incorporated into the designs. See W17 in the CoCP (**application document 7.5.1**) and as indicated on the Design and Layout Plans: Temporary Bridge for Access (**application document 2.11.13**).
	Culverts should be a last resort but noted they would be temporary.	National Grid has considered other options to culverting but this is considered the preferred option in terms of programme and budget.

1.4 Structure of this Report

1.4.1 The structure of this report is summarised in Table 1.3.

Table 1.3 – Structure of this Report

Chapter	Content
1: Introduction	Background information and a summary of engagement with relevant consultees.
2: Development Description	Description of the project and existing baseline environment.
3: Legislation, Policy and Guidance	Summarises relevant local and national flood risk and drainage policies and climate change allowances. Summarises the Sequential and Exceptional Tests.
4: Flood Risk	Summarises the main sources of flood risk to the project during construction and operation and the measures proposed to avoid and reduce effects.
5: Conclusion	States the conclusions of the FRA.

2. Development Description

2.1 Project Description

2.1.1 The reinforcement would comprise up to approximately 18km of overhead line (consisting of approximately 50 new pylons, and conductors) and 11km of underground cable system (with associated joint bays and above ground link pillars).

2.1.2 Four CSE compounds would be required to facilitate the transition between the overhead and underground cable technology. The CSE would be within a fenced compound, and contain electrical equipment, support structures, control building and a permanent access track.

2.1.3 Approximately 27km of existing overhead line and associated pylons would be removed as part of the proposals (25km of existing 132kV overhead line between Burstall Bridge and Twinstead Tee, and 2km of the existing 400kV overhead line to the south of Twinstead Tee). To facilitate the overhead line removal, a new GSP substation is required at Butler's Wood, east of Wickham St Paul, in Essex. The GSP substation would include associated works, including replacement pylons, a single circuit sealing end compound and underground cables to tie the substation into the existing 400kV and 132kV networks.

2.1.4 Some aspects of the project, such as the underground cable sections and the GSP substation, constitute 'associated development' under the Planning Act 2008.

2.1.5 Other ancillary activities would be required to facilitate construction and operation of the project, including (but not limited to):

- Modifications to, and realignment of sections of existing overhead lines, including pylons;
- Temporary land to facilitate construction activities including temporary amendments to the public highway, public rights of way, working areas for construction equipment and machinery, site offices, welfare, storage and access;
- Temporary infrastructure to facilitate construction activities such as amendments to the highway, pylons and overhead line diversions, scaffolding to safeguard existing crossings and watercourse crossings;
- Diversion of third-party assets and land drainage from the construction and operational footprint; and
- Land required for mitigation, compensation and enhancement of the environment as a result of the environmental assessment process, and National Grid's commitments to Biodiversity Net Gain.

2.1.6 For a full description of the project reference should be made to ES Chapter 4: Project Description (**application document 6.2.4**) and the project is also illustrated on the General Arrangement Plans (**application document 2.10**).

2.2 Construction Assumptions

2.2.1 The baseline construction schedule (see ES Appendix 4.2: Construction Schedule (**application document 6.3.4.2**)) assumes an 18 month programme for constructing the

GSP substation in advance of development consent (via a planning application under the Town and Country Planning Act 1990). The phases following construction and commission of the substation would take approximately four years with completion in 2028. The alternative schedule has the GSP substation being constructed as the first phase of work under the DCO and construction activities for the project in this scenario would be completed in late 2028.

2.2.2 In both schedules, there would be a linear rolling construction programme, following completion of site enabling works and there is likely to be concurrent works in different locations at times. Some temporary features, including watercourse crossings and temporary access routes, may be in place for the duration of construction to maintain access to the working area.

2.3 Environmental Baseline

2.3.1 The reinforcement crosses predominantly rural, open land. Due to the extent of the project, it crosses the following main rivers and their associated floodplains (Figure 1):

- Belstead Brook (including its tributary called the Spring Brook);
- River Brett;
- River Box; and
- River Stour (Wixoe to Lamarsh) (including an unnamed tributary to the west).

2.3.2 The Belstead Brook (including the Spring Brook) and River Brett are located in sections of the project where only overhead lines are proposed (Figure 1). During construction there would therefore be very limited interaction with these waterbodies (limited to temporary culvert or bridge crossings for the access tracks).

2.3.3 The River Box and the River Stour are located in sections of the project where underground cables are proposed. The River Stour has two main river channels within the Order Limits; the main channel to the east and an unnamed tributary to the west. The operational infrastructure (CSE compounds and GSP substation) would also be located within their catchments. The Order Limits cross the upper reaches of the Henny Meadow Fleet, before this becomes main river (Figure 1).

2.3.4 The geology within the Order Limits is defined by bedrocks of clay, silt, sand and gravel from the Thames Group, Lambeth Group and Thanet Formation. To the west of the project, to the south of Sudbury, the bedrock also comprises chalk of the White Chalk Subgroup. The superficial deposits are predominantly clay, with silt, sand and gravels following the watercourses (British Geological Survey, 2022).

2.3.5 The hydrogeology is defined by Principal aquifers underlying the White Chalk Subgroup, and Secondary A aquifers underlying the Thanet Formation sands and unproductive strata underlying the London Clay Formation (Department for Environment, Food and Rural Affairs (Defra), 2022). A more in-depth analysis of the geology and hydrogeology can be found in ES Appendix 10.1: Geology Baseline and Preliminary Risk Assessment (**application document 6.3.10.1**) and Appendix 10.2: Groundwater Baseline and Assessment (**application document 6.3.10.2**).

2.3.6 The underlying soils are largely freely-draining slightly acidic loamy and clayey soils which follow the routes of the watercourses. Between these areas lie loamy and clayey soils

with impeded drainage, with slowly permeable areas underlying the Bramford Substation and the proposed GSP substation (British Geological Survey, 2023).

3. Legislation, Policy and Guidance

3.1 Introduction

3.1.1 The following legislation and policy have been considered when producing this FRA:

- Flood and Water Management Act 2010;
- Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a) and the consultation draft of EN-1 (Department for Business, Energy and Industrial Strategy (BEIS), 2021a);
- NPS for Electricity Networks Infrastructure (EN-5) (DECC, 2011b) and the consultation draft of EN-5 (BEIS, 2021b);
- National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2021);
- Planning Policy Guidance (PPG) (MHCLG, 2022); and
- Flood Risk Assessments: Climate Change Allowances (Environment Agency, 2022a).

3.2 National Policies and Guidance

Overarching National Policy Statement for Energy (EN-1)

3.2.1 EN-1 was published in 2011 and provides specific guidance on the development of energy infrastructure in relation to flood risk for the lifetime of the project. The sections of EN-1 of relevance to this FRA are:

- Section 4.8, which discusses climate change adaption; and
- Section 5.7, which discusses flood risk, setting out the minimum requirements of a FRA, as well as information on the application of the Sequential and Exception Tests.

3.2.2 EN-1 confirms that an FRA is required to assess flood risk from all sources for the lifetime of the project. It states that the FRA needs to identify, among other aspects, flood risk reduction and management measures. Residual risks would also require assessment to consider their acceptability.

3.2.1 EN-1 states that the scope of the FRA must be proportionate to the risk and appropriate to the scale of the development that is proposed. EN-1 also states that the FRA must consider different sources of flooding and their effects, as well as the impacts of climate change. These overarching principles have been followed and an assessment of all relevant sources of flood risk are presented in Chapter 4 of this FRA.

3.2.2 EN-1 also includes several additional requirements that are specific to Energy Infrastructure. Those that are of potential relevance to the FRA are set out in Table 3.1, together with the location in this FRA where they are addressed.

3.2.3 This FRA has been prepared by a Chartered Hydrologist with more than 15 years' experience of FRA and flood risk management.

Table 3.1 – EN-1 Requirements Relating to Flood Risk Relevant to the Project and Where They Are Addressed in this FRA

EN-1 Minimum Requirement		Where Addressed in the FRA
Policy	The project should be in line with any relevant national and local flood risk management strategies (paragraph 5.7.9).	Chapter 3: Legislation, Policy and Guidance Chapter 4: Flood Risk
Flood risk	Where necessary, the project should be appropriately flood resilient and resistant, including safe access and escape routes where required, and any residual risk must be safely managed over the lifetime of the project (paragraph 5.7.9).	Chapter 3: Legislation, Policy and Guidance Chapter 4: Flood Risk
Operation of the site	The project should be designed to remain operational when floods occur (paragraph 5.7.24).	Chapter 3: Legislation, Policy and Guidance Chapter 4: Flood Risk
Functional floodplain	The project should not result in a net loss of functional floodplain storage or impede water flows (within Flood Zone 3b) (paragraph 5.7.24).	Chapter 3: Legislation, Policy and Guidance Chapter 4: Flood Risk
Climate change	The impacts of climate change should be considered when planning the location, design, build, operation and, where appropriate, decommissioning of the project (paragraph 4.8.5).	Chapter 3: Legislation, Policy and Guidance
Climate change	The Planning Inspectorate should be satisfied that applicants for new energy infrastructure have taken into account the potential impacts of climate change using the latest UK Climate Projections available at the time the ES was prepared to ensure they have identified appropriate mitigation or adaptation measures (paragraph 4.8.6).	Chapter 3: Legislation, Policy and Guidance
Adaptation	Appropriate mitigation or adaptation measures to cover the estimated lifetime of the project should be identified (paragraph 4.8.6). Any adaptation measures should be based on the latest set of UK Climate Projections, the Government's latest UK Climate Change Risk Assessment, when available and in consultation with the Environment Agency (paragraph 4.8.11). Estimated lifetime of the project should be identified (paragraph 4.8.6).	Chapter 3: Legislation, Policy and Guidance Chapter 4: Flood Risk
Drainage and SuDS	The applicant should give priority to the use of SuDS and make provision for their adoption and maintenance (paragraphs 5.7.9 and 5.7.10).	Chapter 3: Legislation, Policy and Guidance Chapter 4: Flood Risk
Drainage and SuDS	For construction work which has drainage implications, approval for the project's drainage system would form part of the DCO issued by the Planning Inspectorate. The proposed drainage system should comply with any National Standards published by Ministers under Paragraph 5(1) of Schedule 3 to the Flood and Water Management Act 2010 (paragraph 5.7.10).	Chapter 3: Legislation, Policy and Guidance Chapter 4: Flood Risk

EN-1 Minimum Requirement		Where Addressed in the FRA
Drainage and SuDS	Site layout and surface water drainage systems should be designed to cope with events that exceed the design capacity of the system, so that excess water can be safely stored on or conveyed from the site without any adverse impacts (paragraph 5.7.20).	Chapter 3: Legislation, Policy and Guidance Chapter 4: Flood Risk
Sequential Test	The Sequential Test and sequential approach should be applied (paragraphs 5.7.9, 5.7.12 and 5.7.13).	Chapter 3: Legislation, Policy and Guidance
Exception Test	The Exception Test, where necessary, should be applied (paragraphs 5.7.14 to 5.7.17).	Chapter 3: Legislation, Policy and Guidance

National Policy Statement for Electricity Networks Infrastructure (EN-5)

3.2.4 This is the NPS specific to electricity infrastructure and with regard to flood risk reiterates the requirements set out in EN-1, detailed above. Paragraph 2.4.2 of EN-5 states that the project's resilience to climate change should be assessed and the policy states that a FRA should be prepared.

National Planning Policy Framework (NPPF) and Guidance

3.2.5 The NPPF (MHCLG, 2021) sets out the Government's planning policies for England so that flood risk is considered at all stages of the planning and development process. The policy aims to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk of flooding. To achieve this, the policy advocates application of a sequential test whereby development in the low risk flood zone (Flood Zone 1) is preferentially supported. Where there are no reasonably available sites in Flood Zone 1, reasonably available sites in Flood Zone 2 should be considered. Only when there are no reasonably available sites for development in Flood Zones 1 and 2, should the suitability of sites in Flood Zone 3 be considered.

3.2.6 In addition, the NPPF (MHCLG, 2021) states in paragraph 159 that '*the development should be made safe for its lifetime without increasing flood risk elsewhere'*. For a development to be considered acceptable with regard to flood risk, the Sequential Test requirements must be satisfied, along with demonstrating that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- The development is appropriately flood resistant and resilient;
- It incorporates SuDS, unless there is clear evidence that this would be inappropriate;
- Any residual risk can be safely managed; and
- Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

3.2.7 Further details of the requirements for sequential testing and sustainable drainage are provided below.

Sequential Testing

3.2.8 The Sequential Test should be applied to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development proposed.

3.2.9 The PPG on Flood Risk and Coastal Change (MHCLG, 2022) supports the NPPF with additional guidance on flood risk vulnerability classifications and managing residual risks. The PPG provides further description of Flood Zones (Table 3.2) and Vulnerability Classifications (Table 3.3) in order to assess the suitability of a specific site for a certain type of development.

Table 3.2 – Summary of Flood Zone Definitions

Flood Zone	Probability of Flooding	Return Periods
1	Low	Land having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
2	Medium	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%); or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%).
3a	High	Land having a 1 in 100 or greater annual probability of river flooding (≥1%); or land having a 1 in 200 or greater annual probability of sea flooding (≥0.5%).
3b	High – Functional Floodplain	This zone comprises land where water must flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments (SFRA) areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on Flood Maps)

Table 3.3 – Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Zone Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	✓	Exception Test required	✓	✓
Flood Zone 3	Exception Test required	✓	X	Exception Test required	✓
Flood Zone 3b 'Functional Floodplain'	Exception Test required	✓	X	X	X
Key: ✓ = Development is appropriate; X = Development should not be permitted					

3.2.10 The Bramford to Twinstead Reinforcement is classified as 'essential infrastructure' with respect to flooding vulnerability in the NPPF (Table 3.3). The GSP substation and CSE compounds, which represent the parts of the project that are most vulnerable to flooding, are situated in Flood Zone 1, satisfying the Sequential Test.

3.2.11 The Order Limits and Proposed Alignment presented on the General Arrangement Plans (**application document 2.10**) have been identified following an extensive options appraisal process. Overhead lines and associated pylons are mainly located in Flood Zone 1, as are most of the underground cable sections and associated infrastructure. However, as is inevitable with a linear scheme, some locations cross Flood Zones 2 and 3. As detailed in good practice measure W14 in the CoCP (**application document 7.5.1**), National Grid would seek to avoid pylons outside of Flood Zones 2 and 3. Where this is not practicable, a Flood Risk Activity Permit application would be submitted to the Environment Agency. It is therefore concluded that the project passes the Sequential Test.

Exception Test

3.2.12 The Exception Test is only required for projects that do not pass the Sequential Test (Table 3.3). As the project is located in zones with a lower probability of flooding, the Exception Test is not required on the project.

Sustainable Drainage

3.2.13 The PPG on Flood Risk and Coastal Change (MHCLG, 2022) supports the NPPF with additional guidance on managing flood risk. It states that new development presents opportunities to reduce the causes and impacts of flooding through the use of natural flood management techniques, including a comprehensive sustainable drainage approach.

3.2.14 To manage surface water, the guidance states that it is necessary to consider the appropriateness of various SuDS measures, using the SuDS hierarchy set out in the PPG. The aim should be to discharge surface runoff according to the following drainage options, listed with the most favourable option first and least preferable last:

- Into the ground (infiltration);
- To a surface water body;
- To a surface water sewer, highway drain, or another drainage system; and
- To a combined sewer.

3.2.15 The Environment Agency classifies surface water flood risk in four categories; ‘very low’, ‘low’, ‘medium’ and ‘high’ (Table 3.4).

Table 3.4 – Flood Risk from Surface Water Definitions

Probability of Surface Water Flooding	Return Period
Very Low	Land with less than 1 in 1,000 annual probability of surface water flooding (<0.1%)
Low	Land with between 1 in 1,000, and 1 in 100 annual probability of surface water flooding (0.1% - 1%)
Medium	Land with between 1 in 100, and 1 in 30 annual probability of surface water flooding (1% - 3.3%)
High	Land with greater than 1 in 30 annual probability of surface water flooding (>3.3%).

3.2.16 Surface water flooding can be managed through SuDS. The CoCP (**application document 7.5.1**) outlines the good practice measures including SuDS for managing surface water flood risk. As per good practice measure W12, where new permanent impermeable areas are created, drainage would be designed in accordance with the requirements of the Essex County Council SuDS Design Guide (2020) and the Suffolk County Council SuDS Palette (2021).

Flood Risk Assessments: Climate Change Allowances

3.2.17 The United Kingdom Climate Projections 2018 (UKCP18), (Met Office *et. al.,* 2018) are a set of climate change projections that replace the previous set (UKCP09). These are interpreted by the Environment Agency to develop a set of allowances to be applied to assess the predicted impact of climate change on a range of parameters but of relevance to this FRA, effects on rainfall intensity.

3.2.18 The Environment Agency's online advice note Flood Risk Assessments: Climate Change Allowances (2022a) was published in February 2016 and most recently amended in May 2022 to take account of an update to recommended climate change allowances for rainfall intensity.

3.2.19 Fluvial climate change allowances have not been applied in this assessment, as the main risk to the project from river flooding is during construction. Construction would be carried out within the near future (see Section 2.2), meaning future climate change effects are not applicable. In addition, the project has committed to locating compounds and soil stockpiles in the low risk flood zone (Flood Zone 1), where practicable see W07 in the CoCP (**application document 7.5.1**). The decision to not apply fluvial climate change allowance is recorded within the Statement of Common Ground with the Environment Agency (**application document 7.3.3**).

3.3 Rainfall Allowance for Drainage

3.3.1 The majority of the project is within the Environment Agency's Combined Essex management catchment whilst the north-eastern extents of the Order Limits are within the East Suffolk management catchment (Environment Agency, 2022a). For both management catchments, peak rainfall intensity is anticipated to increase between 20% (central estimate) and 40% (upper end estimate) in the 40 year design lifetime of the project.

3.3.2 The effects of climate change on rainfall intensity, in accordance with the latest published guidance in May 2022, would be included in the drainage design for the GPS substation, in line with good practice measure W12 in the CoCP (**application document 7.5.1**) which states *'Where new, permanent areas of impermeable land cover are created, the drainage design will be in accordance with the requirements of the Essex County Council SuDS Design Guide (2020) and the Suffolk County Council SuDS Palette (2021) and will include allowances for climate change in accordance with current Environment Agency requirements.'*

3.4 National Grid Policy

3.4.1 National Grid policy requires that substations considered to be critical infrastructure, should be resilient to flooding up to the 0.1% Annual Exceedance Probability flood event, including an appropriate allowance for climate change, where possible. As detailed in Chapter 4: Flood Risk, the proposed GSP substation is located in Flood Zone 1 and meets

the requirements of the policy. The CSE compounds are also all located within Flood Zone 1, therefore meet the requirements of the policy.

3.5 Local Planning Guidance

3.5.1 In addition to the PPG described above, there are flood risk management-related guidance prepared by district and county councils. The relevant ones are listed below and have been considered when drafting this FRA:

- Local Flood Risk Management Strategy (Essex County Council, 2018);
- Suffolk Flood Risk Management Strategy (Suffolk Flood Risk Management Partnership, 2016);
- Suffolk SuDS Palette (SSP) (Suffolk County Council, 2018); and
- Essex SuDS Design Guide (Essex County Council, 2020).

4. Flood Risk

4.1 Flood Risk Data

4.1.1 There are readily available reports providing a context for flood risk, and specifically flood history, that are relevant to the project and its study area, which was defined to include reaches of watercourses and floodplains that would be crossed by or likely to receive surface water runoff from the project, extending 500m downstream. These reports draw together a range of information and are prepared by relevant planning authorities in their role as LLFA. The evidence base related to flood risk presented in each of these reports is summarised in Table 4.1.

Table 4.1 – Summary of Flood Risk Data Sources

Source	Key Information
Mid Essex SFRA (Scott Wilson, 2007)	The most recent fluvial flooding in the Mid Essex region was recorded in 2000/2001 in Halstead and Yeldham, approximately 5km and 6km respectively from the Order Limits. Flood defences were constructed in Halstead in response to this event. These events are likely linked to the River Colne which does not intercept the Order Limits.
Mid Suffolk District Council SFRA (Scott Wilson, 2008)	With specific regard to flooding incidents or history, there is no mention of any flood events affecting the project study area
Babergh and Mid Suffolk District Council Strategic Flood Risk Assessment Level 1 (JBA, 2020a) and Level 2 (JBA, 2020b).	The SFRA mapping shows flood extents from the 1968 Stour catchment flood event. The extents span parts of the River Stour and River Brett floodplains which cross the Order Limits. The SFRA also references flooding associated with rainfall from a major storm event affecting Henny, Sudbury and Hadleigh in 1987. No more recent flood events within the study area are documented. The Level 1 report also includes information on foul water flooding.
Essex County Council Preliminary FRA (Scott Wilson, 2011) and addendum update (Essex County Council, 2017)	The mapping shows that groundwater flood risk varies, between <25% to >75% and there is 'intermediate' susceptibility to surface water flooding, with two recorded historic surface water flooding incidents. However, no historic flood events are considered to have had 'significant consequences'.
Suffolk County Council Preliminary FRA Report (AECOM, 2011)	Relatively low resolution mapping indicates areas where the River Stour crosses the project have ≥75% susceptibility to groundwater flooding. There is no mention of any flood events within the study area.
Essex County Council Local Flood Risk Management Strategy (Essex County Council, 2018)	There is no mention of any flood events in the study area.
Suffolk Flood Risk Management Strategy (Suffolk Flood Risk Management Partnership, 2016)	The mapping indicates areas of the Proposed Alignment in proximity to watercourses, would experience >0.3m of surface water flooding in a 1% annual exceedance probability flood event. There is no mention of any flood events within the study area.

4.1.2 There are no relevant Flood Investigation Reports published as a requirement of Section 19 of the Flood and Water Management Act 2010. However, this does not preclude the possibility of there having been more minor flooding within the local area.

4.2 Sources of Flooding

4.2.1 Table 4.2 outlines the sources of flooding which have been scoped out of the assessment after publication of the Scoping Opinion (**application document 6.6**):

Table 4.2 – Summary of Scoped Out Flood Sources

Flood Source	Reason for Scoping Out
Sewers (foul water) and Water Mains	As outlined in ES Chapter 4: Project Description (**application document 6.2.4**), the GSP substation would include permanent surface and foul drainage systems. Hard standing areas would be drained to the surface water drainage system. There would be no permanent discharges required but a waste/foul water system would be used on site, comprising short pipes from the two amenities buildings to two separate cesspools that would be periodically emptied as required. Wastewater generated would be very limited given the site would be unmanned and the wastewater would only come from use of facilities in the amenities buildings. The CSE compounds would accommodate small control buildings but would not be supplied with mains water or have welfare facilities generating foul drainage. Therefore, this source of flooding has been scoped out.
Tidal and Coastal	The Order Limits are not located near any coastal or tidal areas. Therefore, this source of flooding has been scoped out.
Reservoirs and other Artificial Sources	There are no reservoirs, canals or other artificial water bodies within or in the vicinity of the Order Limits. Therefore, this source of flooding has been scoped out.

4.2.2 Based on the review of existing flood risk data and reports, the following potential sources of flooding have been considered in relation to the project:

- Fluvial;
- Pluvial (surface water); and
- Groundwater.

4.2.3 Given the nature of the project, there is an important distinction to be made between flood risk during construction and operational risk. The construction phase would require various temporary works in terms of working areas, large excavations and other elements, which, once the works are complete, would be removed. The operational phase would require a smaller footprint of works for a design life of 40 years. The assessment presented in the following sections assesses both construction and operation for each source of flooding.

4.2.4 The assessment considers both the potential impacts on the project, and the potential impacts elsewhere as a result of the project.

4.3 Fluvial Flood Risk

Introduction

4.3.1 The Flood Map for Planning (Environment Agency, 2022c) shown in Figure 1 shows the Flood Zones as defined in Chapter 3. It highlights that the project, as well as proposed temporary construction compounds, are largely in Flood Zone 1. Localised areas of the Proposed Alignment (as shown on the General Arrangement Plans (**application document 2.10**)) are located in Flood Zone 3. The approximate widths of these floodplain areas and the section of the project they are located within the Order Limits are:

- Section AB: Belstead Brook, 80m where the 400kV overhead lines would be constructed and 50m where the 132kV overhead line would be removed;
- Section AB: River Brett tributary, 80m;
- Section C: River Brett 140m;
- Section E: River Box, 130m;
- Section F: River Stour tributary, 30m; and
- Section G: River Stour, 600m.

4.3.2 The most recent record (1968) of fluvial flooding along the River Stour and River Brett within the Order Limits is documented in the Babergh District Council SFRA (JBA Consulting, 2009).

4.3.3 Overall, it is considered that the risk of flooding to the project from rivers is low; however, small areas local to some watercourse crossings are at higher risk.

Construction Phase Risk Assessment

4.3.4 During construction, the majority of the works would take place outside of the floodplain in Flood Zone 1, where the risk of flooding from rivers is defined as very low. At watercourse crossings, particularly at crossings for underground cables, there is a higher risk. However, good practice measures W04, W07, W08, W11, W14, W15, W17, GG06, GG07, GG15 and AS08 in the CoCP (**application document 7.5.1**), would be put in place to reduce flood risk during construction.

4.3.5 The sections of overhead line would have very limited flood risk associated with them during construction. The overhead lines cable would be installed without effects to the watercourses in locations where the floodplain extents are limited. Whilst there would be a requirement to cross watercourses for the temporary construction access routes, flood risk effects would be avoided through the design of suitably sized and orientated temporary crossing structures (W04). The underground cable sections also have limited interactions with the fluvial floodplain outside of the main river crossings.

4.3.6 The proposed GSP substation is not located in Flood Zone 2 or 3, and therefore there is no potential for it to increase fluvial flood risk during construction. This is also the case for the proposed CSE compounds and the main works construction compound off the A134.

4.3.7 The River Stour has the most extensive floodplain within the Order Limits, and both the river and its floodplain would be crossed by the proposed 400kV underground cables. A trenchless crossing of the river is proposed for the underground cable installation, which

avoid effects on the River Stour during construction (W11). Embedded measure EM-G05 states that the Order Limits have been widened outside of the floodplain at the crossing of the River Stour, to accommodate soil storage outside of the floodplain where practicable, or to allow placement of soil leaving gaps to avoid blocking floodplain flow paths.

4.3.8 EM-E05 and EM-G04 state that a trenchless crossing is proposed at the River Box and Stour respectively. The drive pits would be located outside of Flood Zone 3 of the River where practicable or would be managed in accordance with the flood risk action plan (W08 in the CoCP). On receipt of a severe flood warning, the Contractor would deploy suitable flood protection measures to safeguard work site personal and equipment.

4.3.9 The underground cables would be installed using opencut techniques at the crossing of ordinary watercourses. The cables would be installed in dry working areas with the channel flow being over-pumped to maintain downstream conveyance. These works would be timed to avoid flood flow conditions where practicable (W04). Once the cables are installed, the river channel would be reinstated.

4.3.10 Temporary clear span bridge crossings (e.g. bailey bridge) would be used for the temporary access route crossing at the River Stour, River Box and the River Brett. These will be designed with soffits that are raised 600mm above the flood level in accordance with Environment Agency requirements and would be set back 8m (or distance otherwise agreed with the Environment Agency) from the river's edge (W17). An example of a proposed temporary bridge is shown on the Design and Layout Plans Temporary Bridge for Access (**application document 2.11.13**).

4.3.11 The remaining temporary access route crossings would be culverted and involve the installation of temporary dams to create a dry working area during installation. The flow would be over-pumped to maintain downstream conveyance. These installation works would be timed to avoid flood flow conditions where practicable, or if periods of work were necessary when higher flow conditions could be expected, suitable pumping provision would be put in place, with standby pumps also made available (W04). Once installed, the flow would pass through the culvert, which would be sized to accommodate the flow regimes of the respective watercourses (W04). The culverts could be in place for the duration of construction activities and would be removed at the end of construction and the river banks reinstated. An example of a proposed temporary culvert is shown on the Design and Layout Plans Temporary Culvert for Access (**application document 2.11.14**).

4.3.12 These embedded measures and the good practice measures would reduce fluvial flood risk to the project as well as limit any flood risk impacts arising from project construction activities. With these measures in place the residual flood risk would be very low.

Operational Phase Risk Assessment

4.3.13 During operation, the reinforcement would generally be elevated (overhead line) or buried (underground cable). Good practice measure W14 states that pylons would not be constructed within 8m of the top of bank of main rivers, therefore even with the flexibility provided by the Limits of Deviation the GSP substation, CSE compounds and pylons would be situated in Flood Zone 1. Operational flood risk in relation to rivers is therefore concluded to be very low.

4.3.14 In line with good practice measures W06 and GG07, detailed in the CoCP (**application document 7.5.1**), there will be no permanent land raising within Flood Zone 3, nor any permanent changes to the channel form of any watercourses, and land will be restored to pre-construction condition and use. The risk of fluvial flooding impacts on third parties as a result of the project during its operation is also very low.

Conclusion

4.3.15 The FRA has concluded that the project during its construction would be generally at low risk of flooding from rivers. Locally higher risks, particularly to temporary works within main river floodplains, would be reduced through embedded and good practice measures. These measures would also protect construction workers, limit damages to construction equipment and materials and also limit any impacts of the project on fluvial flood risk.

4.3.16 During operation of the project, there would be a very low risk of fluvial flooding and there would be no increase in flood risk as a consequence of the project's operation.

4.4 Surface Water Flood Risk

Introduction

4.4.1 The Environment Agency Risk of Flooding from Surface Water Map (Environment Agency, 2022b) is informed by 'direct rainfall' modelling undertaken at a high (2m) spatial resolution. It illustrates those areas at elevated risk of surface water flooding, in low spots down-gradient of sloping ground or in the topographic valleys associated with current or former watercourses.

4.4.2 The Risk of Flooding from Surface Water Map indicates that most of the project is at 'very low' risk of flooding from surface water (Figure 2). There are localised areas at higher risk in the vicinity of the proposed watercourses crossings, ranging from low to high risk. This includes the Belstead Brook, River Brett, River Box and River Stour, and their associated floodplains and smaller tributaries.

4.4.3 There is only one recorded incident of historical surface water flooding within the Order Limits, this is in the Essex County Council Preliminary Flood Risk Assessment (PRFA). However, this does not appear to coincide with any of the proposed permanent works.

Construction Phase Risk Assessment

4.4.4 During construction, activities would include topsoil stripping and excavation and construction of temporary access routes and construction compounds, which could temporarily change existing land surface permeabilities and have an effect on the rainfall runoff regime. Also, there is potential for existing land drainage systems to be disrupted.

4.4.5 The CoCP (**application document 7.5.1**) includes good practice measures to reduce the impacts of these activities on land drainage and surface water flood risk. Measures W07 which states where new or additional surfacing is required on any access tracks and compound areas, these will be permeable surfaces where ground conditions allow or will be designed to achieve green field rates. Runoff across the site will also be controlled through a variety of methods including header drains, buffer zones around watercourses, on-site ditches, silt traps and bunding (GG15).

4.4.6 In addition, where appropriate, pre-construction field drainage would be installed within the working area to help prevent possible water-logging of the working area and therefore the need for temporary dewatering during construction and to enable the landowner's current drainage system to continue working throughout the period of construction. Landowners will be informed of the design of the land drainage proposals. The design will pay particular attention to the need to reduce the risk so that the drains do not act as pathways for contamination or cause flooding off-site, consulting with the LLFA where necessary. A specialised drainage contractor will review the designs and provide advice to National Grid and the main works contractor during all relevant construction and reinstatement activities (W16). The working area would be reinstated after construction.

Operational Phase Risk Assessment

4.4.7 As outlined in good practice measure W12 in the CoCP (**application document 7.5.1**), the drainage design at the GSP substation and the CSE compounds would be designed in accordance with the requirements of the SuDS Design Guide (Essex County Council, 2020) and the SuDS Palette (Suffolk County Council, 2018). It would include allowances for climate change in accordance with Environment Agency requirements. By conforming to the design standards, the drainage infrastructure would provide the storage necessary to achieve discharges at greenfield rates across the project.

4.4.8 Therefore, there would be no impact on the rainfall runoff regime or surface water flood risk during operation. The reinforcement itself is, in the main, of very low vulnerability to surface water flooding.

Conclusion

4.4.9 The FRA has concluded that there would not be any increase in surface water flood risk as a consequence of the project during construction or operation.

4.5 Groundwater Flood Risk

Introduction

4.5.1 Groundwater flood risk is not as well-defined as other sources of flooding, and an assessment of risk often requires consideration of geological conditions. Groundwater flooding can occur from two general mechanisms:

- Clearwater flooding – where the water table in unconfined aquifers rises above the ground surface, associated with permeable bedrock such as Chalk and common in areas where 'winterbourne' streams are present, which may run dry for much of the year; and
- River-groundwater interaction – where river levels interact with permeable superficial deposits along river valleys, potentially flooding areas away from the river without necessarily overtopping the river banks.

4.5.2 This assessment of flood risk from groundwater is supported by the Groundwater Assessment presented in ES Chapter 10 (**application document 6.2.10**).

Construction Phase Risk Assessment

4.5.3 Section E: Dedham Vale AONB and Section G: Stour Valley would involve trench excavation for the underground cables. The cables would be laid in trenches which would be approximately 1.3m to the base of the trench and approximately 0.9m from the finished ground level to the top of the protective tile. Ground investigation data gathered for the project indicates that the groundwater table would not be intercepted along most of the cable trenches, and therefore the risk of groundwater flooding is low.

4.5.4 Groundwater levels local to the River Stour and Sudbury Branch Railway Line have been identified at less than 1m below ground level. Groundwater levels could also be high in the vicinity of the River Box crossing and some local discharge to ground may be required during construction. Trenchless crossings would be used to install the underground cables at these locations, which would reduce the risk of groundwater emergence at the surface. Further details on localised dewatering are described in the CEMP (**application document 7.5)**.

Operational Phase Risk Assessment

4.5.5 The project is of low vulnerability to groundwater flooding during operation.

4.5.6 The risk of groundwater flooding along the majority of the reinforcement is low. There are localised areas underlain by a Principal aquifer, that the relevant PRFA (Essex County Council, 2018 and Aecom, 2011) indicate have a higher risk of groundwater emergence. The project components located in these areas are mostly overhead lines (pylons) which are designed to be resilient to groundwater flooding. Buried cables are also designed to be resilient to this form of flooding. The proposed GSP substation is underlain by a Secondary aquifer, meaning the risk of clearwater flooding there is remote.

4.5.7 The new pylons and CSE compounds would have concrete foundations. The effect of these foundations on groundwater flows would be very localised and so it can be assumed any additional impact on groundwater flooding would be negligible.

4.5.8 In accordance with good practice measure W12 in the CoCP (**application document 7.5.1**), the drainage infrastructure associated with new areas of permanent impermeable land would not alter groundwater recharge patterns.

Conclusion

4.5.9 Overall, the project is at low risk of groundwater flooding, and both operation of the project and construction activities would have no increased impact on this source of flooding.

4.6 Summary of Potential Flood Sources

4.6.1 Table 4.3 provides a summary of the relative risk from all sources of flooding for both construction and operational phases.

Table 4.3 – Summary of Assessment of Flood Risk By Source

Source	Degree of Hazard	Comments
Fluvial	Construction: Low to High locally	Construction: Largely low risk with areas crossing watercourses at higher risk.
	Operation: Low	Operation: No permanent changes to watercourses or their flow regimes and floodplains.

Source	Degree of Hazard	Comments
Surface Water	Construction: Low to Medium/High locally Operation: Low	Construction: Largely low risk with areas crossing watercourses at higher risk. Operation: overhead lines and underground cable have negligible risk, GSP substation, CSE compounds have low risk.
Groundwater	Construction: Low to Medium locally Operation: Low	Construction: A trenchless crossing is proposed for crossing the River Box, River Stour, the Sudbury Branch Railway Line and the woodland to the south of Ansell's Grove. Operation: GSP substation and CSE compounds at low risk; overhead lines and underground cables in Section G: Stour Valley at low risk.

5. Conclusion

5.1.1 This FRA accompanies an application by National Grid for the reinforcement of the transmission network between Bramford Substation in Suffolk and Twinstead Tee in Essex. It has been carried out in accordance with NPS EN-1 and EN-5. Reference has also been made to the NPPF and the associated PPG for additional guidance regarding flood risk and development.

5.1.2 This FRA has been informed through consultation with relevant stakeholders, including the Environment Agency, Essex County Council and Suffolk County Council.

5.1.3 The predicted impacts of climate change on rainfall intensity have been included in the assessment using the Met Office UK Climate Projections and the Environment Agency Flood Risk Assessment Climate Change Allowances.

5.1.4 A sequential approach has been taken in siting the reinforcement. Due to the linear nature of the project, some sections must necessarily be located in areas with a medium or high likelihood of flooding (Flood Zones 2 and 3). However, evidence of passing the Sequential Test is presented and application of the Exception Test is unnecessary for this project.

5.1.5 National Grid has made a number of commitments around flood risk management measures. These include embedded measures, which are listed within the Register of Environmental Actions and Commitments (**application document 7.5.2**). They also include good practice measures which are documented in the CoCP (**application document 7.5.1**). With these measures in place, the residual risk during the construction phase has been assessed as low risk. Due to the nature of the project (mainly pylons and underground cables) the residual risk during operation is assessed as very low.

5.1.6 In conclusion, this FRA demonstrates that the requirements of EN-1, EN-5 and the NPPF and its associated PPG with respect to flood risk have been met, and the flood risk management measures identified would be secured through the CEMP (**application document 7.5**) and Requirement 4 of the draft DCO.

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Figures

NATIONAL GRID (BRAMFORD TO TWINSTEAD REINFORCEMENT) ORDER
PINS APPLICATION NUMBER: EN020002
ENVIRONMENT AGENCY FLUVIAL FLOOD ZONES - KEY PLAN
REGULATION 5(2)(e)
SHEET 1 OF 1
IN THE DISTRICTS OF MID SUFFOLK DISTRICT COUNCIL, BABERGH DISTRICT COUNCIL AND BRAINTREE DISTRICT COUNCIL

Application Document 5.5

Legend
- Section boundaries
- Order Limits
- Local authority districts
- Existing Bramford Substation

Mid Suffolk District Council
Babergh District Council
Ipswich Borough Council
Braintree District Council
Colchester Borough Council
Tendring District Council

Sheet 1
Sheet 2
Sheet 3

Bramford Substation
Section AB: Bramford Substation/Hintlesham
Section C: Brett Valley
Section D: Polstead
Section E: Dedham Vale Area of Outstanding Natural Beauty
Section F: Leavenheath/Assington
Section G: Stour Valley
Section H: Grid Supply Point Substation

Market, Clare, Acton, Sudbury, Hadleigh, Ipswich, Halstead, Colchester

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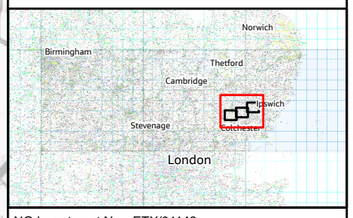

NG Investment No. ETX/01142

ISSUE	DATE	REMARKS	DRWN	CHKD	APPD
A	03/2023	Rev A for DCO Application	GW	LD	CW

PROJECT: Bramford to Twinstead Reinforcement

nationalgrid

TITLE: Figure 1 Environment Agency Fluvial Flood Zones - Key Plan

CIRCUIT / SITE: Bramford – Pelham & Bramford – Braintree – Bulls Lodge

GIS

ORIGINATOR DRAWING NO. AAA_BTT_Figure_A5_5_1_FRA_KeyPlan_Rev0

A3

NG DRAWING No. BT-JAC-020631-500-0008

SHEET NO. 1

NO. OF SHEETS 1

ISSUE: A

SCALE: 1:125000

NATIONAL GRID (BRAMFORD TO TWINSTEAD REINFORCEMENT) ORDER
PINS APPLICATION NUMBER: EN020002
ENVIRONMENT AGENCYFLUVIAL FLOOD ZONES
REGULATION 5(2)(e)
SHEET 1 OF 3
IN THE DISTRICTS OF MID SUFFOLK DISTRICT COUNCIL, BABERGH DISTRICT COUNCIL AND BRAINTREE DISTRICT COUNCIL

Application Document 5.5

AB: Bramford Substation/Hintlesham

C: Brett Valley

- Section boundaries
- Order Limits
- Proposed overhead line
- Proposed modification to overhead line
- Proposed realignment of existing overhead line
- Proposed removal of overhead line
- Proposed underground cables
- Proposed cable sealing end compounds
- Temporary construction compounds
- Grid supply point substation
- Main river
- Ordinary watercourse
- Environment Agency flood zone 3
- Environment Agency flood zone 2

247000 246000 245000 244000 243000 242000 241000 240000 239000

602000 603000 604000 605000 606000 607000 608000 609000 610000 611000 612000 613000

0 0.25 0.5 0.75 1 Kilometers

NG Investment No. ETX/01142

ISSUE	DATE	REMARKS	DRWN	CHKD	APPD
A	03/2023	Rev A for DCO Application	GW	LD	CW

PROJECT: Bramford to Twinstead Reinforcement

nationalgrid

TITLE: Figure 1 Environment Agency Fluvial Flood Zones

CIRCUIT / SITE: Bramford – Pelham & Bramford – Braintree – Bulls Lodge

GIS

ORIGINATOR DRAWING NO. AAA_BTT_Figure_A5_5_1_FRA_Rev0

A3

NG DRAWING No. BT-JAC-020631-500-0008

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NATIONAL GRID (BRAMFORD TO TWINSTEAD REINFORCEMENT) ORDER
PINS APPLICATION NUMBER: EN020002
ENVIRONMENT AGENCYFLUVIAL FLOOD ZONES
REGULATION 5(2)(e)
SHEET 2 OF 3
IN THE DISTRICTS OF MID SUFFOLK DISTRICT COUNCIL, BABERGH DISTRICT COUNCIL AND BRAINTREE DISTRICT COUNCIL

Application Document 5.5

D: Polstead

E: Dedham Vale Area of Outstanding Natural Beauty

F: Leavenheath/Assington

Dedham Vale West Cable Sealing End Compound

Dedham Vale East Cable Sealing End Compound

River Box

River Stour

Polstead Heath

Polstead

Leavenheath

Assington

Newton

Lower

- Section boundaries
- Order Limits
- Proposed overhead line
- Proposed modification to overhead line
- Proposed realignment of existing overhead line
- Proposed removal of overhead line
- Proposed underground cables
- Proposed cable sealing end compounds
- Temporary construction compounds
- Grid supply point substation
- Main river
- Ordinary watercourse
- Environment Agency flood zone 3
- Environment Agency flood zone 2

0 0.25 0.5 0.75 1 Kilometers

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PROJECT: Bramford to Twinstead Reinforcement

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TITLE: Figure 1 Environment Agency Fluvial Flood Zones

CIRCUIT / SITE: Bramford – Pelham & Bramford – Braintree – Bulls Lodge

GIS

ORIGINATOR DRAWING NO. AAA_BTT_Figure_A5_5_1_FRA_Rev0

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ISSUE: A

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PINS APPLICATION NUMBER: EN020002
ENVIRONMENT AGENCYFLUVIAL FLOOD ZONES
REGULATION 5(2)(e)
SHEET 3 OF 3
IN THE DISTRICTS OF MID SUFFOLK DISTRICT COUNCIL, BABERGH DISTRICT COUNCIL AND BRAINTREE DISTRICT COUNCIL

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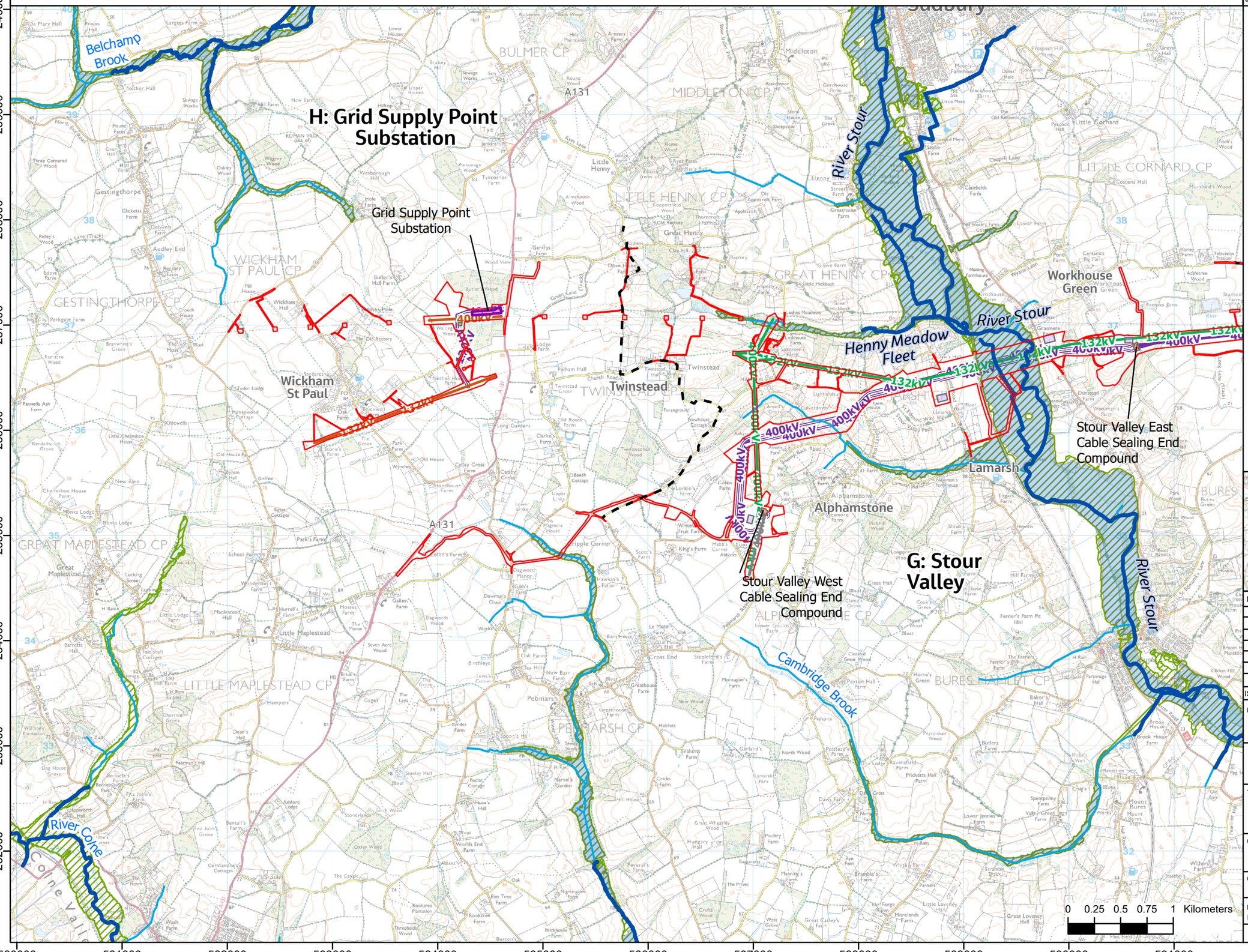

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TITLE: Figure 1 Environment Agency Fluvial Flood Zones

CIRCUIT / SITE :	
Bramford – Pelham & Bramford – Braintree – Bulls Lodge	GIS
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NATIONAL GRID (BRAMFORD TO TWINSTEAD REINFORCEMENT) ORDER
PINS APPLICATION NUMBER: EN020002
ENVIRONMENT AGENCY SURFACE WATER FLOOD ZONES - KEY PLAN
REGULATION 5(2)(e)
SHEET 1 OF 1
IN THE DISTRICTS OF MID SUFFOLK DISTRICT COUNCIL, BABERGH DISTRICT COUNCIL AND BRAINTREE DISTRICT COUNCIL

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Legend
- Section boundaries
- Order Limits
- Local authority districts
- Existing Bramford Substation

Mid Suffolk District Council
Babergh District Council
Ipswich Borough Council
Braintree District Council
Colchester Borough Council
Tendring District Council

Sheet 1
Sheet 2
Sheet 3

Bramford Substation
Section AB: Bramford Substation/Hintlesham
Section C: Brett Valley
Section D: Polstead
Section E: Dedham Vale Area of Outstanding Natural Beauty
Section F: Leavenheath/Assington
Section G: Stour Valley
Section H: Grid Supply Point Substation

Market, Clare, Acton, Sudbury, Hadleigh, Ipswich, Halstead, Colne Valley, Colchester, Norwich, Birmingham, Thetford, Cambridge, Ipswich, Stevenage, Colchester, London

255000
250000
245000
240000
235000
230000
225000

580000
585000
590000
595000
600000
605000
610000
615000

0 1 2 3 4 5 Kilometers

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TITLE: Figure 2 Environment Agency Surface Water Flood Zones - Key Plan

CIRCUIT / SITE: Bramford – Pelham & Bramford – Braintree – Bulls Lodge

GIS

ORIGINATOR DRAWING NO. AAA_BTT_Figure_A5_5_2_FRA_KeyPlan_Rev0

A3

NG DRAWING No. BT-JAC-020631-500-0009

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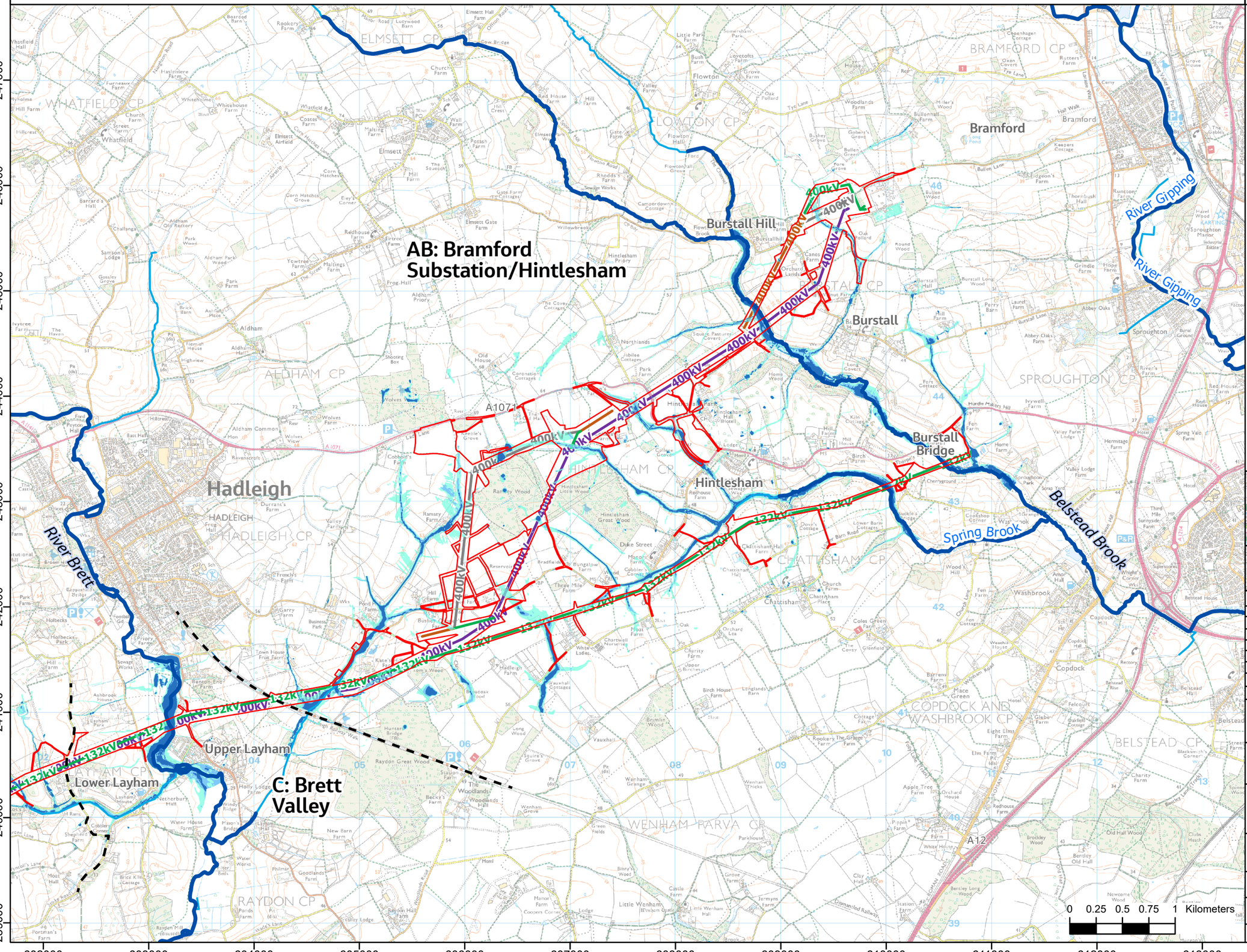
NATIONAL GRID (BRAMFORD TO TWINSTEAD REINFORCEMENT) ORDER
PINS APPLICATION NUMBER: EN020002
ENVIRONMENT AGENCYSURFACE WATER FLOOD ZONES
REGULATION 5(2)(e)
SHEET 1 OF 3
IN THE DISTRICTS OF MID SUFFOLK DISTRICT COUNCIL, BABERGH DISTRICT COUNCIL AND BRAINTREE DISTRICT COUNCIL



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- Section boundaries
- Order Limits
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- Proposed underground cables
- Proposed cable sealing end compounds
- Temporary construction compounds
- Grid supply point substation
- Main river
- Ordinary watercourse
- Risk of flooding from surface water 3.3%
- Risk of flooding from surface water 1%
- Risk of flooding from surface water 0.1%

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TITLE: Figure 2 Environment Agency Surface Water Flood Zones

CIRCUIT / SITE: Bramford – Pelham & Bramford – Braintree – Bulls Lodge

GIS

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REGULATION 5(2)(e)
SHEET 2 OF 3
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D: Polstead

E: Dedham Vale Area of Outstanding Natural Beauty

F: Leavenheath/Assington

Dedham Vale West Cable Sealing End Compound

Dedham Vale East Cable Sealing End Compound

River Box

River Stour

River Brett

Polstead Heath

Lower

Polstead

Assington

Leavenheath

Newton

Boxford

Stoke-by-Nayland

Nayland

A134

A1087

- Section boundaries
- Order Limits
- Proposed overhead line
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0 0.25 0.5 0.75 1 Kilometers

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IN THE DISTRICTS OF MID SUFFOLK DISTRICT COUNCIL, BABERGH DISTRICT COUNCIL AND BRAINTREE DISTRICT COUNCIL

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H: Grid Supply Point Substation

Grid Supply Point Substation

G: Stour Valley

Stour Valley West Cable Sealing End Compound

Stour Valley East Cable Sealing End Compound

- Section boundaries
- Order Limits
- Proposed overhead line
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0 0.25 0.5 0.75 1 Kilometers

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