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Norwich to Tilbury

Volume 6: Environmental Statement

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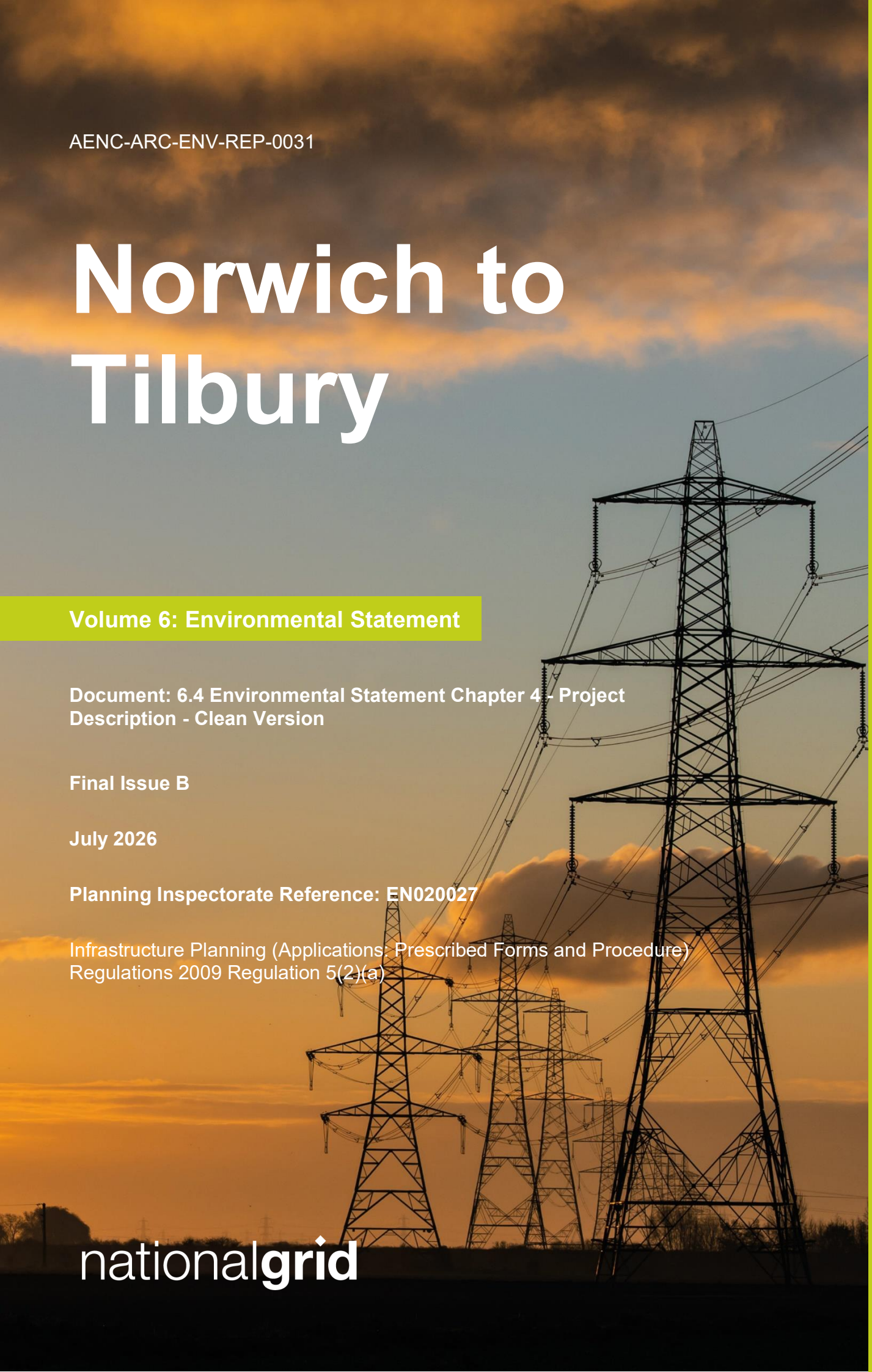


nationalgrid

Revision History

Version	Date	Submitted at
A	29 August 2025	DCO Application
B	21 July 2026	Deadline 7 to include latest cross references

Contents

4. Project Description

4.1 Introduction

4.1.1 Norwich to Tilbury (the 'Project') comprises reinforcement of the transmission network between the existing Norwich Main Substation in Norfolk and Tilbury Substation in Essex, via Bramford Substation, the new East Anglia Connection Node (EACN) Substation and the new Tilbury North Substation.

4.1.2 This chapter describes the application design that has been used for the basis of the Environmental Impact Assessment (EIA) presented within the Environmental Statement (ES) (Volume 6 of the Development Consent Order (DCO) application). It includes reasonable worst-case assumptions about the design and construction methods that may be used to construct the Project. These assumptions are then carried through into the environmental topic chapters (Chapters 6 to 16 (document references 6.6 to 6.16)) as the basis of their assessments.

4.1.3 This chapter is supported by the following figures and appendices:

- Appendix 4.1: Greenhouse Gas Assessment (document reference 6.4.A1) (Revision B)
- Appendix 4.2: Watercourse Crossing Details (document reference 6.4.A2) (Revision C)
- Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B)
- Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B).

4.1.4 The design has developed as a result of the ongoing engineering design, landowner discussions and environmental assessment. It has also been informed by feedback from stakeholders received during informal engagement and non-statutory and statutory consultation. This chapter builds on Chapter 3: Alternatives (document reference 6.3) (Revision B) which sets out how the Project has evolved from a concept stage, through strategic options, route corridors, and draft alignments to the Project presented within the DCO application.

4.1.5 As per Chapter 1: Introduction (document reference 6.1) (Revision B), the Project comprises:

- A new 400 kilovolt (kV) electricity transmission connection of approximately 180 km overall length from Norwich Main Substation to Tilbury Substation via Bramford Substation, a new EACN Substation and a new Tilbury North Substation, including:
  - Approximately 159 km of new overhead line supported on approximately 509 pylons, either standard steel lattice pylons (approximately 50 m in height) or low height steel lattice pylons (approximately 40 m in height) and some of which would be gantries (typically up to 15 m in height) within proposed Cable Sealing End (CSE) compounds or existing or proposed substations

  - Approximately 21 km of 400 kV underground cabling, some of which would be located through the Dedham Vale National Landscape (an Area of Outstanding Natural Beauty (AONB[1])

- Up to seven new CSE compounds (with permanent access) to connect the overhead lines to the underground cables
- Modification works to connect into the existing Norwich Main Substation and a substation extension at the existing Bramford Substation
- A new 400 kV substation on the Tendring Peninsula, referred to as the EACN Substation (with a new permanent access). This is proposed to be an Air Insulated Switchgear (AIS) substation
- A new 400 kV substation to the south of Orsett Golf Course in Essex, referred to as the Tilbury North Substation (with a new permanent access). This is proposed to be a Gas Insulated Switchgear (GIS) substation
- Modifications to the existing National Grid Electricity Transmission overhead lines to facilitate the connection of the existing network into the new Tilbury North Substation to provide connection to the Tilbury Substation
- Ancillary and/or temporary works associated with the construction of the Project.

4.1.6 In addition, third party utilities diversions and/or modifications would be required to facilitate the construction of the Project. There would also be land required for environmental mitigation and Biodiversity Net Gain (BNG).

4.1.7 As well as the permanent infrastructure, land would also be required temporarily for construction activities including, for example, working areas for construction equipment and machinery, site offices, welfare, storage and temporary construction access.

4.1.8 Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) presents details of the Project. Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) presents only the permanent features of the Project including permanent access routes associated with other elements of the work (e.g. to specific pylon locations, or to the underground cable). There would be no physical works associated with these permanent access routes to pylons or underground cables. They are proposed rights of access only to allow for any maintenance or refurbishment required.

4.1.9 In addition, the Works Plans (document reference 2.3) (Revisions A – C) provide tables of parameters relevant to each permanent element of the Project.

[1] National Landscape is the rebranded name of an Area of Outstanding Natural Beauty (AONB) from 22 November 2023

Structure of the Chapter

4.1.10 The remainder of this chapter is divided into the following sections:

- Section 4.2: Project Sections: provides an overview of the Project's key features and the proposed technology solution (i.e. overhead line or undergrounding) which is broken down by Project Section
- Section 4.3: Environmental Mitigation Measures: describes embedded measures built into the Project and provides a description of other types of mitigation measures
- Section 4.4: Good Design Principles: describes the good design principles that have been considered including reducing the use of raw materials and waste generation. It also sets out how the Project has been designed to be resilient to climate change
- Section 4.5: Order Limits and Limits of Deviation (LoD): describes the extents of the maximum deviation permitted for permanent features of the Project presented in this ES (Volume 6 of the DCO application)
- Section 4.6: Application of a Rochdale Envelope and Design Scenarios: describes elements of the Project where flexibility within the design is allowed to provide the design and build Main Works Contractor(s) with sufficient scope for value engineering through innovative design and/or construction techniques
- Section 4.7: Construction – General: describes the Project assumptions that have been used for undertaking the assessment presented in the ES, including construction schedule, working hours and estimated construction workforce
- Section 4.8: Construction – Temporary and Permanent Features: describes how the Project would be constructed including the temporary work features, e.g., temporary construction compounds and haul roads
- Section 4.9: Details of Permanent Features: describes the permanent features of the Project that would be in place once the Project is operational
- Section 4.10: Operation (and Maintenance): describes the activities that are anticipated during the operational phase including site inspections and routine maintenance
- Section 4.11: Decommissioning: This describes what would happen once the Project reaches the end of its design life and/or was no longer required.

4.2 Project Sections

4.2.1 As described in Chapter 1: Introduction (document reference 6.1) (Revision B), the Project has also been sub-divided into eight geographical sections for reader accessibility, based largely on Local Planning Authority boundaries. These are shown on Figure 1.1: Site Location Plan and Project Sections (document reference 6.1.F1) and comprise:

- Section A – South Norfolk Council
- Section B – Mid-Suffolk District Council
- Section C – Babergh District Council, Colchester City Council and Tendring District Council
- Section D – Colchester City Council
- Section E – Braintree District Council
- Section F – Chelmsford City Council and Brentwood Borough Council
- Section G – Basildon Borough Council and Brentwood Borough Council (and part of Chelmsford City Council)
- Section H – Thurrock Council.

4.2.2 Table 4.1 outlines details of each section the Project is split into. The details in Table 4.1 should be read in conjunction with Figure 1.1: Site Location Plan and Project Sections (document reference 6.1.F1), Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B). Figures indicate pylon locations with pylon reference numbering every five pylons with an identification reference ‘RG’, ‘JC’ or ‘TB’ used before each number.

Table 4.1 Description of the Project from north to south by section

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
A	South Norfolk Council	29	The Project would start at its northern end at National Grid's existing Norwich Main Substation. Modification works to connect into the substation are required. The Order Limits head south from Dunston then south-west through arable fields before crossing an unnamed river between Flordon and Toprow. This river is connected to the Flordon Common Site of Special Scientific Interest (SSSI) located approximately 320 m to the south-east of the Order Limits. The Order Limits continue generally south-west through arable fields and crossing some narrow lanes, passing between Forncett St Mary and Forncett End. The Order Limits continue and pass within approximately 110 m of an area of ancient woodland (Bunwell Wood) at Bunwell Hill. The Order Limits then cross the River Tas, west of Cargate Common, and continue south-south-west to the west of Tibenham Airfield. The Project then crosses the B1134 between Goose Green and Long Row, continues south through arable fields, before crossing another unnamed river, approximately 180 m south-east of Shelfanger Meadows SSSI.	Norwich Main Substation Unnamed rivers Flordon Common SSSI Bunwell Wood (Ancient Woodland) River Tas B1134 B1077 A1066 Bressingham Steam Museum and Gardens Church of St Remigius (Grade I) Wortham Ling SSSI Roydon Fen Local Nature Reserve River Waveney	Modification works to connect into the existing Norwich Main Substation Pylons and overhead line

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			The Project then heads west after crossing the B1077 (Shelfanger Road) and then another unnamed river before heading south, around Snow Street, crossing the A1066 between the Bressingham Steam Museum and Gardens and the Grade I listed Church of St Remigius, Roydon. The Project then passes south-east between the Wortham Ling SSSI and Roydon Fen Local Nature Reserve, crossing into Section B, north of Ling Road.		
B	Mid-Suffolk District Council	42	The Project enters Section B and continues to the south past Wortham Ling, through arable fields, before crossing the A143 at Old Bury Road. Shortly after, the Project crosses an unnamed river. The Project continues south-west past on the northern side of Mellis and the Mellis Conservation Area, then heads south and south-east before crossing an unnamed river located to the north-east of Gislingham. The Project continues generally south before crossing the Great Eastern Main Line Railway, which travels north-east to south-west across the path of the Order Limits. The Project continues south past Finningham and Mendlesham Green, crossing the River Gipping.	A143 Unnamed rivers Mellis Conservation Area Railway lines River Gipping A1120 A14 Badley Conservation Area B1113 Great Newton Wood Ancient Woodland Little Newton Wood Ancient Woodland Lower Wood Ancient Woodland B1078	Works at the existing Bramford Substation Substation extension at the existing Bramford Substation Pylons and overhead line

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			The Project continues south before crossing the A1120 at Bell's Lane, then continues south passing by the Grade II* listed Roydon Hall, and crossing the A14 between Creeting St Peter and Creeting St Mary. Shortly after, it crosses an unnamed river and another section of the River Gipping, east of the Badley Conservation Area. The Order Limits then cross the Ipswich to Ely railway line between Stowmarket and Needham Market before crossing the B1113. South of the B1113, the Project passes close to the Great Newton Wood and Little Newton Wood Ancient Woodlands and further south the Lower Wood Ancient Woodland. The Project continues south before crossing the B1078 between Barking Tye and Ringshall Stocks. Here, the Order Limits split in two, continuing south on either side and adjacent to Middle Wood (Ancient Woodland and SSSI) and crosses a river known as 'The Channel'. The two sections of the Order Limits both cross Bildeston Road and continue to the south-east to the north of Flowton where the two sections join again. The Project continues south-east adjacent to Somersham Park Ancient Woodland. The Project then heads south into the existing Bramford Substation where an extension to the	Middle Wood Ancient Woodland and SSSI Offton Castle The Channel Somersham Park Ancient Woodland Bullen Wood Ancient Woodland Round Wood Ancient Woodland Millers Wood Ancient Woodland Bramford Substation	

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			existing site is proposed, along with works to connect the Project into the substation. The Order Limits are adjacent to Bullen Wood Ancient Woodland and interact with Round Wood Ancient Woodland and Millers Wood Ancient Woodland at this location. The Order Limits extend east to allow for third party mitigation works. Section B ends to the south of Round Wood Ancient Woodland.		
C	Babergh District Council, Colchester City Council and Tendring District Council	29	The Project in Section C starts adjacent to Burstall Long Wood Ancient Woodland with the Order Limits split into two sections, allowing for the proposed alignment and third-party mitigation works to the east. The alignment continues south and crosses the A1071 at Thorpe's Hill. Shortly afterwards it heads south-west and crosses an unnamed river. The Order Limits extend east to allow for third party mitigation works. The Project then crosses Spring Brook. The Project then heads south-west through arable fields, crossing Chattisham Road, before continuing west-south-west adjacent to Brimlin Wood Ancient Woodland and Wenham Thicks Ancient Woodland. The Project then transitions from overhead line to underground cable at a	Burstall Long Wood Ancient Woodland New EACN Substation A1071 Spring Brook Brimlin Wood Ancient Woodland Wenham Thicks Ancient Woodland. B1070 B1068 River Stour Black Brook A12 Dedham Vale National Landscape B1029 A137	CSE compound (north of the Dedham Vale National Landscape) Underground cable Pylons and overhead line New EACN Substation

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			CSE compound to the north of Notley Enterprise Park. The underground cables are routed between Raydon and Holton St Mary, and into Dedham Vale National Landscape. The Project stays within the National Landscape located in both Babergh and Colchester. Within the National Landscape to the north-west of Stratford St Mary, the alignment crosses the River Stour, and to the north-east of Langham crosses the Black Brook, outside of the National Landscape. The Project then crosses the A12 and re-enters the National Landscape between Langham and Lamb Corner. The Project once again leaves the National Landscape, crossing Birchwood Road, west of Lamb Corner. From the Colchester and Tendring boundary south of Lamb Corner, the Project heads south-east, crossing the B1029 at Dedham Road. The underground cabling continues south-east, crossing the A137 before the connection enters the new EACN Substation located to the east of Hungerdown Lane. The Project then exits the new EACN Substation, heading west as overhead line, following the alignment back on itself until it crosses the A137, passing to the north of Ardleigh. The Project	Railway line Unnamed river Ardleigh Reservoir	

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			continues west, crossing the northern part of the Ardleigh Reservoir and continuing to the A12, where this section ends.		
D	Colchester City Council	19	In Section D, the Project heads to the west at the A12 Ipswich Road and then is undergrounded at a CSE compound to the north-north-east of Great Horkesley, adjacent to Harrow Wood[2]. The Project crosses under the A134 The Causeway before transferring back to overhead line after Vinesse Road, through the CSE compound to the east of Grove Lodge, north of the B1508. The Project heads south crossing the B1508, heading south-west until it crosses the River Colne. Just south-east of the River Colne, Fiddlers Wood Ancient Woodland is adjacent to the Order Limits. It then continues south-west passing the Fordstreet Conservation Area, before crossing the A1124 at Halstead Road. The Project then continues south past Aldham and Aldhamhall Wood Ancient Woodland, located adjacent to the Order Limits.	A12 Harrow Wood A134 B1508 River Colne Fiddler's Wood Ancient Woodland Fordstreet Conservation Area A1124 Unnamed Ancient Woodland Aldham Wood Ancient Woodland Railway line Roman River Church House Ancient Woodland Stonefield Strip Woodland	Pylons and overhead line CSE compounds Underground cable

[2] Woodland is not mapped as ancient woodland on the national Ancient Woodland Inventory (Woodland Trust, 2025), however is considered an ancient woodland for the purpose of the ES, as a worst case. These are County Wildlife Sites and Local Wildlife Sites where their site descriptions indicate they contain ancient woodland or ancient woodland features

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			The Project then turns south-west at Aldham Hall Farm, past Church House Wood Ancient Woodland and Stonefield Strip Woodland[2], with Marks Tey Brickpit SSSI to the south. The Project crosses the railway line between Marks Tey and Chappel and Wakes Colne, before crossing the Roman River. The Project continues through arable fields past Little Tey before it ends just north of the A120 Colchester Road.	Marks Tey Brickpit SSSI	
E	Braintree District Council	16	At the start of Section E, the Project crosses the A120 Colchester Road. The Project continues south-west past Coggeshall Hamlet and crosses the River Blackwater, before crossing the B1024 at Coggeshall Road. It continues south-west and interacts with Rivenhall Thicks Ancient Woodland between Silver End and Rivenhall. The Project continues west-south-west, crossing the B1018 Cressing Road. It then crosses a railway line connecting White Notley and Witham before crossing the River Brain. At this point, the Faulkbourne Hall Registered Park and Garden is located approximately 270 m to the south of the Order Limits. It then continues west through arable fields; Troy's Wood Ancient Woodland is within approximately 160 m of the Order Limits.	A120 River Blackwater B1024 Unnamed Ancient Woodland Rivenhall Thicks Ancient Woodland B1018 Railway line River Brain Faulkbourne Hall Registered Park and Garden Unnamed Tributary Braintree – Pelham – Rayleigh 400 kV overhead line Mann/Parsons Ancient Woodland	CSE compounds Underground cable Pylons and overhead line

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			Further west, the Project then crosses an unnamed tributary of the River Ter. At this point, the existing Braintree – Pelham – Rayleigh 400 kV overhead line intersects the Project which requires the proposed overhead line to be undergrounded for a short section. This would require CSE compounds to be positioned either side of the existing line to facilitate the transition. As the Project goes back to overhead lines, the Project passes adjacent to an unnamed Ancient Woodland, continuing south-west, where the Order Limits is adjacent to the Mann/Parsons Woods Ancient Woodland[3].		
F	Chelmsford City Council and Brentwood Borough Council	21	Section F of the Project continues south-west through arable fields until crossing the River Ter. At this point, the Order Limits are close to the River Ter SSSI. The Project then continues south-west through arable fields, passing adjacent to Lyonshall Wood Ancient Woodland before passing adjacent to Sheepcotes Ancient Woodland then crossing the A131 Braintree Road. The Project continues south-west crossing the B1008, Chatham Hall Lane and the River Chelmer between Great	River Ter River Ter SSSI A131 Lyonshall Wood Ancient Woodland Sheepcotes Ancient Woodland B1008 River Chelmer Little Waltham Conservation Area	Pylons and overhead line

[3] This ancient woodland GIS layer shows a very small part of the designation within the Order Limits, however this is a mapping/scale error, as the small part of the designation within the Order Limits is an arable field.

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			Waltham and Little Waltham Conservation Areas. The Order Limits interact with the Great Waltham Conservation Area and are within approximately 40 m of Langley's Historic Park and Garden. The Project continues south-west, past Sparrowhawk Wood Ancient Woodland, and Border Wood[2], just south of Broad's Green. The Project then continues south, to the west of Broomfield Hospital, before turning south-west again at Bushy Wood Ancient Woodland, located adjacent to the Order Limits. The Project then passes south of Chignal St James and crosses the River Can. It then crosses the A1060 Roxwell Road and Roxwell Brook. From here, the Project heads south crossing the A414 Ongar Road and then Sandy Brook. The Project heads south-east, to the south of Little Oxney Green, before diverting south-west near Gable Cottages on Margaretting Road. The Project interacts with Writtle-Writtlepark Wood Ancient Woodland, and adjacent to Writtle-James Spring Ancient Woodland, heading south crossing Ivy Barns Lane. The Order Limits pass between and adjacent to Bushey Wood and Osbornes Wood Ancient	Great Waltham Conservation Area Langley's Historic Park and Garden Sparrowhawk Wood Ancient Woodland Border Wood Bushy Wood Ancient Woodland River Can A1060 Roxwell Brook A414 Writtle-Writtlepark Wood Ancient Woodland Writtle-James Spring Ancient Woodland Osbornes Wood Ancient Woodland Bushey Wood Ancient Woodland	

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			Woodlands, where the section ends at the A12 Ingatestone Bypass.		
G	Basildon Borough Council and Brentwood Borough Council (and part of Chelmsford City Council)	14	Section G starts on the southern side of the A12 Ingatestone Bypass, heading south-east over the B1002 at Margaretting, and crossing a railway line linking Stratford and Chelmsford. It continues south-east past Spring Wood, crossing the River Wid, before heading south and crossing Stock Brook. The Project then heads south-west, crossing different sections of the River Wid twice and passing by Harespring Wood Ancient Woodland. It continues south, crossing the railway line linking Billericay and Shenfield, then the A129 Rayleigh Road. The Order Limits extend east to allow for third party mitigation works near Woodlands School Hutton Manor. The Project continues south past Havering's Grove and James's Wood Ancient Woodland. The Order Limits interact with Little Bladen's Wood[2]. The Project then crosses an unnamed river before continuing south through arable fields passing between Little Burstead to the east and Parkhill Wood Ancient Woodland to the west, before crossing the A127 Southend Arterial Road. At this point, the Project is within approximately 50 m of Friern Manor	A12 B1002 Railway lines Harespring Wood Ancient Woodland River Wid Stock Brook Unnamed Ancient Woodland Woodlands School Hutton Manor A129 James's Wood Ancient Woodland Parkhill Wood Ancient Woodland Little Bladen's Wood[2] Botneyhill Wood[2] St Margaret's Wood and Lane[2] A127 Friern Manor Wood Ancient Woodland	Pylons and overhead line

Section Name	Local Planning Authority	Approximate Section Length (km)	Description	Principal Features	Principal Project Infrastructure
			Wood Ancient Woodland. The Project continues south through arable fields concluding this section at the border of Thurrock at the crossing of another railway line between Laindon and West Horndon.		
H	Thurrock Council	10	Section H of the Project continues south through arable fields, with Langdon Ridge SSSI adjacent to the east, before crossing the River Mardyke and then Doesgate Lane. It then continues south through arable fields and some areas of woodland, passing to the west of Horndon on the Hill, before crossing the A13 Stanford-le-Hope Bypass and the A1013 Stanford Road. The Project continues south where it connects into the new Tilbury North Substation adjacent to Orsett Golf Club and Rainbow Wood Ancient Woodland[4]. The Order Limits continue to the west and south of the new Tilbury North Substation to allow for modifications to the existing ZB and YYJ infrastructure, including two CSE compounds south of the proposed Lower Thames Crossing (LTC) project. Ashen Wood Ancient Woodland also interacts with the Order Limits.	Langdon Ridge SSSI River Mardyke A13 A1013 Rainbow Wood Ancient Woodland LTC	Pylons and overhead line New Tilbury North Substation CSE compounds

[4]Rainbow Wood and Ashen Wood are not mapped as ancient woodland on the national Ancient Woodland Inventory (Woodland Trust, 2025); however, surveys undertaken for the Lower Thames Crossing (LTC) project determined that these woodlands were ancient woodland.

4.3 Environmental Mitigation Measures

4.3.1 Three types of mitigation have been incorporated into the Project and assessment: embedded, standard, and additional environmental mitigation.

4.3.2 Environmental mitigation measures have been defined within each environmental topic chapter and where relevant to construction are presented in the following documents and secured by Requirements 4 and 5 in the draft DCO (document reference 3.1) (Revision G):

- Outline Code of Construction Practice (CoCP) (document reference 7.2) (Revision G)
- Outline Construction Traffic Management Plan (CTMP) (document reference 7.3) (and the Travel Plan appended to the CTMP) (Revision F)
- Outline Public Rights of Way (PRoW) Management Plan (document reference 7.6) (Revision D)
- Outline Archaeological Mitigation Strategy and Outline Written Scheme of Investigation (document reference 7.5) (Revision C).

4.3.3 Environmental mitigation that relates to the permanent assets is outlined in the Outline Landscape and Ecological Management Plan (LEMP) (document reference 7.4) (Revision G) and secured by Requirement 4 of the draft DCO (document reference 3.1) (Revision G) submitted as part of the application for development consent.

Embedded Mitigation Measures

4.3.4 Environmental appraisal has been an integral part of the Project design process since conception, which has meant that the Project has been able to avoid environmentally sensitive features as far as reasonably practicable.

4.3.5 National Grid has also embedded mitigation measures into the design of the Project to avoid or reduce significant effects that may otherwise be experienced during construction and operation (and maintenance) of the Project.

4.3.6 Embedded mitigation measures are those that are intrinsic to and built into the design of the Project. Table 4.2 outlines the key embedded measures that have been incorporated into the design presented.

Table 4.2 Embedded mitigation measures

Embedded Measures	Benefits
Whole Project/Alignment	
The Project has committed to deliver 10% BNG with wider environmental and societal benefits	The Project would deliver an overall net improvement in environmental value (including biodiversity) in the area through a combination of on-site and off-site mitigation. This is reported separately, outside of the ES (Volume 6 of the DCO application). Further details can be found in the BNG Report (document reference 7.1) (Revision B).
Sensitive routeing and siting of the alignment and Order Limits	Avoids and reduces as far as practicable effects on identified environmental (including landscape and visual, ecology and heritage assets) and socio-economics receptors. The Order Limits have been designed to avoid large residential and urban areas and consequently avoid areas of existing poor air quality. The alignment and siting have been designed as far as practicable to avoid sensitive noise and vibration features. This included avoiding settlements and residential areas, passing predominantly through rural areas, with the majority of nearby Noise Sensitive Receptors being isolated dwellings and small settlements. Avoiding sensitive features/receptors, as far as is practicable, such as landfills and geological SSSIs, through the routeing and siting stages.
Underground cable	Underground cables are proposed in four locations, including through the Dedham Vale National Landscape. The Dedham Vale National Landscape is a nationally important and designated landscape. With the proposed underground cable, the effects on views and setting would be reduced. This would also reduce effects on the setting of heritage assets located within the National Landscape. This is separate to the need to 'further the purpose' of the National Landscape, outlined in National Landscapes – Duty to Seek to Further the Purposes Report (s85 Countryside and Rights of Way Act 2000) (document reference 5.10).
The Project would include triple Araucaria conductors (or alternative technology that performs to the same or better standard in relation to noise on standard lattice pylons) for new transmission infrastructure[5].	Due to its geometrical configuration, the triple Araucaria design is the least electrically stressed conductor system that National Grid uses. It is the best design for reducing the effects of line crackle (corona discharge) and would reduce the generation of noise from the proposed overhead lines during operation (and maintenance).
Incorporating full line tension gantries	The Project allows for the use of full line tension gantries at CSE compounds and substations (where design allows). The use of

[5] Where modifications for existing transmission overhead lines are required, like-for-like conductors are proposed.

Embedded Measures	Benefits
	full line tension gantries removes the need for a bulkier terminal pylon adjacent to the CSE compound which would reduce visual clutter and therefore help to reduce landscape and visual effects.
The Project has been designed in accordance with National Grid design standards and complies with the guidelines and policies relating to Electric and Magnetic Fields (EMF) stated in the National Policy Statement (NPS) for Electricity Networks Infrastructure (EN-5) (Department for Energy Security and Net Zero (DESNZ), 2024b), including the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines (ICNIRP, 1998).	Compliance with these guidelines and policies means that the Project has designed out potential effects from EMF to a level to meet health and safety standards.
The Project will be designed to comply with design safety standards including the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS) and the suite of National Grid policies and processes which contains details on design standards required to be met when designing, constructing, and operating its projects.	Existing National Grid processes are designed to identify potential safety risks during construction and operation (and maintenance) (including risks from major accidents and disasters) and to design these out at each stage of project development. This informs a suite of National Grid policies and processes, which contain details on design standards required to be met when designing, constructing, and operating assets such as proposed on the Project.
The design would allow for landscape planting around CSE compounds, the new EACN Substation, around the new Tilbury North Substation (if the LTC project is not constructed) and around the existing Norwich Main Substation.	Mitigation areas for landscape planting (and BNG) around permanent features are labelled ‘Environmental Areas’ and are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B). Landscape planting would reduce effects – further details are provided in the Outline LEMP (document reference 7.4) (Revision G).
The design includes largely continuous haul roads along the proposed alignment to	Reduces the effects of construction movements on the local public highway network during construction.

Embedded Measures	Benefits
support construction of the Project.	
Non-motorised user (NMU) routes	Two new temporary NMU routes are proposed, along Bentley Road and Ardleigh Road in Essex and Hoford Road in Thurrock. The NMU routes would comprise an off-road path to separate vulnerable users from the construction traffic. The NMU routes are proposed due to the expected increase in construction traffic and subsequent effects that would have on NMUs that currently share the carriageway
Large or sensitive watercourses, for example all those designated as main river and Water Framework Directive status, would be crossed by the haul roads using temporary clear span bridges.	Reduces the effects on watercourses, their banks and water quality as a result of removing works from within the watercourse.
Rationalisation and mitigation of existing electricity transmission infrastructure	Several existing overhead and underground third-party services would need to be diverted, removed, undergrounded, or protected to facilitate the Project. The Project would align with, cross, or be situated near multiple existing 132 kV overhead lines, sections of which would be undergrounded at: • PKF overhead line, south of Palgrave to west of Mellis • EEPK overhead line, north of Barking • the PI overhead line, from north of Offton to east of Flowton • PLD overhead line, from Bramford Substation to north-west of Sproughton • PHB overhead line, from Bramford Substation to south of Sproughton • PCB overhead line, west of Pinebrook • PSB overhead line, at Fuller Street • PUB overhead line, west of Hutton to south of Rayleigh Road • PSC overhead line, at Dunton Hills Golf Course • PAB overhead line, at Lower Dunton Road • PAB overhead line east of Orsett Golf Club. The locations of these third-party services are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B).
Materials of new above-ground infrastructure	National Grid has considered the proposed materials and colour palette for the CSE compounds and new substations/ substation extensions buildings to be sensitive to the environment they are located in, where practicable. Further information is included in

Embedded Measures	Benefits
	the Design Appraisal for Site-Specific Infrastructure (document reference 7.16) (Revision E).
Replacement planting	Replacement planting would be undertaken at the earliest opportunity given the right planting season to mitigate, where practicable vegetation removed during construction.
Substations – noise control measures: The proposed new substations would include any required noise mitigation measures by design. Mitigation may include, plant selection, siting, screening, and enclosures, as appropriate.	Controls the noise outputs of the new EACN Substation and new Tilbury North Substation and therefore reduce effects on receptors.
Substations – vibration control measures: Plant with moving parts, such as cooling equipment and transformers, would be expected to be mounted on suitable anti-vibration mounts to protect the plant from potential vibration effects and to attenuate vibration generated by the plant.	Reduces the generation of vibration and therefore reduce the effects on receptors.
Surface water runoff from construction sites, haul roads and operational assets would be managed using sustainable drainage systems techniques appropriate to local conditions.	Promotes management of runoff at source, using above-ground features that offer water quality treatment as well as runoff attenuation, and potentially benefits with regard to creating wetland habitats and landscape features.
Orange spacers and bird diverters are to be applied to the earth wire at the River Waveney between pylons RG87 and RG88 and Ardleigh Reservoir between pylons TB15 and TB16 as set out in the Outline LEMP (document reference 7.4) (Revision G).	Increased visibility of the conductors to birds, helping prevent fatal collisions, especially for species with poor frontal vision such as swans and geese.

Standard Mitigation Measures

4.3.7 Standard measures, comprising management activities and techniques, would be implemented throughout construction of the Project to limit effects through adherence to good site practices. These are included in the Outline CoCP (document reference 7.2) (Revision G). Each mitigation measure has been assigned a specific reference, and these are referenced in each environmental topic chapter (Chapters 6 to 16 (document references 6.1 - 6.16)).

Additional Mitigation and Biodiversity Net Gain

4.3.8 Additional mitigation comprises measures over and above embedded and standard mitigation measures to reduce environmental effects. This includes, but is not limited to, mitigation required for protected species. Where applicable, additional mitigation measures are identified within Section 6 of each environmental topic chapter (Chapters 6 to 16 (document references 6.1 to 6.16)) within the ES (Volume 6 of the DCO application) and replicated in the Outline CoCP (document reference 7.2) (Revision G) which is secured through Requirement 4 in the draft DCO (document reference 3.1) (Revision G).

4.3.9 The Environment Act 2021 includes a requirement for Nationally Significant Infrastructure Projects to deliver at least 10% BNG from May 2026. The Overarching NPS for Energy (EN-1) (DESNZ, 2024a) also states, '*Although achieving biodiversity net gain is not currently an obligation on applicants, Schedule 15 of the Environment Act 2021 contains provision which, when commenced, mean the Secretary of State may not grant an application for a Development Consent Order unless satisfied that a biodiversity gain objective is met in relation to the onshore development in England to which the application relates*' (Paragraph 4.6.1). National Grid has committed to deliver 10% BNG with wider environmental and societal benefits, on all construction projects requiring formal planning or consent. The minimum of 10% target for the Project is voluntary as it is not mandated for Nationally Significant Infrastructure Projects until May 2026.

4.3.10 National Grid is working with appointed technical specialists, environmental organisations, and landowners to identify potential opportunities for delivering areas of BNG and, where practicable, also linking to wider environmental gains such as recreation improvement.

4.3.11 The biodiversity baseline has been quantified during the EIA and design process using the Statutory Biodiversity Metric (Department for Environment, Food and Rural Affairs, 2024). This metric has been used to calculate the loss in biodiversity units as a result of construction and operational effects of the Project, as well as the number of biodiversity units required to achieve minimum 10% BNG, through either on-site or off-site habitat creation and enhancement. Further information is included within the BNG Report (document reference 7.1) (Revision B).

4.4 Good Design Principles

4.4.1 This section describes the good design principles that have been adopted throughout the design process including reducing the use of raw materials and waste generation. It also sets out how the Project has been designed to be resilient to climate change.

4.4.2 Chapter 2: Key Legislation and Planning Policy Context (document reference 6.2) (Revision B) sets out the overarching key policy relevant to the Project, including NPS EN-1 and NPS EN-5 (DESNZ, 2024a; 2024b).

4.4.3 Paragraph 4.7.1 of NPS EN-1 states: *'The visual appearance of a building, structure, or piece of infrastructure, and how it relates to the landscape it sits within, is sometimes considered to be the most important factor in good design. But high quality and inclusive design goes far beyond aesthetic considerations. The functionality of an object – be it a building or other type of infrastructure – including fitness for purpose and sustainability, is equally important.'*

4.4.4 Paragraph 4.7.2 of NPS EN-1 states: *'Applying good design to energy projects should produce sustainable infrastructure sensitive to place … efficient in the use of natural resources … and energy used in their construction and operation, matched by an appearance that demonstrates good aesthetic as far as possible'*.

4.4.5 The Project has been designed in line with the National Grid options appraisal process (National Grid, 2012), as outlined Chapter 3: Alternatives (document reference 6.3) (Revision B). The Project has been designed to comply with existing National Grid standards and relevant external guidance and processes, such as the ICNIRP guidelines (ICNIRP, 1998) for reducing effects in relation to EMFs.

Approach to Materials Assets (and Waste)

4.4.6 As outlined in the EIA Scoping Report (document reference 6.19) temporary materials, such as hardcore for the haul roads, and temporary construction compounds (including works cabins and security fencing) would be required during construction. It is assumed that these would be sourced from suppliers within the region (where practicable) and would be reused after completion of the Project (where practicable).

4.4.7 National Grid would adopt good construction and management practices to ensure waste is reduced as far as practicable and that the storage, transport and eventual disposal of any waste have limited environmental effects. The management and collection of waste arisings would be carried out under the requirements of the UK waste regulatory regime.

4.4.8 As detailed within Section 5.7 of the EIA Scoping Report (document reference 6.19) and agreed through the EIA Scoping Opinion (document reference 6.20), a separate materials and waste chapter is not provided within this ES (Volume 6 of the DCO application). Instead, information on materials and waste is included within this chapter, and relevant environmental topic chapters assess effects, including Chapter 16: Traffic and Transport (document refence 6.16) (Revision B), Chapter 7: Air Quality (document reference 6.7) (Revision B) and Chapter 14: Noise and Vibration (document reference 6.14) (Revision B) where appropriate. For example, the transport effects from the management of waste arisings are considered in Chapter 16: Traffic and Transport (document reference 6.16) (Revision B), Chapter 7: Air Quality (document reference 6.7) (Revision B) and Chapter 14: Noise and Vibration (document reference 6.14) (Revision B) (where appropriate).

Design Resilience to Climate Change

4.4.9 The need for the Project is to support the connection and transfer of green, renewable energy into the National Electricity Transmission System network. The Project would support the UK government's (2025) Clean Power 2030 Action Plan to transition the country's energy system to clean power by 2030. Therefore, the operational, medium- to long-term benefits of delivering the Project on a national level are considered to outweigh any short-term effects of greenhouse gas emissions from of material use and construction activities.

4.4.10 In terms of vulnerability of the Project to climate change, overhead lines are designed to withstand extreme weather conditions, such as high winds and ice formation on the conductors. National Grid has previously investigated whether climate change might require overhead lines to be redesigned but found there is more likely to be a reduction in the risk of ice on the wires and intense wind gusts occurring simultaneously. The vulnerability of the Project to future flooding is considered as part of the Flood Risk Assessment (document reference 7.9).

4.4.11 Appendix 4.1: Greenhouse Gas Assessment (document reference 6.4.A1) (Revision B) provides a simple estimate of the greenhouse gas emissions associated with the construction phase of the Project, comparing this against UK emissions to determine if the Project is likely to have a material effect on the ability of the Government to meet its carbon reduction targets. This approach is in accordance with the EIA Scoping Report (document reference 6.19) and EIA Scoping Opinion (document reference 6.20). Appendix H: Greenhouse Gas Reduction Strategy is also provided within the Outline CoCP (document reference 7.2) (Revision B).

4.5 Order Limits and Limits of Deviation

4.5.1 The Order Limits are defined as the maximum extent of land within which the Project, as defined within the ES (Volume 6 of the DCO application), may be carried out, and includes both permanent and temporary land required to build and operate (and maintain) the Project.

4.5.2 The Order Limits include LoD which represent the maximum deviation for permanent features, such as the overhead line, pylons, CSE compounds, new substations and underground cables. This allows for adjustment to the final positioning of Project features to avoid localised constraints or unknown or unforeseeable issues that may arise.

4.5.3 The assessment presented within the ES (Volume 6 of the DCO application) is based on the design, LoD and parameters as shown on the Works Plans (document reference 2.3) (Revisions A - C) , Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B). However, it should be noted that the permanent aspects of the Project, including pylon locations, are not fixed and could be located anywhere within the LoD, as defined on the Works Plans (document reference 2.3) (Revisions A - C) (unless a commitment has been made to restrict the LoD, details of which are outlined within the Outline CoCP (document reference 7.2) (Revision G)). The location and orientation of the CSE compounds, new EACN Substation, new Tilbury North Substation and underground cables may also change within the LoD. The associated temporary construction works would also change to the revised locations, albeit within the Order Limits.

4.5.4 Table 4.3 outlines details of the Order Limits and LoD that have been used to undertake the assessment within this ES (Volume 6 of the DCO application).

Table 4.3 Details of Order Limits and Limits of Deviation

Project Component	Details
Proposed overhead line	
Order Limits and vertical, lateral and longitudinal LoD	The Order Limits are generally 100 m wide, i.e. 50 m either side of the centre line of the proposed overhead line. The vertical LoD would be to any extent not exceeding 6 m upwards from the pylon design heights presented within the Works Plans (document reference 2.3) (Revisions A – C)) to allow for variations in heights between pylons to allow extra height to clear existing features, maintaining electrical clearance to the ground. The lateral LoD of 50 m either side of centreline and the longitudinal LoD[6] allows flexibility to move pylon positions in any direction for unforeseen circumstances, such as poor ground conditions or archaeological finds, and to cater for maximum conductor (overhead line) swing. Commitments to restrict the LoD for specific pylon locations are included within the Outline CoCP (document reference 7.2) (Revision G).
Proposed new substations and modifications to existing substations	
Order Limits and vertical, lateral and longitudinal LoD	The Order Limits include approximately 640 m x 740 m for the new EACN Substation (including spacing for the associated Environmental Area)[7]; approximately 340 m x 530 m for the new Tilbury North Substation[8]; and approximately 300 m x 600 m for the extension works needed at Bramford Substation (including the footprint of the existing substation). There is no defined vertical (downwards) LoD for the works to substations. The vertical (upwards) LoD could be up to 10% higher than shown on the layout and elevation plans (document reference 2.6) (Revision D) excluding aerials, handrails, rooftop equipment and lightning protection. The lateral and longitudinal LoD for the substation works are as shown on the Works Plans (document reference 2.3) (Revisions A – C), including space for the substations, drainage, accesses, construction compounds and soil storage.
Proposed CSE compounds	
Order Limits and vertical, lateral and longitudinal LoD	The Order Limits include approximately 64 m x 90 m for the CSE compounds, plus the LoD as defined below. There is no defined vertical (downwards) LoD for the works to CSE compounds. The vertical (upwards) LoD could be up to 10% higher than

[6] Longitudinal LoD means movement along the line of the Project

[7] The operational footprint of the new EACN Substation is proposed to be approximately 550 m x 230 m; further detail is within Section 4.9.

[8] The operational footprint of the new Tilbury North Substation is proposed to be approximately 340 m x 300 m; further detail is within Section 4.9.

Project Component	Details
	shown on the layout and elevation plans (document reference 2.6) (Revision D). The lateral and longitudinal LoD are generally 50 m on all sides of the proposed location but vary locally depending on existing features (e.g. hedgerows, watercourses).
Proposed underground cables	
Order Limits and vertical and lateral LoD	The Order Limits are generally 220 m wide. In some instances, the Order Limits have been widened to, for example, accommodate mitigation for protected species should it be required at the time of construction. There is no defined vertical LoD as the extent would be as necessary or convenient, however the minimum depth between the top of the protective tiles and made ground level would be approximately 0.9 m (where not within a substation or CSE compound). Lateral LoD of 100 m (50 m either side of the approximately 120 m cable construction swathe).
Removal of existing and proposed 132 kV overhead lines	
Order Limits and vertical and lateral LoD	The Order Limits are generally 35 m wide for the underground cable installation (replacing the overhead line being removed) to allow for lateral LoD. The LoD and Order Limits for the 132 kV works as shown on the Works Plans (document reference 2.3) (Revisions A -C) include space for temporary overhead line diversions, the underground cable alignment and the existing alignment.
Removal of existing 33 kV and 11 kV overhead lines	
Order Limits and lateral LoD	The Order Limits are generally 25 m wide for the underground cable installation to allow for lateral LoD. The LoD and Order Limits for the 11 kV and 33 kV works as shown on the Works Plans (document reference 2.3) (Revisions A - C) allow for dismantling and diversion of wood pole electricity and communications overhead lines needed to facilitate the Project.

4.6 Application of a Rochdale Envelope and Design Scenarios

4.6.1 Advice Note Nine: Rochdale Envelope (Planning Inspectorate, 2025) provides guidance regarding the degree of flexibility that may be considered appropriate within an application for development consent under the Planning Act 2008. The advice note acknowledges that there may be parameters of a project's design that are not yet fixed and, therefore, it may be necessary for the ES (Volume 6 of the DCO application) to assess likely worst-case variations to ensure that the likely significant environmental effects of the Project have been assessed.

4.6.2 Sufficient flexibility within the design is allowed to provide the future detailed design and build Main Works Contractor(s) with sufficient scope for 'value engineering' through innovative design and/or construction techniques and to respond to unknown

information such as ground conditions. As such, the Project design presented in this ES (Volume 6 of the DCO application) and the accompanying assessment reflects the need for this flexibility and the requirements of Advice Note Nine: Rochdale Envelope (Planning Inspectorate, 2025) to ensure that the likely significant effects of the Project are assessed. Furthermore, the design has been informed by the EIA with the design reflecting iterative working between the designers and the environmental specialists.

4.6.3 The Order Limits include LoD, which represent the maximum locational flexibility for permanent features, such as the overhead line, pylons, underground cables, CSE compounds, the proposed new EACN Substation and the proposed new Tilbury North Substation.

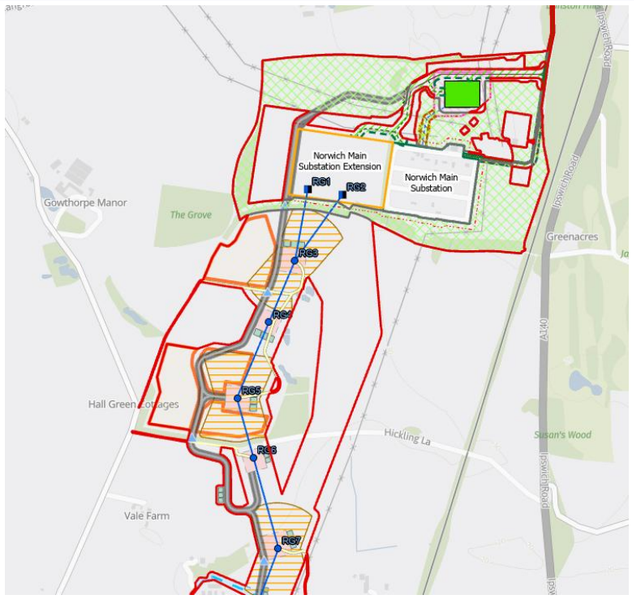
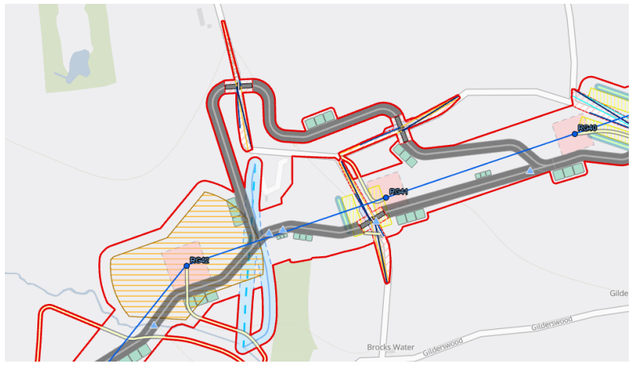
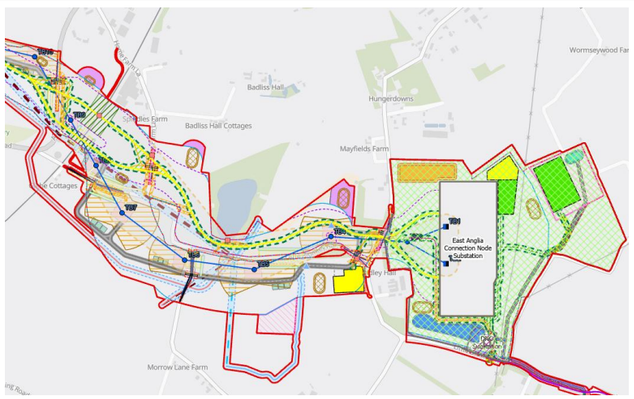
4.6.4 The assessment of likely significant effects in this ES (Volume 6 of the DCO application) is based on the description of the design, construction, and operation (and maintenance) of the Project presented in this chapter and shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B). Consideration has also been given to the potential for variation in the description of individual components of the Project.

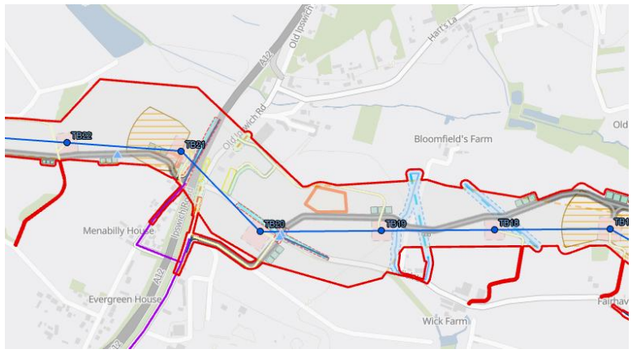
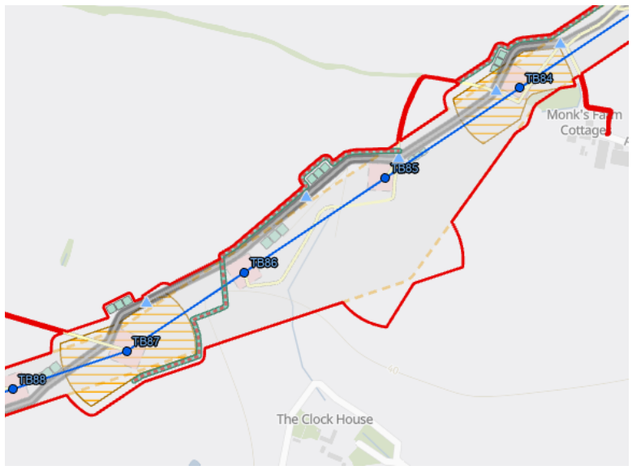
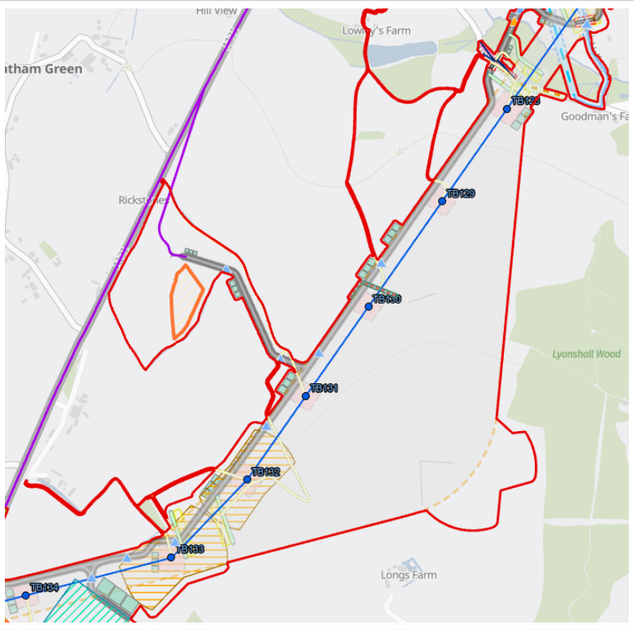
4.6.5 The environmental topic chapters consider sensitivity testing/flexibility in design that may be adopted to see if there would be new or different significant effects. Sensitivity testing/flexibility in design is assessed within Section 9 of each environmental topic chapter (Chapters 6 to 16 (documents references 6.6 to 6.16)) and includes:

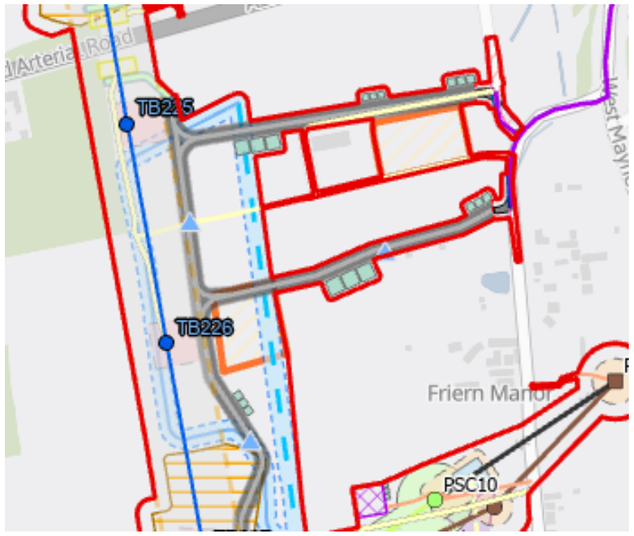
- Flexibility in construction programme:
  - Assessment of delays to the construction schedule: Each environmental topic chapter provides an assessment to determine if the environmental effects would be different if the construction programme was delayed
- Flexibility in design:
  - Flexibility within the LoD, for example changes to the location or height of permanent features, such as pylons, within the LoD (other than where locations of pylons are committed to as detailed within the Outline CoCP (document reference 7.2) (Revision G))
  - Flexibility within Order Limits, for example there are elements of the Project where design flexibility has been identified.

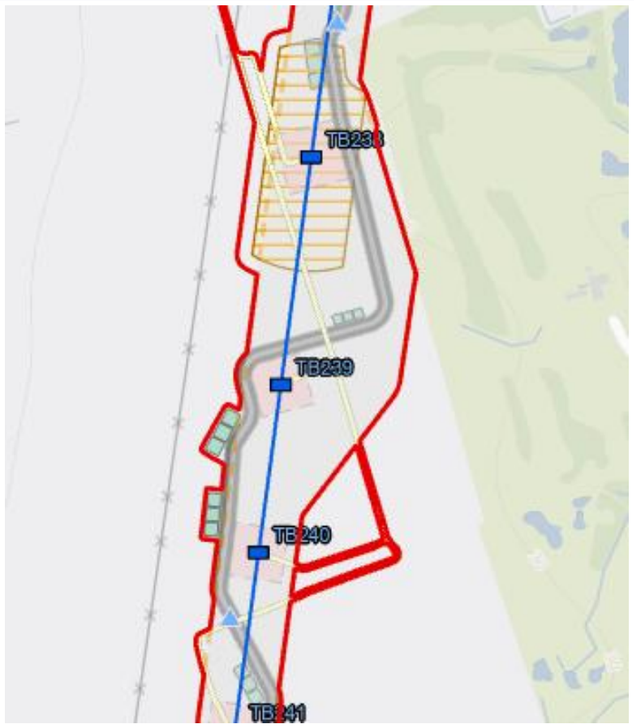
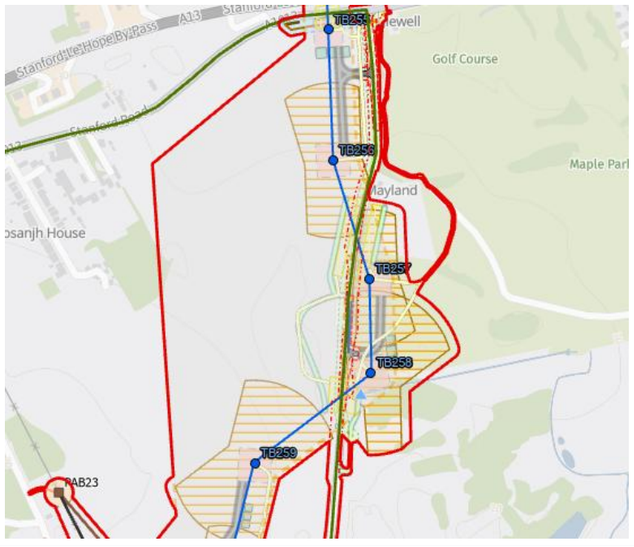
4.6.6 To assess the potential effects of these elements, a single scenario is assessed within Section 7 with an assessment of the flexibility presented in Section 9 of each environmental topic chapter. Further detail is presented in Table 4.4 as to how each element has been assessed within the ES (Volume 6 of the DCO application).

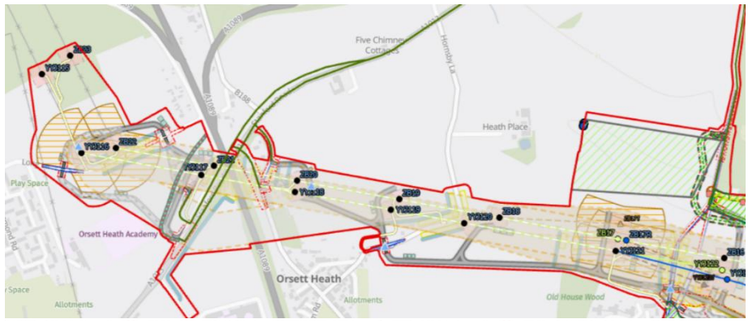
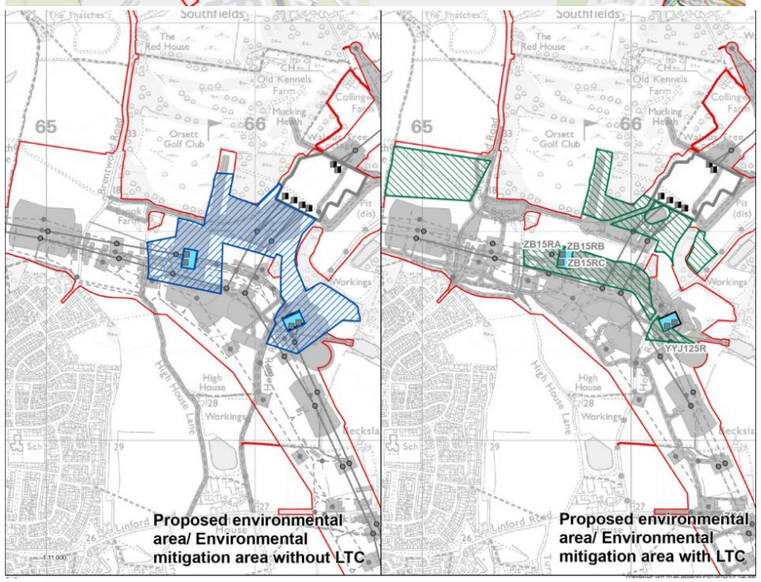
Table 4.4 Summary of design scenario assessed in the ES

Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
1. Norwich Main Substation (Section A)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) show an overhead line alignment exiting the Norwich Main Substation between RG001 and RG007. The LoD and Order Limits in this location have been widened to the east to allow flexibility to change the alignment should planning consent not be granted for a battery storage facility to the south of the substation.	The overhead line alignment shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the widened LoD and Order Limits should the battery storage facility not be consented, which would allow an overhead line alignment to be accommodated further east.
2. Anglian Water Sewage Works south of Tabernacle Lane (Section A)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) shows two haul roads within the Order Limits between RG40 and RG42. Two haul roads are presented to provide an alternative haul road that avoids crossing through an Anglian Water sewage works and potential land it has noted may be used for reed planting.	The haul road that runs parallel to the overhead line between RG40 and RG42 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the alternative haul road that avoids the Anglian Water sewage works to the north should reed planting prevent the use of the parallel haul road.
3. Silica sands mineral site west of the proposed new EACN Substation (Section C)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows an overhead line alignment and underground cable alignment between TB1 and TB8. The LoD and Order Limits have been widened in this area to allow flexibility to facilitate a swap of the overhead line and underground cable north or south of Little Bromley Road, subject to the progression of the silica sands minerals site, i.e. locating the underground cables to the north of Little Bromley Road would reduce sterilisation of potential silica sands mineral site.	The overhead line and underground cable alignment between TB1 and TB8 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the alternative reverse locations of the overhead line and underground cable alignment should the silica sands mineral site be an inappropriate/ uneconomical location for extraction or be of the quality identified by Essex County Council.

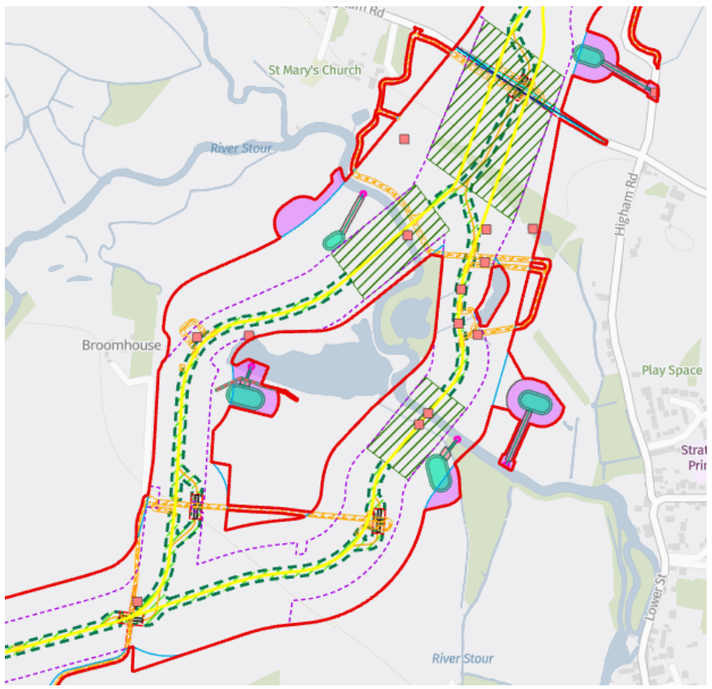
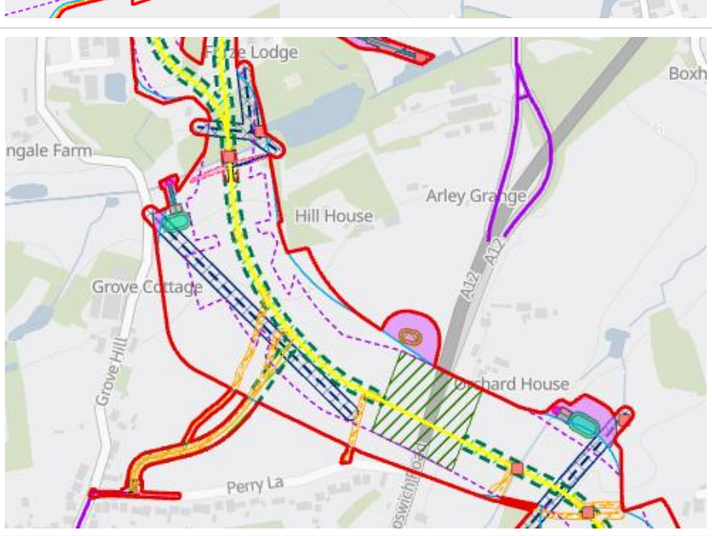
Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
4. Flying Trade Group and Crown Quarry east and west of the A12 (Sections C and D)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows widened Order Limits between TB18 and TB22. The LoD and Order Limits have been widened between TB18 and TB22 as there are a number of planning applications associated with the Flying Trade Group and Crown Quarry developments adjacent to the A12.	The overhead line alignment between TB18 and TB22 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment for an alternative alignment within the widened Order Limits should an alternative alignment be required.
5. Mineral extraction site north-west of Kelvedon (Section E)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows an overhead line alignment between TB84 and TB87. The LoD and Order Limits have been widened between TB84 and TB87 to allow flexibility to change the alignment to reduce effects on a potential mineral extraction site should it be identified as an allocation in a future mineral plan.	The overhead line alignment between TB84 and TB87 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the widened LoD and Order Limits should an alternative alignment be required to avoid the mineral extraction site.
6. Lions Hall Minerals Site east of the A131 and to the west of Lyonshall Wood Ancient Woodland (Section F)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows an overhead line alignment between TB128 and TB133. The LoD and Order Limits have been widened between TB128 and TB133 to allow flexibility to change the alignment to reduce effects on the Lions Hall Minerals Site should it be progressed.	The overhead line alignment between TB128 and TB133 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the widened LoD and Order Limits should an alternative alignment be required to avoid the Lions Hall minerals site should it be progressed.

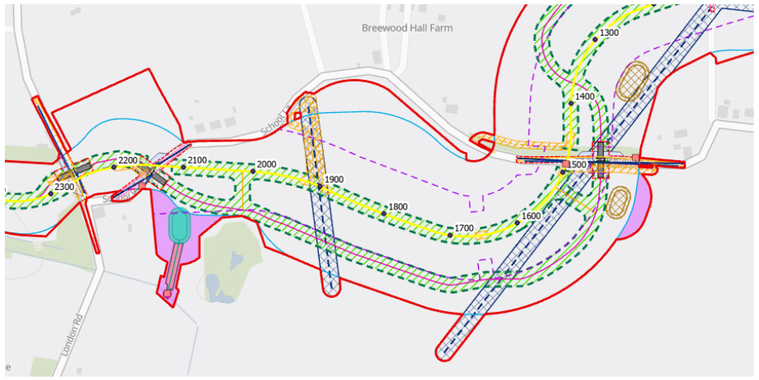
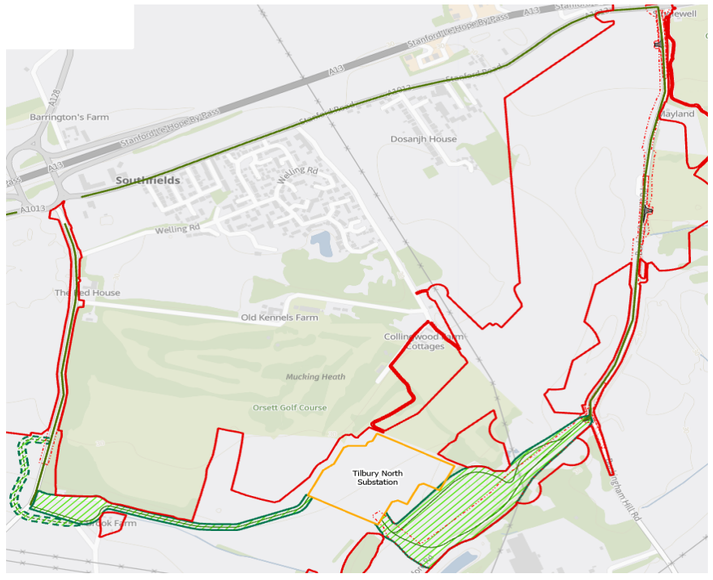
Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
7. Chelmsford Bypass east of the A131 and to the west of Lyonshall Wood Ancient Woodland (Section F)	As above	Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) shows a haul road between TB130 and TB131. The Order Limits have been widened to facilitate an alternative haul road off the proposed Chelmsford Bypass new roundabout, should the Chelmsford Bypass progress, which would sever the currently proposed construction haul road that follows the overhead line alignment.	The haul road between TB130 and TB131 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the widened LoD and Order Limits should an alternative haul road be required.
8. Crest Nicholson housing development south of the A127 (Section G)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) shows two haul roads/construction access arrangements within the Order Limits between TB225 and TB226. Two haul roads are presented to provide an alternative haul road should the Crest Nicholson housing development progress.	The haul road that runs furthest north shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the alternative haul road to the south should the Crest Nicholson housing development progress.

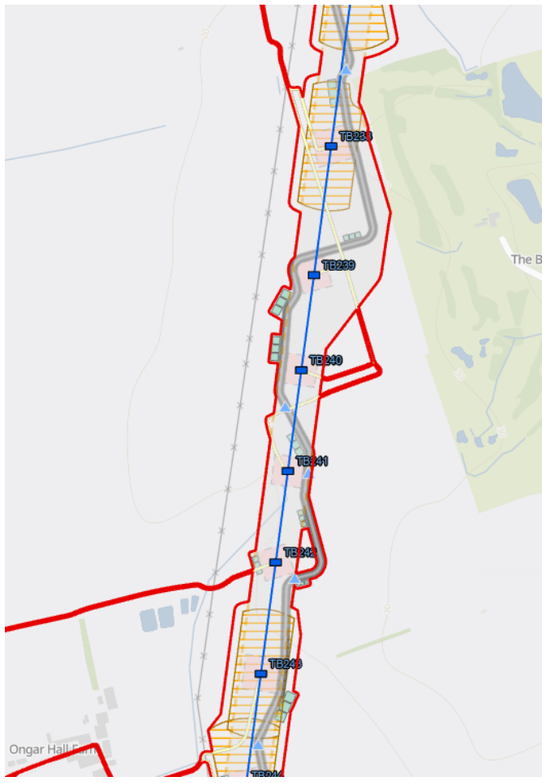
Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
9. British Pipeline Agency (BPA) pipeline crossing west of Langdon Hills Golf and Country Club (Section H)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows an overhead line alignment between TB238 and TB240. The LoD and Order Limits have been widened between TB238 and TB240 to allow flexibility to enable an alternative alignment with more angles to facilitate a more perpendicular crossing at the BPA pipeline.	The overhead line alignment between TB238 and TB240 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the widened LoD and Order Limits should an alternative alignment be required to cross the BPA pipeline.
10. Southfields development south of the A1013 (Section H)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows an overhead alignment between TB255 and TB259. The LoD and Order Limits have been widened between TB255 and TB259 to allow flexibility to allow an alternative alignment if the Southfields housing development does not go ahead, as the alignment could then move to the west, removing two crossings of Buckingham Hill Road, a crossing of a historic landfill site and pylons situated within parkland and a quarry site.	The overhead line alignment between TB255 and TB259 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment for an alternative alignment within the widened Order Limits should the Southfields development not be progressed.

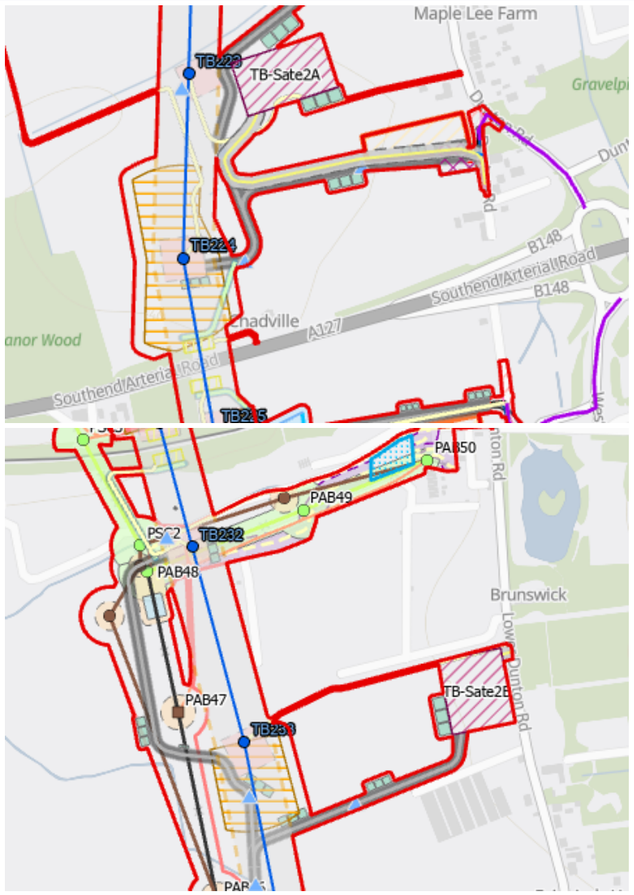
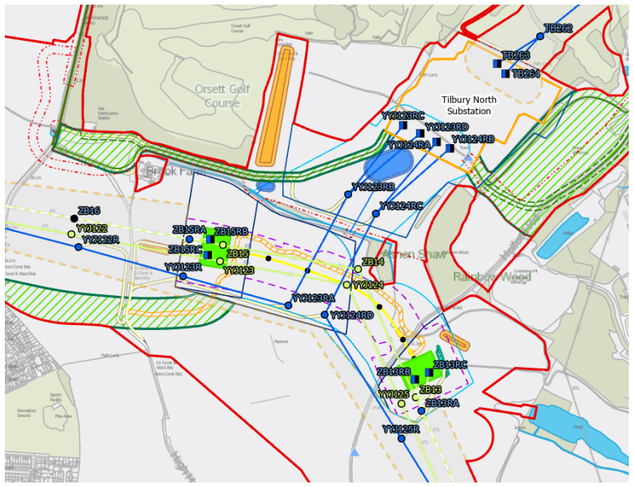
Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
11. Lower Thames Crossing (LTC)[9] south of the proposed new Tilbury North Substation (Section H)	  	Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows temporary and permanent works to existing overhead line infrastructure (YYJ and ZB) to the south of the A13 and A1089 junction in the proximity of Heath Road. The LoD and Order Limits have been widened at this location to allow a change to the design should the ongoing coordination identify a change is required. Should LTC not be progressed, an alternative Environmental Area is also proposed.	The location of temporary and permanent works to existing overhead line infrastructure (YYJ and ZB) south of the A13 and A1089 junction in the proximity of Heath Road shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The Environmental Area 'with LTC' is also assessed within each environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment for alternative alignment within the widened Order Limits and an amended Environmental Area, should the LTC project not be progressed or ongoing coordination identifies a change is required.

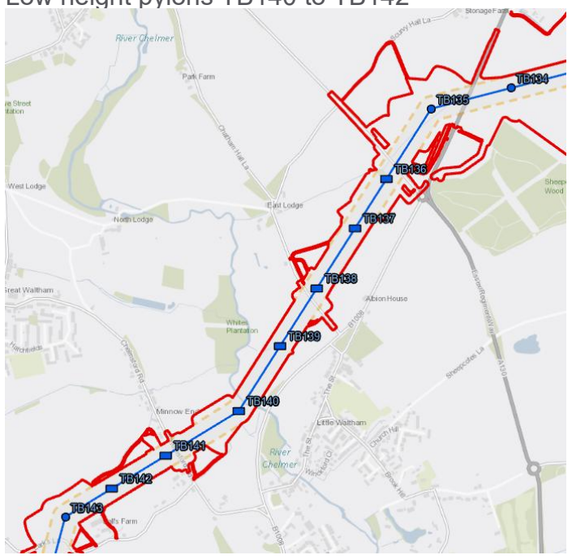
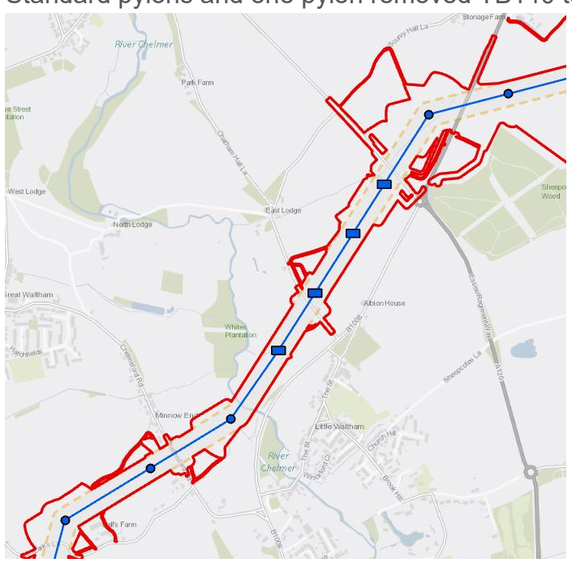
[9] The LTC project is shown on Figure 17.1: Cumulative Long List of Other Developments (document reference 6.17.F1)

Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
12. River Stour crossing west of Stratford St Mary (Section C)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows two underground cable crossings of the River Stour. The LoD and Order Limits have been widened at the crossing of the River Stour to allow for a double eastern and western crossing or a single crossing (either an eastern only or western only crossing), subject to detailed design of the trenchless crossing methods and detailed ground investigation. The area is constrained by various water bodies, a high-pressure gas main and Source Protection Zone 1. The double eastern and western crossing would not interact with the Source Protections Zone 1. However, if a single western crossing was taken forwards following detailed design the Project would interact with a Source Protection Zone 1.	The double underground cable alignment crossing the River Stour shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of a single crossing in either the western or eastern corridors.
13. Black Brooknorth of Langham (Section C)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) shows an underground cable alignment to the south of Black Brook. The LoD and Order Limits have been widened slightly to the west of the A12 and south of Black Brook to allow for flexibility of routeing individual cable trenches in the vicinity of existing United Kingdom Power Network (UKPN) underground cables.	The underground cable alignment crossing to the south of Black Brook shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of an alternative alignment within the widened Order Limits should it be required.

Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
14. Great Horkesley south of School Lane (west of Great Horkesley) (Section D)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) shows widened LoD and Order Limits to the south of School Lane (west of Great Horkesley) to allow for a wider temporary construction area if required as the underground cable alignment to the west is heavily constrained.	The widened LoD and Order Limits shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) are assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)).
15. Tilbury North Access at the proposed new Tilbury North Baseline conditions have been gathered from desk-based information (see Section 12.4) and presented with reference to the section of the Project within which they are located. (Section H)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) present the temporary and permanent access options associated with the new Tilbury North Substation and associated works. The two proposed temporary access options into the new Tilbury North Substation during construction comprise: • A Primary Access Route (PAR) via Stanford Road (east of the Orsett Cock junction), Buckingham Hill Road and Hoford Road leading to a temporary haul road with two alternative alignments: – One running mainly along or alongside Hoford Road before crossing the south-western part of the Clearserve site – One running mainly through the Clearserve site from north-east to south-west • A PAR via Brentwood Road leading to a temporary haul road with alternative alignments with and without LTC in place: – Without LTC: east to west between Brook Farm and Orsett Golf Club using the existing access to the south of High House Lane – With LTC: initially a temporary access road to the west of Brentwood Road, crossing Brentwood Rd and then running east to west between Brook Farm and Orsett Golf Club. On completion of the LTC Brentwood Road bridge embankment works and new junction arrangements with High House Lane, access to the substation would be via Brentwood Road and the new junction with High House Lane and then east between Brook Farm and Orsett Golf Club.	Temporary and permanent accesses via the Clearserve site are assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). Temporary access via Brentwood Road and permanent access running east to west between Brook Farm and Orsett Golf Club is assessed within the ‘sensitivity testing’ section within each environmental topic chapter.

Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
		• The two proposed access options into the new Tilbury North Substation during operation (and maintenance) comprise: – A permanent new widened access along Hoford Road leading to a permanent private access road with two alternative alignments: ○ One running mainly along or alongside Hoford Road before crossing the south-western part of the Clearserve site ○ One running mainly through the Clearserve site from north-east to south-west – A permanent access running east to west between Brook Farm and Orsett Golf Club. The new NMU route, if provided along Hoford Road during construction, would be removed after construction.	
16. Thurrock Airfield and Low Heights west of Langdon Hills Golf and Country Club (Section H)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) show an alignment between TB238 and TB243. Low height pylons are proposed between TB238 and TB243 to cater for Thurrock Airfield. However, should a housing development be brought forwards at Thurrock Airfield and/or the airfield be closed, low height pylons would not be required and standard lattice pylons would be installed instead.	The use of low height pylons between TB238 and TB243 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of standard lattice pylons between TB238 and TB243 should low heights not be required.

Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
17. Temporary construction compounds		There are two options for a satellite compound in Basildon, due to a planning application for Brentwood Housing Development (21/01525/OUT) which has yet to be determined. Only one satellite compound would be taken forward depending upon the outcome of the planning application. The two options are: • Option 1) a compound off Brentwood Road, near TB223 (TB-Sate2A) • Option 2) a compound at Lower Dunton Road, near TB233, Basildon (TB-Sate2B).	Temporary construction compounds are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B). Option 1 is assessed within the 'residual effects' section of ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)) and option 2 is covered within the 'sensitivity testing' section.
18. South of the new Tilbury North Substation (Section H)		Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) show to the south of the proposed new Tilbury North Substation alterations to the existing ZB route that comprise amended pylon locations, two proposed new CSE compounds and a section of underground cable between the CSE compounds. In addition, the existing YYJ route is shown with alterations to the locations of existing pylons and new pylons to facilitate a connection into Tilbury North Substation and exiting the new substation to provide the onward connection to the existing Tilbury connection. The LoDs in this location around the underground cable, existing and proposed new locations of YYJ and ZB pylons and the two CSE compounds has been widened to allow flexibility to allow for design refinements due to uncertainties regarding other projects (including the LTC project, housing	The Project shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The 'sensitivity testing' section within each environmental topic chapter presents an assessment of the widened LoD should the Project need to respond to third party developments.

Name of Design Scenario	Image	Description	Summary of How the Design Scenario is Assessed in the ES
		developments and aggregate facilities). There are different forms that this could take with overhead line or cable configurations for the turn in and out of the new Tilbury North Substation with variable positioning of necessary CSE compounds - for example changes may include a double CSE compound arrangement and undergrounding of the YYJ route into the proposed new Tilbury North Substation.	
19. The Walthams and Standard Heights to the south of the River Chelmer (Section F)	Low height pylons TB140 to TB142  Standard pylons and one pylon removed TB140 to TB142 	Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) show pylons TB140, TB141 and TB142 to the south of the River Chelmer as low height pylons. After consideration of feedback during consultations in 2025 certain technical details are being refined which may result in standard lattice pylons to the south of the River Chelmer being installed. Therefore, flexibility has been retained to revert to standard lattice pylons following further technical details being refined – this may also include removing the need for one of the three pylons and a slight change to the locations of the remaining two pylons within the LoD.	The use of low height pylons between TB140 to TB142 shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) is assessed in each ES environmental topic chapter (Chapters 6 to 16 (document references 6.6 to 6.16)). The ‘sensitivity testing’ section within each environmental topic chapter presents an assessment of standard lattice pylons between TB140 to TB143.

4.7 Construction – General

Construction Programme

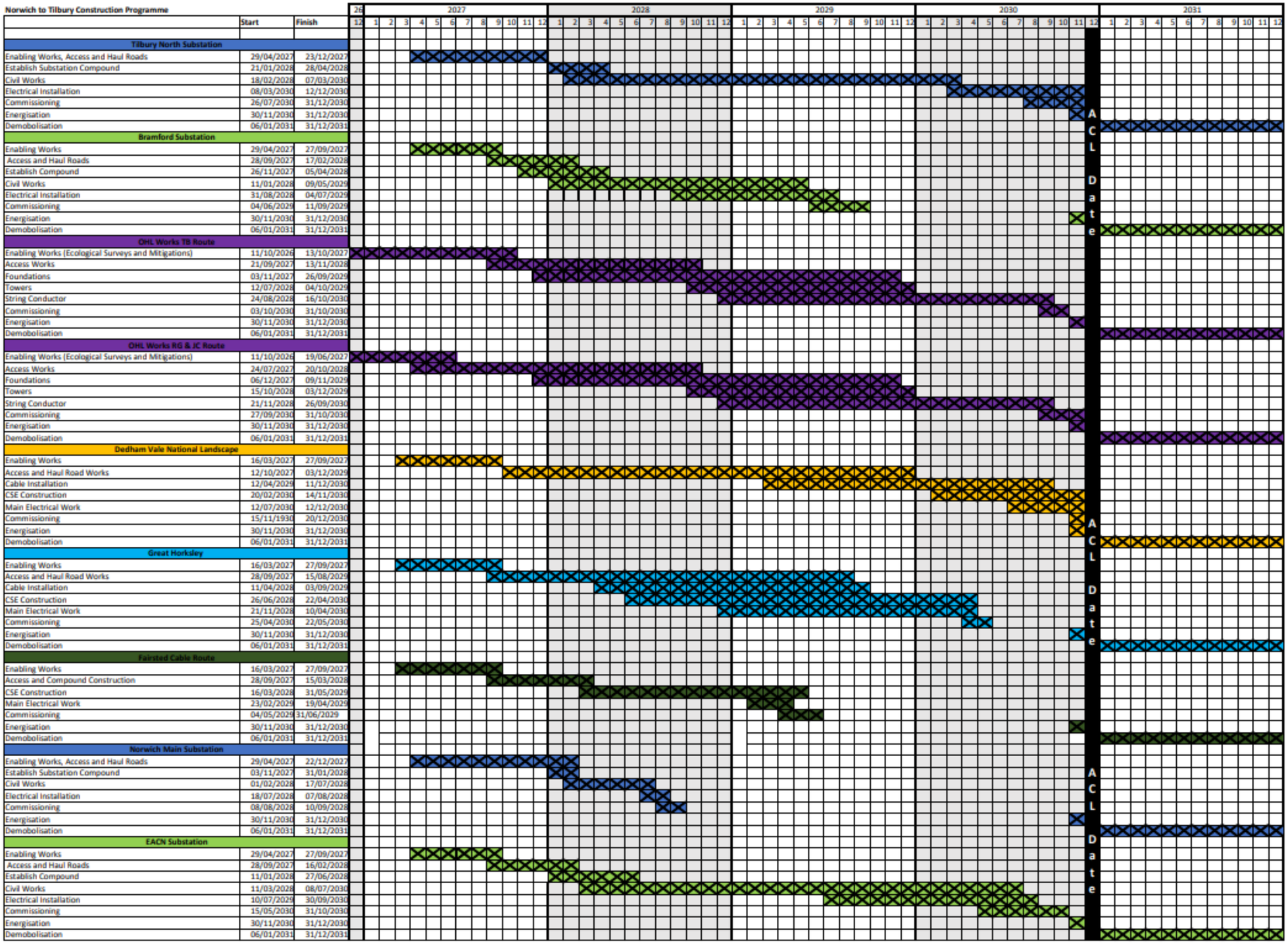
4.7.1 Prior to the grant of DCO consent, a number of pre-construction environmental surveys would be undertaken in 2026.

4.7.2 Should consent be granted, it is anticipated that construction of the Project would commence in 2027 and continue for four years through to 2031 (including demobilisation). Certain pre-commencement operations could take place following the grant of DCO consent and in advance of construction, including:

- Engineering investigations and surveys
- Environmental (including archaeological) investigations and monitoring
- Surveys and monitoring investigations associated with assessing ground conditions
- Diversion and laying of services, protection works comprising utilities protection works or fencing and protection slabs
- Site clearance
- Environmental mitigation measures
- Remediation associated with contamination or other adverse ground conditions
- Site set up works associated with the establishment of construction compounds and temporary laydown areas
- Temporary accesses
- Erection of temporary enclosures or temporary demarcation fencing marking out site boundaries and the temporary display of site notices or advertisements.

4.7.3 Indicative construction phasing is presented in Image 4.1.

Image 4.1 Indicative construction programme[10]



Norwich to Tilbury Construction Programme	Start	Finish
Tilbury North Substation		
Enabling Works, Access and Haul Roads	29/04/2027	23/12/2027
Establish Substation Compound	21/01/2028	28/04/2028
Civil Works	18/02/2028	07/03/2030
Electrical Installation	08/03/2030	12/12/2030
Commissioning	26/07/2030	31/12/2030
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031
Bramford Substation		
Enabling Works	29/04/2027	27/09/2027
Access and Haul Roads	28/09/2027	17/02/2028
Establish Compound	26/11/2027	05/04/2028
Civil Works	11/01/2028	09/05/2029
Electrical Installation	31/08/2028	04/07/2029
Commissioning	04/06/2029	11/09/2029
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031
OHL Works TB Route		
Enabling Works (Ecological Surveys and Mitigations)	11/10/2026	13/10/2027
Access Works	21/09/2027	13/11/2028
Foundations	03/11/2027	26/09/2029
Towers	12/07/2028	04/10/2029
String Conductor	24/08/2028	16/10/2030
Commissioning	03/10/2030	31/10/2030
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031
OHL Works RG & JC Route		
Enabling Works (Ecological Surveys and Mitigations)	11/10/2026	19/06/2027
Access Works	24/07/2027	20/10/2028
Foundations	06/12/2027	09/11/2029
Towers	15/10/2028	03/12/2029
String Conductor	21/11/2028	26/09/2030
Commissioning	27/09/2030	31/10/2030
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031
Dedham Vale National Landscape		
Enabling Works	16/03/2027	27/09/2027
Access and Haul Road Works	12/10/2027	03/12/2029
Cable Installation	12/04/2029	11/12/2030
CSE Construction	20/02/2030	14/11/2030
Main Electrical Work	12/07/2030	12/12/2030
Commissioning	15/11/1930	20/12/2030
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031
Great Horksley		
Enabling Works	16/03/2027	27/09/2027
Access and Haul Road Works	28/09/2027	15/08/2029
Cable Installation	11/04/2028	03/09/2029
CSE Construction	26/06/2028	22/04/2030
Main Electrical Work	21/11/2028	10/04/2030
Commissioning	25/04/2030	22/05/2030
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031
Fairsted Cable Route		
Enabling Works	16/03/2027	27/09/2027
Access and Compound Construction	28/09/2027	15/03/2028
CSE Construction	16/03/2028	31/05/2029
Main Electrical Work	23/02/2029	19/04/2029
Commissioning	04/05/2029	31/06/2029
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031
Norwich Main Substation		
Enabling Works, Access and Haul Roads	29/04/2027	22/12/2027
Establish Substation Compound	03/11/2027	31/01/2028
Civil Works	01/02/2028	17/07/2028
Electrical Installation	18/07/2028	07/08/2028
Commissioning	08/08/2028	10/09/2028
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031
EACN Substation		
Enabling Works	29/04/2027	27/09/2027
Access and Haul Roads	28/09/2027	16/02/2028
Establish Compound	11/01/2028	27/06/2028
Civil Works	11/03/2028	08/07/2030
Electrical Installation	10/07/2029	30/09/2030
Commissioning	15/05/2030	31/10/2030
Energisation	30/11/2030	31/12/2030
Demobolisation	06/01/2031	31/12/2031

[10] 'OHL' stands for 'overhead line' and 'ACL' stands for 'Available for Commercial Load'.

Construction Working Hours

4.7.4 It is assumed that the core working hours for construction (as set out within Requirement 7 of the draft DCO (document reference 3.1) (Revision G)) would be:

- Monday to Friday: 07:00 to 19:00
- Saturdays, Sundays, Bank Holidays and other public holidays: 07:00 to 17:00.

4.7.5 No percussive piling works would take place outside of the hours of 07:00 to 19:00 Monday to Friday and 07:00 to 17:00 on Saturdays.

4.7.6 Unless otherwise agreed with the Local Highway Authority, no Heavy Good Vehicle (HGV) deliveries would be made to site outside of the hours of 07:00 to 19:00 Monday to Friday and 07:00 to 17:00 on Saturdays.

4.7.7 The following operations may take place outside the core working hours:

- Trenchless crossing operations including at landfalls and beneath highways, railway lines, woodlands, nature reserves, Sites of Special Scientific Interest or watercourses
- The installation and removal of conductors, pilot wires and associated protective netting (included but not limited to) across highways, railway lines or watercourses
- The jointing of underground cables
- The continuation of any work activity commenced during the core working hours to a point where they can securely and or safely be paused
- Any highway works requested by the Local Highway Authority to be undertaken on a Saturday or Sunday or outside the core working hours
- The testing or commissioning of any electrical plant installed as part of the authorised development including undertaking of any identified corrective activities
- The completion of works delayed or held up by severe weather conditions which disrupted or interrupted normal construction activities
- Activity necessary in the instance of an emergency where there is a risk to persons or property
- Security monitoring
- Non-intrusive surveys
- Intrusive surveys
- Oil processing of transformers or reactors in substation sites
- Delivery to the transmission works of abnormal indivisible loads and any highway works requested by the Local Highway Authority to be undertaken outside the core working hours
- Mechanical and electrical installation works within buildings once erected and enclosed.

4.7.8 The core working hours exclude:

- Start up and close down activities up to 1 hour either side of the core working hours.

4.7.9 The severe weather conditions referred to means any weather which prevents work from taking place during the core working hours by reason of physical incapacity (whether for reasons of visibility, ground conditions, power availability, site access or otherwise) or being contrary to safe working practices.

Night working

4.7.10 There is no intention for night working on the Project as standard. However, there would be occasions where night working is required, as set out in the operations that may take place outside of the core working hours above. There is also the potential for the trenchless crossing works to be undertaken at night. Parts of the trenchless crossing operations require continuous working to achieve completion of the crossing. Some road works may also need to be undertaken at night to reduce effects on local traffic.

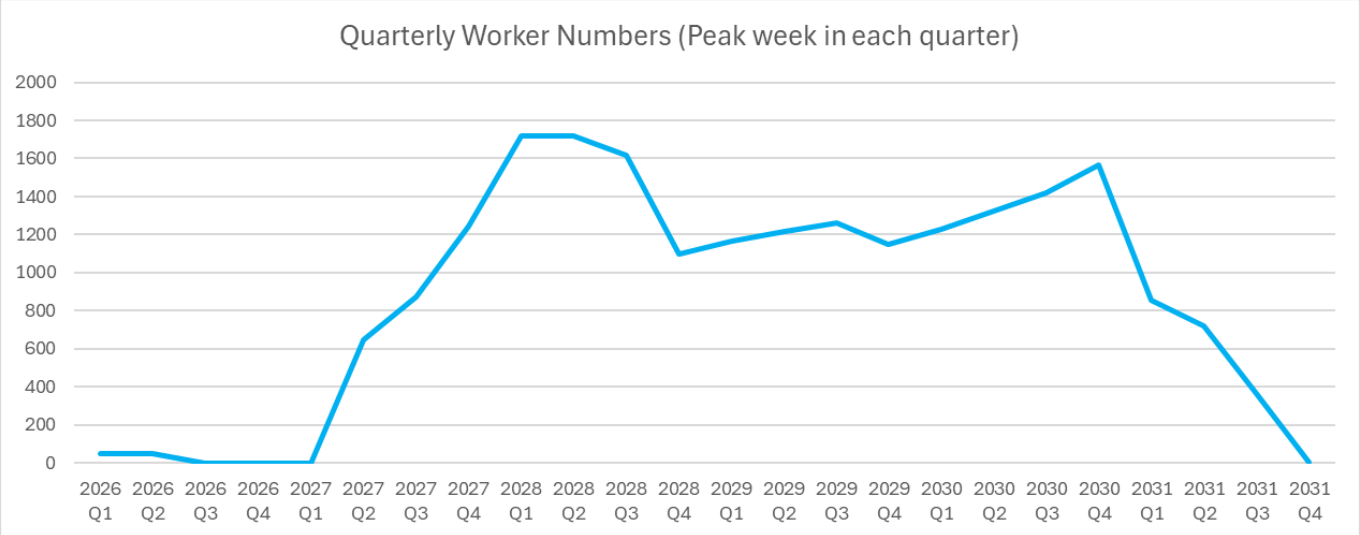
Construction Workforce and Vehicles

Estimated Workforce

4.7.11 National Grid has estimated the number of construction workers that it would require on the Project and how these would be spread across the construction programme.

4.7.12 Over the four-year construction phase, there would be a maximum peak day where approximately 1,720 Full Time Equivalent (FTE)[11] employees would be working on the Project. Employees would be spread across various work sites along the 180 km Project. Image 4.2 outlines the estimated peak daily workforce within the busiest week within each quarter across the construction of the Project.

Image 4.2 Estimated maximum daily workforce throughout the construction of the Project (quarterly work numbers – peak week within quarter)



[11] 'FTE' measures the total number of hours worked by employees in relation to a full-time work schedule.

4.7.13 In addition to the above, the Project would generate approximately 4,800 FTE gross direct employees across the four-year construction phase.

4.7.14 The majority of employment activities would require trained specialists who are qualified to work on National Grid infrastructure, and it is assumed that these would be sourced from an existing pool of approved contractors. However, experience of other National Grid projects suggests that it is likely that a minimum of 10% of the workers could be sourced from the local labour market, including apprentices, security workers and delivery drivers.

Estimated Construction Vehicles

4.7.15 National Grid has estimated the flows / volumes of construction vehicles that it anticipates would be required to construct the Project. These estimates are provided in Appendix 16.4: Traffic and Transport Construction Effects (document reference 6.16.A4) (Revision B). The numbers are based on worst-case assumptions.

Existing Features During Construction

4.7.16 The paragraphs that follow outline assumptions relating to existing features during construction.

Land Drainage

4.7.17 Where appropriate, pre-construction field drainage would be installed in working areas to:

- Help prevent possible waterlogging of working areas and therefore the need for temporary dewatering during construction
- Enable the landowner's current drainage system to continue working throughout construction
- Help prevent damage to the soil structure
- Aid recovery from construction activities
- Help prevent any future drainage problems.

4.7.18 Landowners would be consulted on the design of the land drainage proposals. The design would reduce risk so that the drains do not act as pathways for contamination or cause flooding off site. The Lead Local Flood Authorities (LLFAs) and Internal Drainage Boards (IDBs) would also be consulted on drainage design where necessary. Following construction, the land would be reinstated to its former condition (unless otherwise agreed) including installation of a replacement drainage scheme where appropriate.

4.7.19 A specialised drainage contractor(s) would review the drainage designs and provide advice to National Grid and the Main Works Contractor(s) during all relevant construction and reinstatement activities. Permanent records of the land drainage locations would be made and passed to the landowners/occupiers.

4.7.20 The Outline CoCP (document reference 7.2) (Revision G) describes a number of commitments linked to sustaining existing land drainage infrastructure which is secured by Requirement 4 in the draft DCO (document reference 3.1) (Revision G).

Public Rights of Way

4.7.21 A number of PRoWs would be affected by the construction of the Project; the existing PRoWs intersecting the Project are shown on Figure 15.3: Recreational Land and Recreational Routes (document reference 6.15.F3). Discussions with PRoW officers have been held to discuss the management of PRoWs, including managing, diverting and/or temporarily closing PRoWs. Management of PRoW during construction is detailed within the Outline PRoW Management Plan (document reference 7.6) (Revision D) and shown on the Access, Rights of Way and Public Rights of Navigation Plans (document reference 2.5) (Revisions B – D).

Water Usage, Abstractions, Discharges and Dewatering

4.7.22 It is currently assumed that no discharges (other than treated and restricted surface water runoff) to surface waters are required for the Project during construction. It is also assumed that there would be no new temporary or permanent abstractions and that the water supply needs of the Project during construction would be sourced from mains water supply or, in remote locations where mains water may not be available, water would be tankered in. With regards to grey water generated from welfare facilities, it is assumed that this would be discharged to the public sewer or, where this is not practicable, be collected and tankered off site to a licensed disposal facility.

4.7.23 Where excavation of soil is required, for example at the base of the pylons and for the cable trenches, and where water is encountered in the excavation, it would be pumped out using an appropriate pump and a sump made in the subsoil using the excavator. The water would be pumped from the sump and allowed to filter through silt traps. The assessment presented within the ES (Volume 6 of the DCO application) assumes that there may be the need for temporary short-term dewatering, such as removal of rainwater or surface water when undertaking soil excavation. It is anticipated these would be local discharges to ground (after using settlement tanks) and not to watercourses. Removing rainwater from excavations does not require a permit.

4.7.24 It is assumed that no temporary discharges to watercourses are required for dewatering. Where this is not practicable in localised areas, any discharge to surface water would be undertaken in accordance with relevant consents.

4.7.25 Dewatering is assessed within the ES (Volume 6 of the DCO application) at locations where there is an intersection with the water table (and active lowering of the water table) for 100 days or more and therefore could require a permit. Permits relating to temporary dewatering (abstraction) may be required at the trenchless crossings. If the abstracted groundwater is discharged immediately to a soakaway, the abstraction would be exempt from an abstraction licence. If the water is not immediately discharged to a soakaway, it would be exempt when the abstraction is:

- Less than 100 m^3 per day and located more than 500 m from a designated site or 250 m from a spring, well or borehole, or
- Less than 50 m^3 per day and located less than 500 m from a designated site or 250 m from a spring, well or borehole.

4.7.26 In all other cases, a licence would be required. Once the discharge duration, volume and water quality have been assessed, a decision would be made, in conjunction with the Environment Agency, as to whether an abstraction licence and/or discharge permit is required.

4.7.27 The discharge would be exempt from a discharge permit if it is a groundwater discharge where the water quality meets the Drinking Water Standards and is of less than 30 days duration (Environment Agency, 2021). It would also be exempt if it is a surface water discharge of clean water, without suspended solids, and is for a duration of less than three months.

4.7.28 Drainage outfalls are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and in Appendix 4.2: Watercourse Crossing Details (document reference 6.4.A2) (Revision B).

Assumptions on Materials and Waste During Construction

Materials During Construction

4.7.29 The nature of the Project means that it is not practicable to use secondary sources during construction, as this can affect the operation and the design life of the Project. However, National Grid has existing processes in place to source materials from sustainable sources and to use recycled materials where these do not compromise the required design standards and operational life, where practicable.

4.7.30 The material sources are unlikely to be identified until the detailed design and procurement stage of the Project, which would happen post-consent. Table 4.5 outlines an estimate of the main materials and quantities that are anticipated based on the Project alignment, as shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B), and knowledge of similar projects.

Table 4.5 Approximate key materials quantities anticipated for the Project

Material	Estimated Quantity
Concrete for foundations of new pylons	43,700 tonnes
Cement-bound sand (for underground cables)	128,000 m^3
Steel for pylons	17,400 tonnes
Overhead line conductors (aluminium)	7,900 tonnes
Underground cables, 400 kV (copper assumed)	400 km
Underground cables, UKPN mitigation (copper, fibre optic and ducting assumed)[12]	85 km (8,400 tonnes)
Stone for haul roads, compounds, work areas, etc.	3,335,000 tonnes
Stone/chippings/imported fill for permanent CSE compound and substation platforms	521,300 tonnes

[12] Assumed length of UKPN mitigation for overhead line interactions only. New underground cables interactions with existing UKPN utilities are assumed to be mitigated with modifications to existing structures, e.g. pole lifting where required. Further detail is included in Section 4.8.

4.7.31 Although materials would be resourced from within the region where practicable, it is recognised that certain temporary materials, such as hardcore for the haul roads and temporary construction compounds, may need to be resourced from outside the region. Further detail can be found within Transport Assessment (document reference 7.11) (Revision B).

4.7.32 Where practicable, this material would be reused at other construction projects after completion of the Project. Opportunities to retain materials *in situ*, where specifically requested by landowners, would also be considered subject to any additional permission being obtained by the landowner. Other construction items such as works cabins and security fencing would be sourced from within the region (where practicable).

Waste During Construction

4.7.33 Waste materials would be produced during construction. NPS EN-1 (paragraphs 5.15.2 and 5.15.3) (DESNZ, 2024a) states that the waste hierarchy must be applied when managing waste and disposal of waste should only be considered where other waste management options are not available. Table 4.6 describes the main wastes anticipated on the Project and if they are likely to be recycled or reused based on experience of similar projects.

Table 4.6 Approximate key waste quantities anticipated from the Project

Waste	Estimated Quantity	Proposed Hierarchy
132 kV and 400 kV steel pylons	1,000 tonnes	Assume recycled
400 kV, 275 kV, 132 kV, 33 kV and 11 kV conductors	300 tonnes	Assume recycled
Removed foundations of 132 kV and 400 kV pylons (assumed partially removed)	1,200 tonnes	Assume recycled
Low voltage wooden poles	Approximately 1,000 (1,700 tonnes)	Assume recycled
Stone for haul roads, compounds, work areas, etc.	3,335,000 tonnes	Assume recycle
Displaced soil from pylon bases	26,955 tonnes	Assume reused on site where suitable

4.7.34 It is assumed that any soil excavated from the Project (e.g. displaced from the cable ducts or pylon foundations) would be reused on site where soil is suitable for reuse (for example, not contaminated and giving consideration to land holdings and applicable biosecurity measures). This could be through the backfilling of foundations removed from 132 kV overhead line removal, the cable trenches and for landscaping. It is assumed that all soil could be reused on site; however, if it arises that excess soil cannot be reused on site, this soil would be taken off site.

4.7.35 The Main Works Contractor(s) would produce a Site Waste Management Plan (SWMP) prior to construction (an Outline SWMP is provided as an appendix to the

Outline CoCP (document reference 7.2) (Revision D)). The Outline SWMP provides a framework to reduce the generation of waste in the first place and appropriate measures to reuse and recycle materials where practicable. The SWMP would identify appropriate waste facilities to dispose of materials.

4.8 Construction – Temporary and Permanent Features

Introduction

4.8.1 This section describes how the permanent assets would be constructed as well as temporary features such as temporary construction compounds and haul roads.

Temporary Construction Compounds

4.8.2 There would be an element of preparatory works/pre-commencement works/enabling works in anticipation of construction at all temporary construction sites. The working areas would be demarcated and secured by temporary fencing appropriate to the location, for example provision of stockproof fencing in grazing areas. Gated entrances would be installed at the entrance to the working areas, to secure the site. Once secured, the working area, temporary construction compounds and proposed cable sections would generally be stripped of the upper layers of soil which would be stored appropriately within the Order Limits.

4.8.3 Temporary construction compounds would be established early in the construction programme. Site cabins (standard modular units) would be up to double storey and may be raised to take account of potential flood risk.

4.8.4 The sustainability of temporary construction compounds has been optimised, for example locating them close to PARs, close to the core works they are supporting and where practicable away from residential receptors. The temporary construction compounds are likely to include grey water harvesting for toilet flushing, solar power on site, electric charging for plant and vehicles etc. National Grid requires an internal Sustainability Action Plan (which would be a live document driven by internal requirements and not by EIA) to be prepared for all of its construction projects; this plan would provide further sustainability commitments the Main Works Contractor(s) would be required to adhere to, for example providing Electric Vehicle charging and procuring energy efficient site cabins.

4.8.5 The following types of temporary construction compounds are proposed to facilitate construction of the Project:

- Main Works compounds (overhead line) (two proposed): These would act as the key focal points for deliveries, materials storage, fuel storage, office space, meeting facilities, welfare facilities and power generator(s) for the Project delivery teams. Main Works compounds would be approximately 275 m x 200 m. They would be typically surfaced with stone chippings over geogrid
- Satellite compounds (overhead line) (five proposed): These would be positioned at strategic locations along the Project. They would be smaller than the Main Works compounds, approximately 130 m x 110 m, and would serve as specific working areas to provide local welfare facilities for staff and points for delivery of materials to the working areas. They would be typically surfaced with stone chippings over geogrid

- Primary compounds (underground cable) (three proposed): These would provide storage for approximately 54 cable drums, and have approximate dimensions of 155 m x 155 m. These would allow for deliveries, materials storage, fuel storage, office space, meeting facilities, welfare facilities and crane platforms typically for unloading cable drums. They would be typically surfaced with stone chippings over geogrid. An additional six secondary construction compounds are proposed along the cable alignment which would be similar to the primary compounds but smaller to reflect the available space and Project needs at the specific location
- Substation/CSE compounds (10 proposed): These would be appropriately positioned at substation and CSE locations. These would be similar in size and arrangement to those used for the cable works, with the cable drum storage being replaced with additional laydown area
- Concrete batching plant compounds (four proposed): These would provide a location for temporary concrete batching equipment, with approximate dimensions of 62 m x 90 m. These would allow for assembly of the batching equipment, topsoil storage, aggregate storage (for concrete mixing) and HGV access around the equipment. Batching equipment would typically be 10 m in height. The batching plants would provide Cement-Bound Sand (CBS) for backfill of the cable trench and concrete for substation and CSE compound works. These compounds would be located at strategic positions, based on anticipated concrete/ CBS demand. They would be typically surfaced with stone chippings over geogrid
- 132 kV overhead line mitigation works UKPN compounds (17 proposed): These would be appropriately positioned within the working area for the 132 kV mitigation works and approximately 40 m x 40 m in size, located at each end of the proposed works. They would be typically surfaced with trackway
- Highway mitigation compounds (13 proposed): These are required to facilitate the construction of the highway mitigation works, for example road widening and passing places. They would generally include welfare facilities, traffic management equipment, vehicle parking and material storage. They would be typically surfaced with stone chippings over geogrid.

4.8.6 The locations of temporary construction compounds are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and detailed in Table 4.7. General Layout Drawings for each of the temporary construction compound types are provided in the Design and Layout Plans (document reference 2.6) (Revisions A and D).

Table 4.7 Proposed temporary construction compounds

Compound Name (reference)	Project Section	Compound Type
Land to north of Norwich Substation, South Norfolk (RG-SC01)	Section A	Substation compound
Diss Road, near RG56, South Norfolk (RG-Sate1)	Section A	Satellite compound (overhead line)
Old Bury Road, near RG96, Mid Suffolk (RG-Main)	Section B	Main Works compound (overhead line)
Site set back from Bells Lane, near RG155, Mid Suffolk (RG-Sate2)	Section B	Satellite compounds (overhead line)
Land to the east of Bramford Substation, Mid Suffolk (RG-SC02)	Section B	Substation compound
Land east of Woodland Road, north of Raydon (JC-SC01)	Section C	CSE compound
Land off B1070, Raydon (JC-CC02 and JC-BC01)	Section C	Primary (cable) and concrete batching plant compound
Land south of Dedham Road, north of Langham (JC-CC03 and JC-BC02)	Section C	Primary (cable) and concrete batching plant compound
Land south of Birchwood Road, to the west of Lamb Corner, Colchester (JC-CC04)	Section C	Primary compound (cable)
Land south of Little Bromley Road, Bradley Hall, Tendring (JC-CC05)	Section C	Secondary compound (cable)
Land at the EACN Substation, Tendring (JC-SC06, JC-SC07 and JC-BC03)	Section C	Substation and concrete batching plant compound (batching plant compound coincides with part of an additional construction laydown area that has been allocated to support substation, overhead line or cables work as required).
Land south of Broad Lane, Great Horkesley (TB-SC01)	Section D	CSE compound
Land north of Broad Lane, Great Horkesley (TB-CC02 and TB-BC01)	Section D	Secondary (cable) and concrete batching plant compound
Land west of A134, Tye Green, Colchester (TB-CC03)	Section D	Secondary compound (cable)
Land west of Crabtree Lane, north of Bellmead, Colchester (TB-SC04)	Section D	CSE compound

Compound Name (reference)	Project Section	Compound Type
Great Tey Road, near TB66, Colchester (TB-Sate1)	Section D	Satellite compound (overhead line)
Land east of Fairstead Road, north of Fairstead (TB-SC05)	Section E	CSE compound
Land east of Fairstead Road, north of Fairstead (TB-CC06)	Section E	Secondary (cable) compound
Off Braintree Road, near TB134, Chelmsford (TB-Main)	Section F	Main Works compound (overhead line)
Land east of A131, near Sheepcotes Wood (TB-CC07)	Section F	Secondary (cable) and CSE compound
Off Brentwood Road, near TB223, Basildon (TB-Sate2A)13	Section G	Satellite compound (overhead line)
Lower Dunton Road, near TB233, Basildon (TB-Sate2B)23	Section H	Satellite compound (overhead line)
Site north of Hoford Road, adjacent to Orsett Golf Club, Thurrock (TB-SC08)	Section H	Substation compound
Site north of Hoford Road, adjacent to Orsett Golf Club, Thurrock (ZB-SC01)	Section H	CSE compound
Site west of Hoford Road and east of Brentwood Road (ZB-CC02)	Section H	Secondary (cable) compound
Site west of Hoford Road and east of Brentwood Road (ZB-SC03)	Section H	CSE compound
132 kV overhead line mitigation works compounds		
PKF35, north of the A143, Old Bury Road (PKF-C1)	Section B	132 kV overhead line mitigation works compound
PKF16, east of Burgate Road (PKF-C2)	Section B	132 kV overhead line mitigation works compound
EEPK10, south-west of Hill House Lane (EEPK-C1)	Section B	132 kV overhead line mitigation works compound
EEPK14, east of Hascot Hill (EEPK-C2)	Section B	132 kV overhead line mitigation works compound
PI35, north of Offton Road/ Holly Road (PI-C1)	Section B	132 kV overhead line mitigation works compound

[13] There are two options for satellite compounds in Basildon, due to pending planning applications. Only one compound would be taken forward. Further details can be found in Table 4.4.

Compound Name (reference)	Project Section	Compound Type
PI15, north of Tye Lane (PI-C2)	Section B	132 kV overhead line mitigation works compound
PHB/PLD, south-east of Bramford Substation (PHB-C2)	Section B	132 kV overhead line mitigation works compound
PLD48, west of Loraine Way (PLD-C1)	Section B	132 kV overhead line mitigation works compound
PHB22, north of the A1071 (PHB-C1)	Section C	132 kV overhead line mitigation works compound
PCB5, east of Thorpe's Hill (PCB-C1)	Section C	132 kV overhead line mitigation works compound
PSB42, west of Fairstead Lodge Road (PSB-C2)	Section E	132 kV overhead line mitigation works compound
PSB39, east of Cole Hill (PSC-C1)	Section F	132 kV overhead line mitigation works compound
PUB47, north of Rayleigh Road (PUB-C1)	Section G	132 kV overhead line mitigation works compound
PUB43, south-east of Hall Green Lane (PUB-C2)	Section G	132 kV overhead line mitigation works compound
PSC10, west of Lower Dunton Road (PSC-C1)	Section G	132 kV overhead line mitigation works compound
PAB50, west of Lower Dunton Road (PAB-C2)	Section H	132 kV overhead line mitigation works compound
PAB22, west of Buckingham Hill Road (PAB-C1)	Section H	132 kV overhead line mitigation works compound
Highway Mitigation Compounds		
Wymondham Rd/B1113 Junction (near Mulbarton, Norfolk)	Section A	Highway mitigation construction compound
Major Lane, near Gislingham, Suffolk	Section B	Highway mitigation construction compound
Wickham Road/Eastlands Lane Junction, near Finningham, Suffolk	Section B	Highway mitigation construction compound
B1113 Finningham Road, near Rickinghall, Suffolk	Section B	Highway mitigation construction compound
Bullen Lane/B1113 Junction, near Bramford, Suffolk	Section B	Highway mitigation construction compound
A12/B1070 Junction (A12 Junction 31), near Holton St Mary, Suffolk	Section C	Highway mitigation construction compound

Compound Name (reference)	Project Section	Compound Type
Bentley Road/A120 Junction, near Little Bentley, Essex	Section C	Highway mitigation construction compound
Bentley Road/Church Road Junction, near Little Bromley, Essex	Section C	Highway mitigation construction compound
Ardleigh Road/Little Bromley Road/Grange Road Junction, near Little Bromley, Essex	Section C	Highway mitigation construction compound
Wick Lane, near Ardleigh, Essex	Section C	Highway mitigation construction compound
Ivy Barns Lane, near Margaretting, Essex	Section F	Highway mitigation construction compound
Church Lane, near Margaretting, Essex	Section F	Highway mitigation construction compound
Dunton Road, near Dunton Wayletts, Essex	Section G	Highway mitigation construction compound

4.8.7 In addition to the temporary construction compounds listed in Table 4.7, a number of temporary construction laydown areas would be required. These would be predominantly located at the site access points (or bellmouths) where the PARs meet the Order Limits and are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B).

4.8.8 The construction laydown areas would store stone and other materials to facilitate the construction of the Project (predominantly for the haul roads). Material storage would typically only be needed for the first 12 months of construction and would likely store material to a maximum of 4 m in height at any one time.

4.8.9 Construction laydown areas have been selected to avoid sensitive environmental features. It is assumed that they would generally be stripped of topsoil which would be stored appropriately and typically surfaced with stone chippings over geogrid. They would be reinstated to their former condition following their use.

4.8.10 As well as the temporary construction compounds outlined above, site staff welfare units (including Portaloos or similar) would also be required along the Project at strategically placed locations, to allow construction staff to have access to welfare facilities.

4.8.11 In addition, materials may be temporarily placed adjacent to any temporary construction areas during construction, for example pylon components before being erected.

Non-Road Mobile Machinery (NRMM) and Use

4.8.12 All temporary construction compounds and trenchless crossing locations would require the use of generators. UKPN connections may be available to supply electricity to the temporary construction compounds. UKPN connections would be made where practicable within the Order Limits. However, any UKPN connections

remain subject to agreement and cannot be guaranteed. Therefore, as a worst-case it is assumed that generators would be present at all temporary construction compounds. Further assumptions on NRMM and generator use are detailed within Chapter 7: Air Quality (document reference 6.7) (Revision B).

Temporary Construction Access and Haul Roads

Access Strategy

4.8.13 Construction traffic would use the Strategic Road Network (SRN)[14] and Major Road Network (MRN)[15] to access the Project. From the MRN and SRN, construction traffic would be routed along a PAR to a site access point (or bellmouth). From these site access points; traffic would be routed off the public highway along haul roads to access the construction works.

4.8.14 Crossover points would also be provided where the haul roads meet and cross the public highway and private tracks, i.e. a bellmouth would be provided either side of the public highway/private track to allow construction traffic to safely cross. In some instances, crossover points are also site access points.

4.8.15 A number of PARs have been identified to access the haul roads, with additional PARs proposed for longer sections of continuous haul road where appropriate. Generally, PARs are proposed to access each end of a haul road section, allowing construction traffic to enter the haul road at one end, travel along the haul road and exit the other end (if required). Dead-end haul roads have been avoided as far as practicable. However, there are some instances where part of the haul roads can only be accessed from one PAR due to site-specific constraints.

4.8.16 There may be circumstances where traffic movements along haul roads, or on the SRN / MRN and / or Local Road Network (LRN)[16], are compromised, which may affect construction vehicles using agreed PARs and site access points. In the event of any incident occurring which affects the safe and efficient operation of the road network, additional mitigation measures may be needed. Further detail is provided in the Outline CTMP (document reference 7.3) (Revision F).

4.8.17 Site access points and crossover points have been sited based on site-specific constraints and highway safety considerations. The locations of the site access points on the public highway are generally close to the underground cabling and overhead line construction corridors. The most suitable location for the proposed site access points have been determined with consideration of road geometry, increasing junction visibility and other site-specific constraints. Locations have, where appropriate, been chosen to reduce the effects on trees and hedgerows. Existing land/field accesses have been used where they are considered to be suitable locations as determined by the above assessment criteria. When forming site access points, connectivity for NMUs would be preserved, where safe and practicable.

4.8.18 The site access point layouts are designed to allow for two-way HGV movements. A standard detail showing the typical layout of the site access points, including the

[14] Major roads and motorways critical to long-distance travel, economic activity and connectivity between regions.

[15] Regionally important roads, such as key A-roads connecting areas to the strategic road network.

[16] Locally important roads primarily connecting local areas.

junction layout and visibility splays, is shown on Typical Access Bellmouth and Visibility Splay (document reference 2.6.3).

4.8.19 The site crossover points are designed to enable HGVs to cross directly over the access or highway, but do not allow for HGVs to turn into or out of them. A standard detail showing the typical layout of the site crossover points is shown on Typical Crossover Bellmouth and Visibility Splay (document reference 2.6.3).

4.8.20 For site crossover points on single lane roads where traffic light control may be required, an area for vehicle 'stacking' is provided. These areas allow vehicles to pass each other where they have been held at a simultaneous red light.

4.8.21 As part of the Project, the following are anticipated to be required:

- Approximately 278 site access points
- Approximately 51 site crossover points
- Approximately 44 combined site access points and site crossover points.

Haul Roads

4.8.22 The almost continuous haul road along the entire length of the alignment are proposed to typically be constructed within the underground cable corridor and adjacent to the overhead line.

4.8.23 The proposed haul roads are only discontinuous at major obstructions along the underground cable and overhead line corridor such as major roads, railways, areas of environmental or historical significance and major watercourses.

4.8.24 For overhead line construction, the haul roads would be typically 6 m wide, with passing places (widening to 8 m) provided at typical intervals of 200 m. The frequency of passing places would be determined by site-specific conditions at the detailed design stage and the forward visibility along the haul roads.

4.8.25 For the construction of underground cables, CSE compounds and substations, the haul roads would be typically 8 m wide to allow for the delivery and movement of larger equipment using Abnormal Indivisible Load (AIL) vehicles.

4.8.26 The typical cross section of the haul road would be 21 m wide, to allow for topsoil and subsoil storage, drainage, and demarcation fencing. A standard detail showing the typical layout of the haul road is shown on the Design and Layout Plans (document reference 2.6.3-1).

4.8.27 For the assessment of haul road construction, it is assumed that topsoil (and some subsoil) would be stripped and aggregate (e.g. stone) placed on top of the subsoil, delivered to site by HGVs. However, the Main Works Contractor(s) once appointed may adopt different construction methods or transport techniques that would not result in materially new or different effects to those assessed in this ES.

4.8.28 Within the underground cable sections, the haul roads would normally be positioned central to the alignment, i.e. with cable trenches located either side of the haul roads. Therefore, no additional vegetation clearance would be required, except in some cases where the haul road deviates from the underground cable alignment to reach a site access point onto the public highway.

4.8.29 In some locations, overhead line construction corridors would need to be accessed from the underground cable corridors. In these locations, a haul road is proposed to

be constructed adjacent and parallel to the underground cable corridor to access the overhead lines (this is also referred to as a 'bypass haul road'). This would be provided to separate the overhead line construction vehicle movements from the works associated with the underground cable construction. Bypass haul roads are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B).

4.8.30 Image 4.3 shows the typical construction of a haul road.

Image 4.3 Typical construction of a haul road

EACN Substation Temporary Access Arrangement

4.8.31 The construction access to the new EACN Substation is proposed via the A120, Bentley Road and a proposed permanent private access road between Bentley Road and Ardleigh Road. Under this proposed access arrangement, all Project construction traffic would use this route.

4.8.32 If the North Falls and Five Estuaries windfarm projects' construction corridor and associated haul road between Bentley Road and Ardleigh Road is available for use by the Project, then this haul road is expected to be used by the Project. If this alternative shared haul road arrangement is used, it is proposed that construction vehicles, including HGVs, would be routed to the new EACN Substation via the A120, Bentley Road and the North Falls and Five Estuaries construction corridor haul road between Bentley Road and Ardleigh Road. The proposed permanent private access road between Bentley Road and Ardleigh Road would still be constructed in this scenario to provide access for AIL and light vehicles.

Tilbury North Temporary Access Arrangement

4.8.33 The two proposed temporary access options into the new Tilbury North Substation during construction are presented in Table 4.4.

Public Highway and Traffic Management

4.8.34 Works to the existing highway network, including road widening, associated construction laydown areas and other highway measures (including removal of some street furniture) are required in certain locations along PARs as mitigation in order to make the existing highway more suitable for construction vehicles. The works would generally consist of widening at constrained locations or widening to provide passing places for HGVs. These locations are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B).

4.8.35 Traffic management would be used where required to maintain public or workforce safety. This would occur when working near the existing highway network, for instance constructing and removing site access points, erecting/dismantling scaffolding and where the underground cables cross the public highway. Further details of traffic management can be found in the Outline CTMP (document reference 7.3) (Revision G).

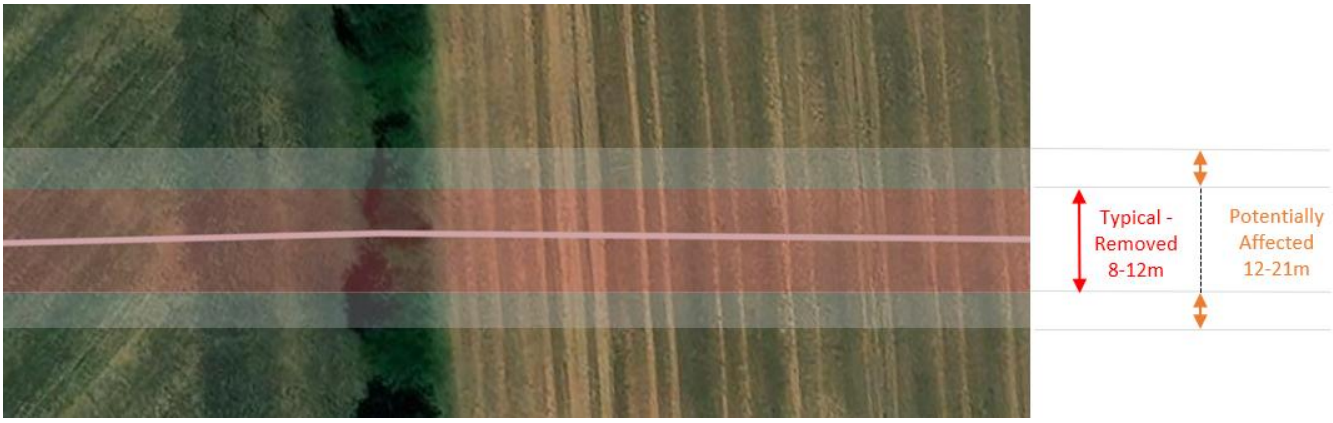
4.8.36 National Grid would discuss any traffic management, road closures and diversions with the relevant Local Highway Authority and the emergency services. Further details, including any proposed road closures and diversions, are set out within the Transport Assessment (document reference 7.11) (Revision B).

Vegetation Clearance for Haul Roads

4.8.37 To facilitate the construction of the haul roads, temporary vegetation clearance would be required (and reinstated after the works). It has been assumed that worst-case vegetation removal/management would comprise (also presented on Image 4.4):

- A typical 12 m swathe of removed vegetation (including hedgerows), allowing for up to 8 m wide haul roads and 2 m either side to allow for drainage
- A further 4.5 m either side of the 12 m swathe would be potentially affected, which includes LoD. Therefore, up to 21 m of vegetation falls within the potentially affected category.

Image 4.4 Haul road vegetation clearance requirements



4.8.38 For the overhead line haul roads, the Project would seek to reduce vegetation clearance to a 10 m swathe, allowing for 6 m wide haul roads and 2 m either side for drainage. Passing places would seek to avoid hedgerow crossings, though in some instances this may not be practicable due to visibility/health and safety concerns, and therefore as a worst-case it is assumed a 12 m swathe would be removed.

4.8.39 Where the haul road falls within areas being cleared for the overhead line/underground cable, no additional vegetation clearance would be required.

4.8.40 Temporary crossings would be required over watercourses, streams, and field ditches to maintain the haul roads along the alignment; these would likely consist of temporary bridges or culverts. Further detail is included in Appendix 4.2: Watercourse Crossing Details (document reference 6.4.A2) (Revision C).

4.8.41 At interfaces with the road network, additional vegetation clearance is anticipated. Vegetation clearance associated with site access points to form appropriate visibility splays, and any traffic management requirements, would vary from site to site. However, where practicable vegetation would be trimmed or cut to stump rather than full removal. Visibility splays have been developed to inform the Order Limits in accordance with the Design Manual for Roads and Bridges (National Highways, 2025) and with consideration of site-specific conditions, up to a maximum distance of 215 m either side of each site access point.

Overhead Line

4.8.42 The working areas around each new pylon would be cleared of vegetation and fenced appropriately. Access to each pylon location would be installed. Temporary appropriate technology / material would be required adjacent to each new pylon location, on which to place plant such as cranes and piling rigs. The stone working areas would typically be 60 m x 60 m (or 70 m x 70 m for angle/terminal/low-height suspension structures and 80 m x 80 m for low-height tension structures). Materials would be brought to site on HGVs and would include the steelwork for the pylons and the conductors (i.e. cabling) wrapped around large drums.

4.8.43 The base of the pylons would involve the excavation of the soil. Piling (which may include percussive) would be required at some pylon locations, subject to the ground conditions. A sample series of ground investigation has been completed (the remaining ground investigation would be undertaken by the Main Works Contractor(s) before detailed design) which would inform the foundation designs. The assessment assumes as a worst-case that percussive piling would be required at each pylon foundation.

4.8.44 Different foundation types can be used for lattice pylons, such as pad and column, vertical tube piles or bored mini-pile foundations, depending on the local ground conditions. The type of foundation to be used is typically identified during the detailed design stage by the Main Works Contractor(s) following intrusive ground investigation surveys.

Standard Pad and Column Foundations

4.8.45 For lattice suspension pylons, pad and column foundations are typically used. For tension, low height lattice pylons and terminal pylons, larger and deeper pad and column foundations are required. These are shown on the Design and Layout Plans (document reference 2.6.2).

4.8.46 The following works would be required to install foundations:

- Excavations are required for each pylon leg
- Foundation formwork (mould) is then inserted, cast, and filled with concrete
- The concrete is left to harden (set)

- The excavated hole is backfilled to ground level
- The foundation formwork would be removed and any remaining sub-soil subject its make up would be distributed on site or removed from site.

Piled Foundations – Tube or Bored Mini-Pile

4.8.47 In areas with poorer ground conditions that are unsuitable for pad and column foundations, vertical steel tube pile foundations or bored mini-pile foundations can be used. These are connected by a pile cap at or below ground level.

4.8.48 Using a piling hammer supported by a piling rig, steel tube piles are driven into the ground. A maximum transportable length of up to 15 m is driven at a time, and if longer piles are required, additional sections are welded together before continuing the drive.

Pylon Assembly and Erection

4.8.49 Following the installation of working areas and the appropriate foundations, pylon steelwork can be assembled, and the pylons can be erected.

4.8.50 Lattice pylons comprise many separate steel members. These are delivered to site in bundles by HGV. The steelwork for the pylons would be bolted together on the ground (see Image 4.5) and each pylon would be assembled in sections beginning with each of the four steelwork legs being fastened to the stubs (each of the four concrete foundation legs as described above). The pylon would be erected using a mobile crane to lift the assembled steelwork into position (see Image 4.6).

Image 4.5 Pylon steelwork preparation on the ground

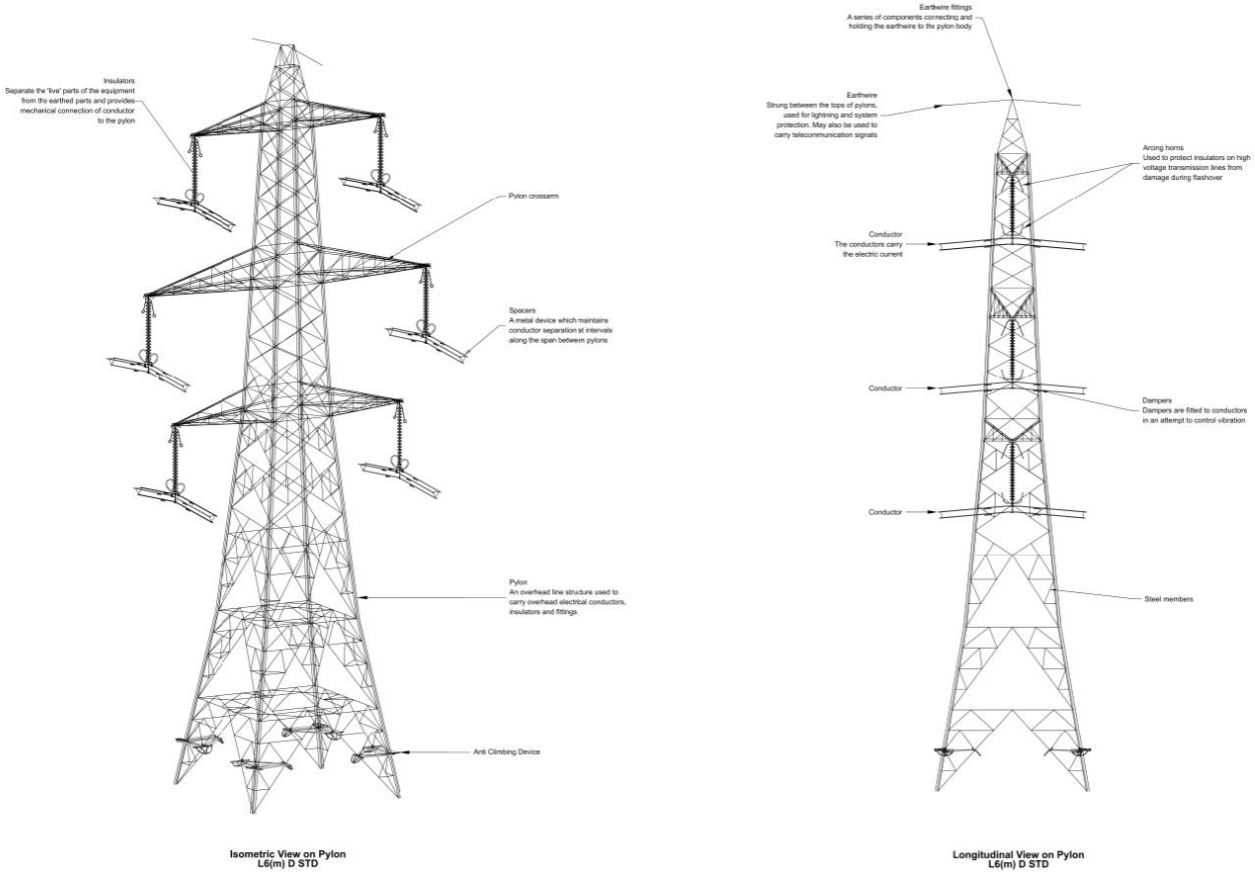
Image 4.6 Pylon erection

4.8.51 Overhead Line Craftpersons help guide the sections into place and bolt the pylon together. The insulators would be fastened to the pylons in preparation for installing the aluminium conductors. The conductors would typically be installed in sections between tension pylons, where the overhead line changes direction. A bowtie shaped pulling site would be established, for tension/angle pylons, at one end of the section with the conductors running out from a tensioning site at the other end of the section, to keep the wires off the ground. Pilot wires would be used to pull conductors between pylons. Additional fittings, such as spacers (to prevent the conductors from touching each other) and dampers (to prevent oscillations in the overhead line), would then be fitted to the conductors. An earth wire would run along the top of the pylons and contain optical fibres to allow transmission of data around the system.

Image 4.7 Machinery associated with conductor pulling

4.8.52 Helicopters are proposed to be used to support the construction of a limited suite of activities where their use offers the opportunity to reduce the number of vehicle movements and shorten the duration of an activity. Helicopters are proposed to support overhead line stringing by installing the pilot cable (the pulling bond, which is used to pull the conductors onto the pylons). Efficiencies (time and vehicle movements) could be achieved by the helicopter being able to install the main heavy-duty bond on a single flight, whereas more traditional methods require an initial lightweight bond to be installed to pull through two or three progressively stronger bonds. This method would take a day or two to install the six bonds required compared with potentially a number of weeks for more traditional methods. Helicopters are not proposed to be used for other aspects of pylon construction owing to the proximity of residential properties and the number of roads to be crossed. It is assumed that helicopters would use existing airfields/helipads as their operational base (including for refuelling and parking between tasks). Variation from this by an appointed helicopter operator would be subject to a separate agreement to temporarily use land and be required to satisfy relevant planning and pollution control requirements.

Image 4.8 Example of a 400 kV double circuit lattice pylon

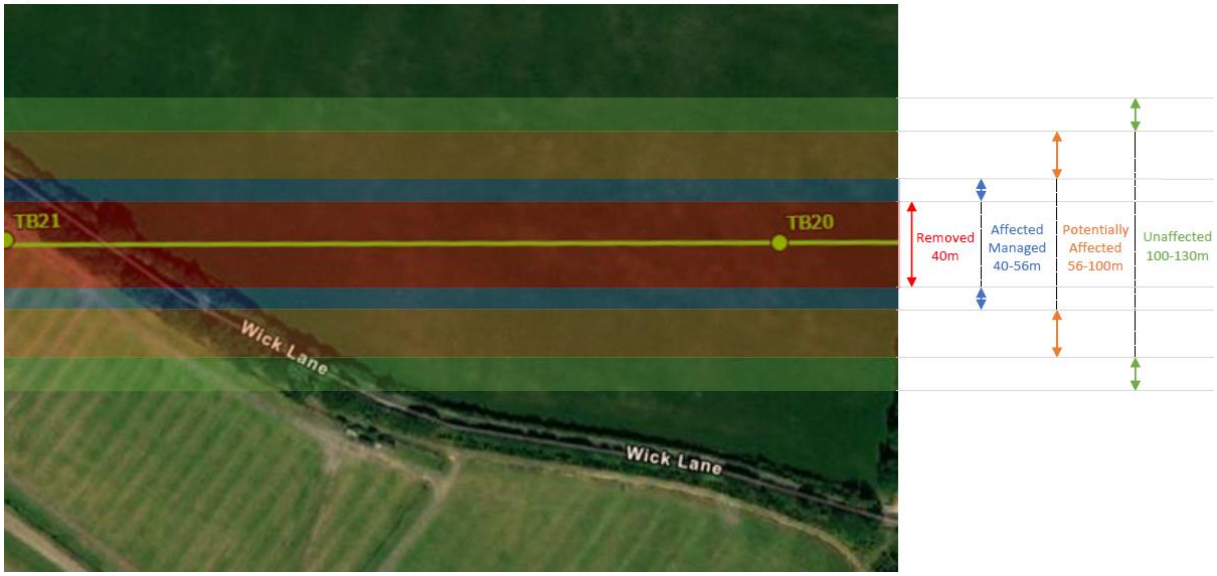


Vegetation Clearance for Overhead Lines

4.8.53 For the purposes of the ES (Volume 6 of the DCO application), a general approach has been assumed (unless otherwise stated) that where the Project interacts with woodland, trees and hedgerows, clearance would comprise the following approach for standard lattice pylons (refer to Image 4.9):

- Vegetation removed (to ground level or sufficient height to meet electrical clearances plus an allowance for growth)[17]: A 40 m wide swathe of vegetation removed to allow for the construction and operation (and maintenance) of the overhead line (to include all physical infringements to conductor, including conductor swing[18] (45° blown-out conductor), i.e. 20 m either side of each overhead line centreline)
- Vegetation affected/managed: An additional up to 8 m of vegetation either side of the 40 m may then need be managed during construction and operation (and maintenance) to allow for electrical clearance from the conductor to be maintained (assumes a generalised allowance of 0.5 m growth per year over a five-year period)
- Vegetation potentially affected: A further up to 22 m of vegetation either side of the 8 m would be potentially affected, which includes allowances for design flexibility as per the proposed lateral LoD
- Vegetation unaffected: Vegetation beyond the 22 m would be unaffected.

Image 4.9 Vegetation clearance requirements for standard lattice pylons



4.8.54 Note that, in locations where low height pylons are proposed (at TB135 to TB143 and TB237 to TB244), the general approach values are increased to reflect that the low height pylons are wider and, as such, a wider extent of vegetation is impacted. The values are increased to the following (refer to Image 4.10):

- Vegetation removed (to ground level or sufficient height to meet electrical clearances plus an allowance for growth): A 51 m wide swathe of vegetation removed to allow for the construction and operation (and maintenance) of the overhead line (to include all physical infringements to conductor, including

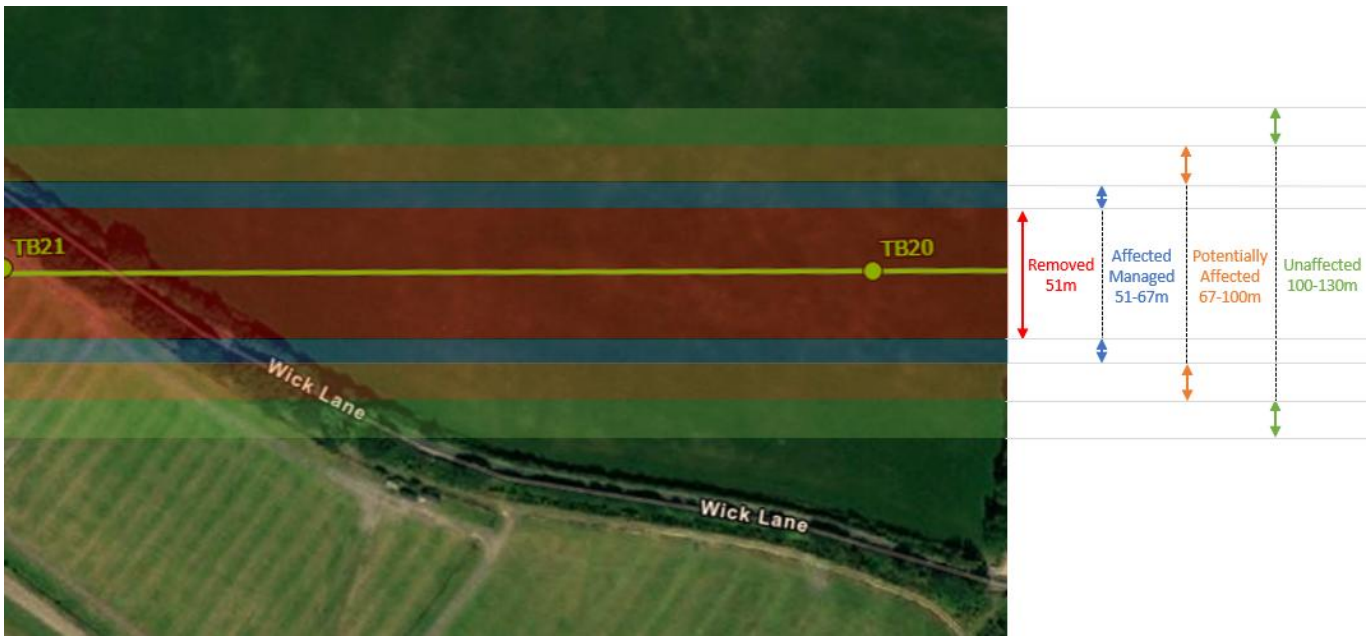
[17] Hedgerows beneath the overhead line conductors would be retained in situ. Hedgerow management may be required to meet overhead line electrical clearances (dependent on the hedgerow height) and a temporary 3 m section of hedgerow may require cutting to stump to facilitate the stringing of the pylons (pulling through of the bond wire). Any hedgerow within a pylon footprint would require permanent removal and any hedgerow within a working area may require temporary removal.

18 Conductor swing is the lateral deflection of a conductor system from its normal vertical position due to wind, which varies based on the length of the span and sag conditions; swinging from the crossarm tip of the pylon.

conductor swing (45° blown-out conductor), i.e. 25.5 m either side of each overhead line centreline)

- Vegetation affected/managed: An additional up to 16 m of vegetation either side of the 51 m may then need to be managed during construction and operation (and maintenance) to allow for electrical clearance from the conductor to be maintained (assumes a generalised allowance of 0.5 m growth per year over a five-year period)
- Vegetation potentially affected: A further up to 16.5 m of vegetation either side of the 16 m would be potentially affected, which includes allowances for design flexibility as per the proposed lateral LoD
- Vegetation unaffected: Vegetation beyond the 16.5 m would be unaffected.

Image 4.10 Vegetation clearance requirements for low height pylons



4.8.55 Further consideration has been given to veteran trees, other higher quality trees and areas such as ancient woodland that have been identified through arboricultural surveys and a desk study. A review of these features has been undertaken to identify where the generalised approach can/needs to be refined to avoid, prevent or reduce effects to sensitive features. Further details are outlined in Appendix 13.6: Arboricultural Impact Assessment (document reference 6.13.A6) (Revision B) and the Outline CoCP (document reference 7.2) (Revision B). In addition, the Trees and Hedgerows to be Removed and or Managed Plans (document reference 2.16) (Revisions C - D) present the generalised approach together with where it has been refined.

4.8.56 The Outline CoCP (document reference 7.2) (Revision G) includes a commitment that following detailed design and prior to construction (of relevant parts of the Project), relevant surveys would be undertaken of arboricultural features that may be impacted or need to be removed to ensure any tree / hedgerow removal is reduced as far as practicable.

Crossing Protection

4.8.57 Where the new overhead line crosses a road, railway line or navigable watercourse, scaffolding would be used to protect the crossing during construction. During site set up, scaffolding would be placed on either side of the feature. Each scaffold would be designed for the individual crossing that it would protect. The work area required for scaffold protection is dictated by the angle at which the overhead line crosses the asset which it is protecting. Crossing protection/scaffold is shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B).

4.8.58 Crossing protection would be made from steel scaffolding, with a net made of steel wire bonds anchored from scaffold to scaffold (see Image 4.11). Netting would be pulled across using karabiners to connect it to the steel wire bonds. The scaffold would be capable of withstanding a conductor being dropped on it in the unlikely event that this were to occur. The working area around the scaffold would be sufficient to erect the scaffold and to install and accommodate ground anchors or kentledge blocks required to stabilise the structure and catenary wires supporting the nets. Temporary road closures would be required to facilitate the erection and dismantling of the scaffold netting across the public highway. For a minor road, this would be up to approximately 30 minutes, out of peak traffic times. For a major road, this would be up to approximately four hours at night-time.

Image 4.11 Example of scaffold protecting a road crossing

Substations

4.8.59 The Project requires reinforcement works to the existing National Grid network, including a substation extension at the existing Bramford Substation and modification works to connect into the existing Norwich Main Substation. The Project also requires the construction of the new EACN Substation and the new Tilbury North Substation. Each substation design would be unique, dependent on the proposed equipment and

site-specific conditions. However, they would follow a similar typical construction sequence and programme. The typical construction sequence to construct or extend an electrical substation required for the Project would involve the following:

- Vegetation clearance and stripping of topsoil[19] from the proposed permanent site area and any working areas (topsoil would be stored in bunds on site, for reuse as part of landscaping proposals)
- Set up of temporary access and temporary construction compounds including:
  - Temporary lighting
  - Temporary drainage
  - Temporary fencing
  - Laying and compaction of granular material (and asphalt where required)
- Excavation of drainage attenuation features, installation of pipes, etc.
- Earthworks for construction of permanent site access and platform (including forming temporary soil bunds for storing excavated material). Where practicable, the temporary and permanent access would be combined
- Civil engineering works, to include permanent fencing, access, drainage and foundations of larger structures and/or equipment that is sensitive to ground settlement)
- Percussive piling may be required. This would be confirmed through a programme of ground investigation which would inform the foundation designs to be confirmed at detailed design. Therefore, within the ES (Volume 6 of the DCO application) it is assumed that percussive piling would be required at all new and existing substations
- Installation of structures (e.g. gantries)
- Building works, if the site is to include proposed GIS bays
- Overhead line or underground cabling works, as necessary
- Mechanical and electrical equipment installation
- Testing of equipment
- Commissioning/energisation
- Reinstatement of working areas outside the permanent substation boundary (including environmental mitigation and landscaping as required).

CSE Compounds

4.8.60 Although the Project predominantly comprises overhead lines, there are four sections of underground cable.

4.8.61 Where overhead lines transition to underground cables (and vice versa), a CSE compound is required. This would comprise high voltage equipment and gantry

[19] Subsoil would be stripped where required as per the individual site requirements and proposed earthworks strategies. Where suitable, the subsoil would be reused within the earthworks or as part of the landscaping proposal. Where the subsoil cannot be reused it would be removed from site.

structures, to enable the transition between underground cables and overhead conductors. An example of a CSE compound is presented in Image 4.12.

Image 4.12 Example CSE compound with gantry[20]

4.8.62 A CSE compound is required at each interface between the new overhead line and the new underground cable. The typical construction sequence to install a CSE compound required for the Project would be similar to that set out for substations, above.

4.8.63 Percussive piling may be required in the CSE compounds. This would be confirmed through a programme of ground investigations which would inform the foundation designs to be confirmed at detailed design. Therefore, within the ES (Volume 6 of the DCO application) it is assumed that piling would be required at all CSE compounds.

4.8.64 The CSE compounds proposed are listed within Table 4.8 with regard to the section of underground cable they are associated with.

Underground Cables

4.8.65 Table 4.8 outlines the sections of underground cables proposed as part of the Project. The transfer from overhead line to underground cable would be facilitated by the CSE compounds, as detailed in the previous CSE compounds section.

[20] Gantries, and compound sizes and/or layouts, within the Project may differ from that presented in this image.

Table 4.8 Proposed underground cable requirements

Cable Section	Project Section	Approximate Length (km)	Associated CSE Compounds
Dedham Vale National Landscape	Section C	16.8 (approximately 5.7 km is within the National Landscape designation)	Wenham Grove CSE compound[21]
Great Horkesley	Section D	3.9	Great Horkesley (EACN side) and Great Horkesley (Tilbury side)
Fairstead	Section E	0.15	Fairstead (EACN side) and Fairstead (Tilbury side)
North Tilbury (related to the ZB/YYJ route)	Section H	0.6	Tilbury North (Tilbury side) and Tilbury North (Warley side)
Approximate total length		**21**	

4.8.66 The standard means of installing underground cables is using opencut techniques. Typically, for opencut construction, a construction corridor 120 m wide is required for a double circuit 400 kV underground cable alignment. The 120 m width includes the haul roads, soil storage, pre-construction drainage areas, communications cables and typically six cable trenches for 18 cables (three cables per phase) assumed to be to a typical minimum depth of 1.2 m and suitably spaced apart to allow for the required heat dissipation between cables and circuit phases. This is presented in the Design and Layout Plans (document reference 2.6) (Revision D).

4.8.67 Standard opencut installation typically involves the following processes:

- Appropriately fencing off the working area to secure the site from trespassing and livestock
- Vegetation would be removed where necessary and topsoil would be stripped from the working area and stored for reuse
- A haul road would be installed along the alignment to provide access for construction vehicles to the working areas
- Several open trenches (typically six trenches each accommodating three cables) would be excavated, ducts would be placed within the trenches and then backfilled with a surround of CBS. Telecommunication and ancillary cables are usually placed adjacent to the main cables and within the CBS surround prior to backfilling

[21] Southern end of the cable alignment connects into the EACN Substation, therefore only one CSE compound required

- Concrete joint bays would be constructed with the High Voltage Alternating Current (HVAC) cables pulled into the ducts from one joint bay to the next using a winch
- HVAC cables would be jointed (requiring work in a controlled environment)
- The joint bays would be backfilled and link pillars installed above ground to allow monitoring of the cables
- At road crossings, the above works would require traffic management to safely separate the public from the construction activities. Where the road is wide enough, the trenches and ducts would typically be installed across one side of the road, while the other remains operational (using temporary control). The arrangement would then be swapped to the other side to complete the crossing. For narrower roads, a temporary closure and diversion would be required
- Watercourse crossings would typically be undertaken by damming upstream and downstream of the cable alignment to create a dry working area. Water flows would then be pumped from the upstream side to the downstream side of the working area to maintain the flow of the watercourse.

4.8.68 The preferred approach for this Project is to use ducting. A ducted system would result in a more flexible construction programme and enable quicker reinstatement of ground compared to a traditional direct burial method, where the trench would remain open for much longer. There may be locations where ducting is not the best solution, such as where topography limits installation techniques. In such cases, standard opencut methods may be employed (i.e. direct burial).

4.8.69 The underground cables would typically be delivered to the working area using specialist low-loading articulated lorries. The cable would be transported on cable drums, and a crane or specialist hoist would be used to offload these from the delivery vehicles. The underground cables would be pulled off the drums onto rollers in the trenches using winches. The cables would then be pulled through the ducts and would need to be jointed together at joint bays. Depending on the cable manufacturer and length of cable drums available for each section, joint bays would typically be required every 500 m to 1 km. These would be constructed on site in controlled conditions and the finished joints would be suitably protected.

4.8.70 Once the cables have been installed, the temporary works including any haul roads and temporary construction compounds would be removed. The land would be reinstated to its previous condition and use (or a condition agreed with the landowner), subject to any planting restrictions, for example trees cannot be planted over the top or within 10 m of underground cables.

Trenchless Installation

4.8.71 Where open trench is not feasible, for example where the alignment crosses an existing live railway line or other drivers such as for environmental mitigation, trenchless installation may be required. An example of which is Horizontal Directional Drilling (HDD). Typically, for HDD, a construction corridor approximately 200 m wide[22] is required. The underground cable would typically be at a depth of 10 m

[22] Trenchless crossings require a wider construction swathe and permanent easement than opencut installation. This is because trenchless crossings require the cables to be installed at a greater depth, and the deeper the installation the greater the separation between the cables needs to be for them to maintain their effective capacity.

below ground level; however, the depth would depend on the methodology employed and local constraints.

4.8.72 The underground cable would be installed using a drilling or boring method (or a suitable alternative method) to pass beneath features. There are different trenchless methods that could be used, and each method would have a different construction footprint (all of which could be accommodated within the Order Limits). Depending on the technique, there may be a need to undertake several passes to make the hole wide enough to allow the ducts (pipes) to be pulled through.

4.8.73 Trenchless installation is an expensive option, often one of the noisiest activities during construction, requires a longer programme and can be technically challenging in areas of less suitable geology. Therefore, opencut trench installation is the preferred technique where there are no constraints.

4.8.74 Temporary discharges may be required relating to dewatering and over-pumping in the cable sections, particularly where deeper working is required such as at the trenchless crossing. It is anticipated these would be made to ground, rather than to watercourses. Where this is not practicable in localised areas, any discharge to surface water would be made in compliance with relevant consents.

4.8.75 Some trenchless methods require use of a drilling slurry such as bentonite to support the surrounding ground while the drilling/boring commences. The use of pressurised liquids presents a risk of environmental contamination, either through loss of fluids into permeable strata or breakout of fluids at the surface. Adequate mitigation of these risks requires detailed ground investigation and further design of the trenchless crossings – further assessment of this is presented in Chapter 9: Contaminated Land, Geology and Hydrogeology (document reference 6.9) (Revision B). Space for access arrangements from the public highway to the proposed trenchless crossing locations is included within the Order Limits in the event of a pollution incident during construction.

4.8.76 There are up to five trenchless crossings proposed to construct the Project. A summary of the trenchless crossings is provided in Table 4.9, and they are labelled on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B). The location and number of the trenchless crossings presented in Table 4.9 are subject to further micro-siting/ engineering design which would be informed by ground investigation.

Table 4.9 Proposed trenchless installation locations

Trenchless Section	Project Section(s)	Approximate Length (m)
Higham Road	Section C	320
River Stour (north part)	Section C	230
River Stour (south part)	Section C	190
A12 highway crossing	Section C	150
Railway crossing (east of Ardleigh)	Section C	100

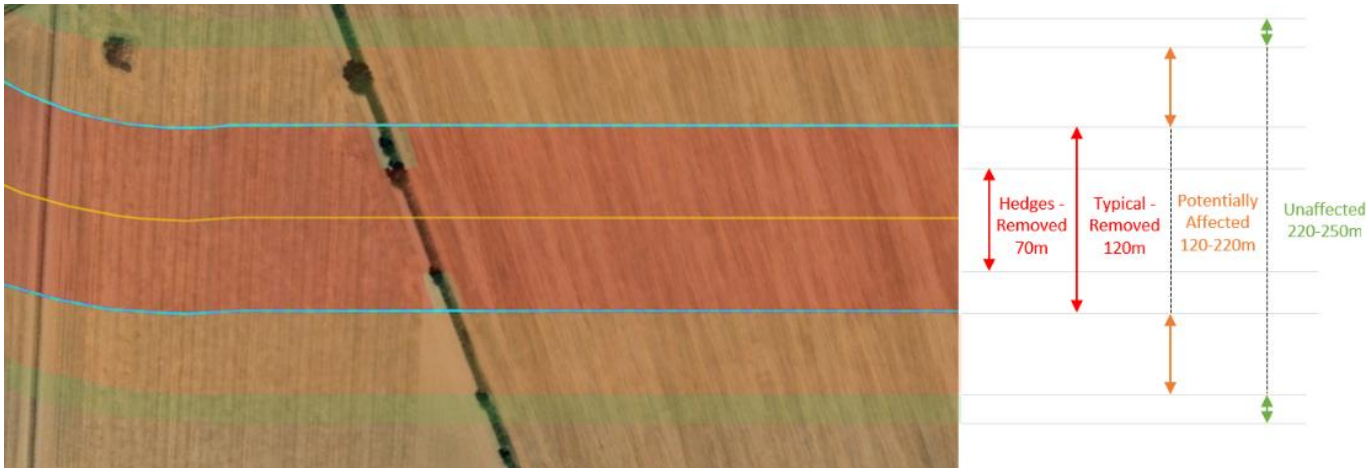
Additionally, trenchless crossing methods require a degree of separation between drills, ensuring that adjacent drills do not affect or encroach on each other and that cable separation is maintained.

Vegetation Clearance for Underground Cabling

4.8.77 It has been assumed (unless otherwise stated) that where the Project interacts with woodland, trees and hedgerows, clearance would comprise the following phased approach for underground cabling:

- To facilitate the construction of the underground cable, a typical 120 m wide swathe of vegetation would be removed. Hedgerow removal would be within the 120 m construction swathe (typically limited to 70 m) and removal would be reduced where practicable (restricted to the footprint of the cable swathe and required haul roads, and soil would not be stored on hedgerows). Following construction, hedgerows would be replanted, however trees would not be replanted above the cable sections and vegetation would be managed to ensure it does not affect the buried cables
- A further up to 50 m of vegetation either side of the maximum 120 m swathe would be potentially affected during construction, allowing for the LoD (50 m either side)
- Vegetation beyond the 50 m would be unaffected.

Image 4.13 Vegetation clearance requirements for underground cables



4.8.78 Further consideration has been given to veteran trees, other higher quality trees and areas such as ancient woodland that have been identified through surveys and a desk study. A review of these features has been undertaken to identify where the generalised approach can/needs to be refined to avoid, prevent or reduce effects to sensitive features. Further details are outlined in Appendix 13.6: Arboricultural Impact Assessment (document reference 6.13.A6) (Revision B) and the Outline CoCP (document reference 7.2) (Revision G). In addition, the Trees and Hedgerows to be Removed and or Managed Plans (document reference 2.16) (Revisions C - D) present the generalised approach together with where it has been refined.

Modification and Removal of Existing National Grid Pylons

4.8.79 Sections of the existing YYJ and ZB National Grid overhead lines need to be modified to facilitate the connection of the existing transmission network into the new Tilbury North Substation. The works are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) and comprise:

- The re-routeing of the existing YYJ overhead line to a more southerly permanent alignment. This would require eight new pylons and the removal of five existing pylons
- Undergrounding a short section (approximately 0.55 km) of the existing ZB overhead line and the construction of two new CSE compounds, each with a permanent access. In addition, three new pylons would be required and four existing pylons removed
- A number of temporary overhead line diversions onto temporary pylons and use of the proposed permanent pylons in a temporary arrangement would be required to facilitate the works to maintain 'live' circuits for the YYJ and ZB overhead lines. It is assumed that these temporary diversions would be required for a minimum of two years but up to three years. Any temporary pylons like the permanent pylons would be approximately 50 m in height and would require similar foundations to permanent pylons, as described earlier in this chapter
- To facilitate all of the above, the YYJ and ZB overhead line conductors need to be restrung between pylons YYJ116 to YYJ129 and ZB9 to ZB22.

4.8.80 Where pylons are proposed to be removed, it may be necessary to establish a 60 m x 60 m working area. Typically, this area would not be stoned; instead, if ground conditions are poor, trackway may be used. Removal of pylons would involve removing the conductors by lowering cut sections to the ground, then lowering the insulators and fittings to the ground. Where a pylon is in a clear area and it is safe to do so, the pylon would be removed by 'felling' the whole structure. Alternatively, a mobile crane would be used to remove the structure in sections which would then be lowered to the ground. Once dismantled, the pylon steelwork would typically be broken up on site then removed. The reinforced concrete foundation would then be removed typically to a depth of 1.2 m below ground level. The excavation would then be backfilled and the ground reinstated and any waste removed from site to a suitable licensed waste management facility.

Watercourse Crossings

4.8.81 The haul road requires the crossing of multiple ditches, drains and watercourses. The method of crossing a watercourse would depend on several factors. For example, large or important watercourses, main rivers and all Water Framework Directive status waterbodies require clear span bridges. Smaller watercourses and ordinary watercourses would use culverts. Watercourse crossings would largely be temporary and would be removed (and land reinstated) after the construction works.

4.8.82 The underground cable would typically cross ordinary watercourses by opencut methods as previously described. Main rivers would be crossed using trenchless methods.

4.8.83 Details of specific watercourse crossings are identified within Appendix 4.2: Watercourse Crossing Details (document reference 6.4.A2) (Revision C), which forms the basis of the assessment in the ES (Volume 6 of the DCO application).

4.8.84 Where a PRoW diversion crosses a watercourse, it is assumed a culvert would be required. Watercourse crossings would be temporary and would be removed (and land reinstated) after construction works.

Bridges

4.8.85 For the haul roads, depending on the watercourse crossing and on localised conditions, it may be possible to install a modular bridge. Typically, the components of these bridges are delivered directly to site and the bridge is installed and positioned as required with minimal additional construction works.

4.8.86 If site conditions do not allow for a modular bridge to be used, other bridge structures may be used that require additional construction works, for example creating concrete abutments or driving sheet piles into ground adjacent to the watercourse and using gabion baskets for the bridge to be laid on. Appendix 4.2: Watercourse Crossing Details (document reference 6.4.A2) (Revision C) identifies watercourses that would be crossed with a bridge. This appendix forms the basis of the assessment in the ES (Volume 6 of the DCO application). Typical drawings for bridge crossings are included in the Design and Layout Plans (document reference 2.6.2) (Revisions A and D).

Culverts

4.8.87 For smaller and ordinary watercourses, culverts would typically be used for haul road crossings. The conditions of the watercourse, such as its size, depth, ecological properties and strength and volume of flow, would determine the components (i.e. twin wall pipes or box culverts) to be used. The most common method would be circular culvert installation, with box culverts used for large ditches or small watercourses. Appendix 4.2: Watercourse Crossing Details (document reference 6.4.A2) (Revision C) identifies watercourses that would be crossed with a culvert. This appendix forms the basis of the assessment in the ES (Volume 6 of the DCO application). Typical drawings for culvert crossings are included in the Design and Layout Plans (document reference 2.6.2) (Revisions A and D).

Third Party (Statutory Undertakers) Works

4.8.88 Prior to the commencement of construction works for the Project, several existing overhead and underground third-party services would need to be diverted, removed, undergrounded, or protected. This is largely where they interface with the Project, for example with proposed new overhead line crossings, along PARs or at site access point locations. The construction methodology would largely follow the same premise as per the 400 kV overhead line and underground cable proposals but on a reduced scale in terms of width of cable trenches, size of working areas, and types and sizes of vehicles required to undertake the works.

4.8.89 The required mitigation methods and duration (i.e. permanent or temporary mitigation) need to be confirmed with the asset owners prior to any works being carried out. However, third-party works are outlined in the paragraphs that follow.

UK Power Networks 132 kV Pylons

4.8.90 Works to remove, underground and divert existing 132 kV lattice pylon overhead line UKPN infrastructure are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) and detailed in Table 4.10. Flexibility has also been retained and assumed to underground the 132 kV infrastructure along the existing alignment, other than in locations outlined the Outline CoCP (document reference 7.2) (Revision G).

4.8.91 Works typically would include site set up and access requirements similar to the construction of the new 400 kV pylons and underground cables but reduced in scope due to the smaller scale of the assets to be removed, undergrounded or diverted.

4.8.92 It may be necessary to establish a temporary diversion of the overhead line while the mitigation works are undertaken to ensure security of supply to end users by keeping one of the circuits live. To maintain supply, one live circuit would be routed on temporary poles, masts or pylons around the area of work so that pylon removal can be undertaken in an electrically isolated safe area (the temporary diversion of the overhead lines is required for approximately eight months up to one year). Only the angle structures have been shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) as the type of structures to be used are yet to be confirmed by UKPN; additional structures between those presented would likely be required during the works. A working area with an approximate 50 m radius at pylon locations and 20 m either side of centreline along the spans to be removed/temporarily diverted would be required. Typically, this area would not be stoned; trackway would be used instead.

4.8.93 It is assumed that typically these works would make use of existing access points. For access to temporary construction compounds and the installation of the underground cable diversions associated with these works, a bellmouth junction would be required due to the nature and type of vehicle movements (delivery of underground cable drums) to these locations. The connection from the bellmouth to the construction swathe would typically not be stoned; trackway would be used instead.

4.8.94 Dismantling of pylons would first involve removing the conductors, then lowering the insulators and fittings to the ground. Where a pylon is in a clear area and it is safe to do so, the pylon would be removed by ‘felling’ the whole structure. Alternatively, a mobile crane would dismantle the structure in sections which would then be lowered to the ground. Once dismantled, the pylon steelwork would typically be broken up on site and then removed. The reinforced concrete foundation would then be removed (for the purposes of the assessment within the ES (Volume 6 of the DCO application), this is assumed to be a depth approximately 1.2 m below ground level), the excavation backfilled, ground reinstated and any waste removed from site to a suitable licensed waste management facility.

4.8.95 To facilitate the underground cable, the last remaining pylon would typically be replaced with a terminal pylon supporting a CSE platform, as shown on Image 4.14.

Image 4.14 Example of CSE platform

4.8.96 From here the 132 kV underground cable diversion would be installed as per the 400 kV underground cable alignment but reduced in scope due to the smaller scale of the assets. The installation of underground cable diversions is assumed to be in a single trench typically up to 3 m in width and 1.2 m in depth to the cover (worst-case for deep ploughing). An underground cable LoD of 35 m has been applied. Sensitive features would be avoided such as heritage assets, woodland including ancient woodland, and ecologically valuable habitats including SSSIs, County Wildlife Sites (CWS) and Local Wildlife Sites (LWS). However, it is assumed that any vegetation within the LoD would be removed during construction and reinstated where practicable following the works.

4.8.97 In addition to the above, to facilitate the dismantling of the PSC and PAB route (to the west of Lower Dunton Road and subsequent underground cable diversion route), a new 132 kV substation extension would be required to the west of the existing UKPN Basildon Grid Substation at Dunton Hills. This would accommodate new equipment required to facilitate the undergrounding of the PAB overhead line, due to a lack of space in the existing Basildon Grid Substation footprint. The substation extension would be approximately 80 m by 50 m with a maximum height of 15 m.

4.8.98 The schedule of works to existing UKPN infrastructure is included in Table 4.10.

Table 4.10 Schedule of works to existing UKPN infrastructure

UKPN 132 kV Route Identification	Route Location	Approximate Overhead Dismantling Length (km)	Approximate Underground Cable Diversion Length (km)
PKF	South of Palgrave to west of Mellis	5.3	6.9
EEPK	North of Barking	1.2	1.4
PI	North of Offton to east of Flowton	5.6	6.3
PLD	Bramford Substation to north-west of Sproughton	1.3	1.6
PHB	Bramford Substation to south of Sproughton	3.0	3.2
PCB	West of Pinebrook	0.9	0.9
PSB	At Fuller Street	1.0	1.4
PUB	West of Hutton to south of Rayleigh Road	2.1	2.4
PSC	At Dunton Hills Golf Course	1.9	1.6
PAB	At Lower Dunton Road (inclusion of new substation compound)	0.5	0.5[23]
PAB	East of Orsett Golf Club	0.2	0.3
Approximate Total:		**23.0**	**26.5**

UKPN Low Voltage[24]/11 kV/33 kV and Openreach Wood Pole Infrastructure

4.8.99 Works to remove, underground and divert existing low voltage/11 kV/33 kV and Openreach wood pole UKPN infrastructure along the overhead line alignment are shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B). Flexibility has also been retained to allow for the undergrounding of this third party infrastructure along the existing alignment, where this would not lead to materially different significant effects assessed within the ES (Volume 6 of the DCO application).

4.8.100 Vehicles and equipment would be similar to that required for the proposed 400 kV overhead line and underground cable works but at a reduced scale relevant to the works. A terminal wood pole structure would be installed at each end of the section to

[23] Subject to substation extension details and final location of substation gantries and underground cable interface.

[24] Lower than 11 kV.

be undergrounded to facilitate the transition from overhead line to underground cable. The installation of underground cable diversions is assumed to be in a single trench typically up to 1 m in width with 1.2 m depth to the cover (worst-case for deep ploughing). These would be routed either within the existing highway, highway verges or across farmland (using existing gaps through hedgerows where practicable). An underground cable LoD of 25 m has been applied. Sensitive features would be avoided such as heritage assets, woodland including ancient woodland, and ecologically valuable habitats including SSSIs, CWS and LWS. Any residential gardens included within the Order Limits reflect existing oversail by existing UKPN low voltage, 11 kV and 33 kV and Openreach infrastructure and access to such areas is required to facilitate removal or, for example, stringing works.

4.8.101 It is assumed works would be completed using suitable vehicles, for example standard 4x4 or agricultural type vehicles and an excavator (size relevant to the works), which would use the public highway or existing agreed access routes (for the wood pole line), field gates and hedgerow gaps (where practicable). It is assumed there would be no requirement to create new physical temporary access tracks.

4.8.102 This work comprises:

- 47 Openreach mitigation designs
- Five UKPN low voltage mitigation designs
- 89 UKPN 11 kV mitigation designs
- 21 UKPN 33 kV mitigation designs (two of which are steel lattice pylon overhead lines).

4.8.103 Where the proposed 400 kV underground cable alignment interacts with existing low voltage/11 kV/33 kV UKPN and Openreach wood pole infrastructure, it is proposed that, where necessary, the height of the existing wooden poles would be raised to allow for safe vehicle clearance underneath during construction and operation (and maintenance). A lateral LoD of 25 m has been applied. The works would require limited vegetation clearance during construction, and during operation (and maintenance) vegetation would be managed to maintain the required clearance from the overhead line similar to what is currently required for routine maintenance. Construction activities would include the provision of temporary access to the existing and proposed pole locations, the creation of a working area, the installation of new wooden poles, the stringing of new conductors and fibres, and the removal of the existing poles. It is assumed trackway would be used for the access and working areas.

Reinstatement

4.8.104 Once the Project has been constructed and commissioned, the temporary construction working areas would be removed and the site reinstated. Haul roads (including temporary bridges and culverts) are likely to be removed unless identified as offering a long-term improvement to the environment and land usage during the detailed design (and agreed with the landowner, LLFA and/or the Environment Agency (where required)). Temporary features such as site welfare, working areas, fencing and scaffolding would be removed. Any stripped topsoil would be reinstated, and the site would be returned to its former use, subject to any planting restrictions or agreements with landowners.

4.8.105 Reinstatement would also include landscaping. This is likely to include reseeding grassland areas, replanting hedgerows, and trees. It would also include additional landscape planting in some areas to help screen the new infrastructure from sensitive receptors.

4.8.106 Proposed planting is detailed within the Outline LEMP (document reference 7.4) (Revision G), which outlines proposed locations and specifications of planting, along with required maintenance schedules to ensure the success of the landscaping scheme.

4.9 Details of Permanent Features

Introduction

4.9.1 This section describes the permanent features of the Project. They are split into four main components:

- Overhead lines (including CSE compounds)
- Underground cables
- The new EACN Substation and new Tilbury North Substation
- Substation extension works at the existing Bramford Substation and modification works to connect into the existing Norwich Main Substation.

4.9.2 Where permanent works to existing public highways are proposed, these are also described.

Overhead Line (Including CSE compounds)

4.9.3 The National Grid standard for overhead lines operating at 400 kV is for pylons carrying two circuits one each side of the pylon, each with three conductors, i.e. a double circuit configuration.

4.9.4 The Project consists of approximately 159 km of overhead line comprising approximately 509 pylons, either standard steel lattice pylons or low height steel lattice pylons, and gantries (typically up to 15 m in height) within proposed CSE compounds. The new overhead line would use triple Araucaria conductors (or alternative technology that performs to the same or better standard in relation to noise on standard lattice pylons). Three types of pylons are proposed as part of the alignment:

- Suspension pylons: used in straight-line positions to suspend the conductor on vertical suspension insulator strings (presented in Image 4.15)
- Tension (also called angle) steel lattice pylons: support the overhead line where the line changes direction (presented in Image 4.16). Tension pylons may also be used in a straight-line situation to break up a long section of suspension pylons for loading and stringing purposes
- Terminal pylons: a type of tension pylon used at the ends of overhead lines where they connect to substations or to underground cables via a CSE compound or substation (presented in Image 4.18).

4.9.5 Additionally, to facilitate the overhead line connection at the new Tilbury North Substation to the existing network, modifications to the existing YYJ and ZB overhead line are required. Eleven new pylons are required, and eight existing pylons would be removed. Additionally, two CSE compounds are required to facilitate the short section of underground cable on the ZB route.

4.9.6 The design assumes standard steel lattice pylons for the majority of the alignment which would be approximately 50 m in height (compared to approximately 30 m for the existing 132 kV pylons in the area and of a similar size to the existing 275/400 kV pylons in the area). Pylon extensions would be required in some locations to allow extra height to clear existing features and maintain electrical clearance to the ground. The intention is to use glass insulators as standard across the Project; however, porcelain or polymeric insulators remain an option for the Main Works Contractor(s), subject to procurement and/or site-specific needs.

4.9.7 Pylons would typically be at 330 m spacing, subject to site constraints.

4.9.8 Where new pylons are erected parallel to the existing 400 kV infrastructure, an 85 m separation distance would be required as shown on Figure 4.1: Proposed Project Design (document reference 6.4.F1) (Revision B) and Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B).

4.9.9 In two locations, low height steel lattice pylons (Image 4.17) are proposed. These have only two cross arms as opposed to three on a standard lattice pylon, thus reducing their height by approximately 10 m (to approximately 40 m) but widening them by approximately 10 m. Low height steel lattice pylons are proposed:

- Between Great and Little Waltham as mitigation for Langleys House (Grade I listed building), and to a lesser extent Langleys Registered Park and Garden (Grade II) and Great and Little Waltham Conservation Areas (refer to Chapter 11: Historic Environment (document reference 6.11) (Revision D)) – pylon reference TB136 to TB142
- To the east of Thurrock Airfield to provide overflight clearance mitigation – pylon reference TB238 to TB243.

Image 4.15 Typical suspension steel lattice pylon[25]

Image 4.16 Typical tension/angle lattice pylon[25]

[25] Image is illustrative and arrangements/layouts within the Project may differ from that presented in this image.

Image 4.17 Typical low height lattice pylon (suspension (left) and tension pylon (right))[25]

Image 4.18 Typical terminal lattice pylon[25]

Cable Sealing End Compounds

4.9.10 The CSE compounds, as described previously, typically occupy a footprint of approximately 90 m x 64 m for a 400 kV double circuit. Each CSE compound would have two gantries (typically 26 m wide by 15 m tall) (refer to Image 4.12 which shows an example) within the CSE compound which then connect to the CSE compound via high voltage busbars and other high voltage electrical equipment. In addition, a small portable relay room may be required in each compound. Each compound would be surrounded by security fencing typically up to 4 m high, to protect the equipment. There would be a minimum 2 m clear zone around the perimeter of the fence to allow maintenance and access. Operational lighting is not required. Task lighting may be required when undertaking specific maintenance activities.

4.9.11 There would be a permanent access road installed to connect each CSE compound to the local road network, providing access for operation (and maintenance) activities, which would be up to 5 m wide (increasing locally for passing places and for tracking of larger vehicles on bends). It is assumed in the ES (Volume 6 of the DCO application) that these would be constructed using a bound solution (asphalt or concrete pavement as a worst-case); however, this would be determined at the detailed design stage. Vegetation planting would be provided around each CSE compound to help screen the site; further details are provided within the Outline LEMP (document reference 7.4) (Revision G) and shown on Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B).

4.9.12 Drainage would also be required and is assumed to comprise an attenuation pond (or alternative feature) and outfall as shown on Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B).

Underground Cables

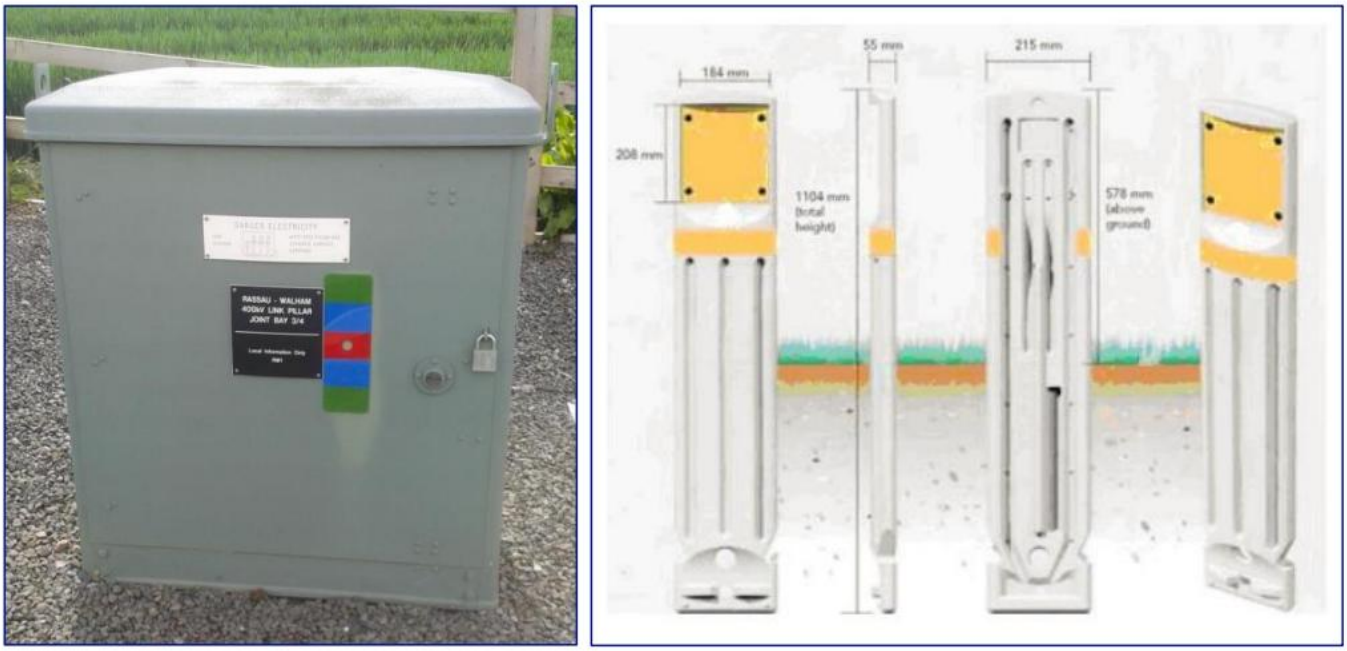
4.9.13 The underground cables, detailed above, would typically comprise 18 transmission cables. Each cable would be approximately 150 mm diameter and buried within a series of six trenches excavated to a typical minimal depth of 1.2 m and would be surrounded by cement-bound sand to aid dissipation of heat from the cables. This would then be topped with protective warning tiles and tape which aids protection of the cables from accidental mechanical damage. One or more of the cable trenches would also include small-diameter communication cables (typically two communications cables in total).

4.9.14 Depending on the cable manufacturer and availability of cable lengths, joint bays would be required every 500 m to 1 km on each cable trench. At these locations, above-ground link pillars and marker posts would be required (Image 4.19). The dimensions, frequency and specific locations of the link pillars are to be confirmed through detailed design; however, where practicable they would be located near field boundaries, with typical dimensions of 2 m x 0.7 m x 1.5 m plus, for example, a timber fenced area around them, typically 3 m x 4 m.

4.9.15 Above-ground marker posts are required where cables run across a railway, run across agricultural land or change direction, at joint positions and at other locations where required by the cable design (Image 4.19).

4.9.16 A below-ground chamber would also be required, at every or every other joint bay, for communications cables.

Image 4.19 Typical above-ground link pillar and marker post



Proposed New EACN Substation

4.9.17 The operational footprint of the proposed AIS new EACN Substation is proposed to be approximately 550 m x 230 m with heights up to approximately 15 m excluding any requirement for landscaping and cable/overhead line connections. In addition, several small buildings would be constructed to house electrical equipment, battery storage, workshops, together with suitably sized office/amenity buildings. The site would be surrounded by security fencing typically up to 4 m in height to protect the equipment. There would be a minimum 2 m clear zone around the perimeter of the fence to allow maintenance and access.

4.9.18 Exterior and interior lighting[26] would be provided at the site to allow for safe movement and the operation (and maintenance) of equipment. Lighting columns would typically be 12.5 m tall. All lighting would be designed in accordance with the appropriate design standards. The position of lighting columns would be subject to detailed design and would be determined by safety and operational requirements. Lighting would be directional and is intended to support safe movement of pedestrians and vehicles around the site (and minimise light spill to the local environment). The lighting would therefore not be on by default, only whilst there are activities happening at the site as dictated by operational requirements. Additional task lighting may be required when undertaking specific maintenance activities.

4.9.19 Vegetation planting would be provided at the new EACN Substation to help screen the site, and any surplus spoil would be incorporated into landscaping proposals

4.9.20 Improvements to the public highway along the PAR (carriageway widening and associated works to Bentley Road and Ardleigh Road) and the proposed permanent private access road between Bentley Road and Ardleigh Road, to the south-west of Little Bromley, would be retained permanently. These would be retained to provide

[26] The maximum illuminance would be approximately 20 lux within the fence line with an approximate maximum illuminance of 10 lux around the perimeter fence line. The minimum average illuminance would be approximately 6 lux, using LED lighting.

permanent access to the new EACN Substation for HGVs and AILs during operation (and maintenance). The permanent site access road would remain private and be gated to prevent unauthorised access; this road is shown on Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B). This would be up to 5 m wide (increasing locally for passing places and for tracking of larger vehicles on bends). It is assumed in the ES (Volume 6 of the DCO application) that this would be constructed using a bound solution (asphalt or concrete pavement as a worst-case); however, this would be determined at the detailed design stage.

4.9.21 Drainage would also be required and is assumed to comprise an attenuation pond (or alternative feature) and outfall as shown on Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B).

4.9.22 Directly to the south of the new EACN Substation, a UKPN Substation is required to provide Low Voltage Alternating Current (LVAC) supply from the local UKPN network to the new EACN Substation. It would be approximately 25 m by 25 m with a maximum height of 5 m. It would include a distribution transformer, enclosure, and a distribution board, along with underground cables.

Proposed New Tilbury North Substation

4.9.23 The operational footprint of the new GIS Tilbury North Substation is proposed to be approximately 340 m x 300 m with heights of approximately 15 m excluding any requirement for landscaping and cable/overhead line connections. A new GIS hall building is proposed, which would be approximately 135 m x 20 m x 15 m (length x width x height). GIS halls are required for GIS substations to contain the specialist equipment. This is a different technology to what is proposed at the new EACN Substation, which would use AIS. GIS equipment can be positioned closer together as it is not reliant on just air for insulation, as a result the footprint of the substation can be reduced. An associated annex would also be required with dimensions of approximately 135 m x 12 m x 15 m. These buildings would typically be steel framed with a metal sheet cladding finish. The site would be surrounded by security fencing typically up to 4 m in height and other security features to protect the equipment. There would be a minimum 2 m clear zone around the perimeter of the fence to allow maintenance and access.

4.9.24 Exterior and interior lighting would be as per the proposed new EACN Substation[26].

4.9.25 Drainage would also be required and is assumed to be as per the proposed new EACN Substation as shown on Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B).

4.9.26 Details of the proposed permanent access options into the new Tilbury North Substation during operation (and maintenance) are provided in Table 4.4.

4.9.27 The permanent access would be up to 5 m wide (increasing locally for passing places and for tracking of larger vehicles on bends). It is assumed in the ES (Volume 6 of the DCO application) that this would be constructed using a bound solution (asphalt or concrete pavement as a worst-case), however, this would be determined at the detailed design.

Modifications to Existing Substations

4.9.28 Modifications to existing substations are required as part of the Project. The details of the likely works required at existing substations are outlined in the paragraphs that follow.

Norwich Main Substation

4.9.29 Modification works are required to allow the Project to connect into the Norwich Main Substation. The works required for the Project would comprise:

- Two new 400 kV full line tension gantries (up to 15 m in height) within Norwich Main Substation
- Installation of new, and modifications to existing, apparatus within the footprint of Norwich Main Substation.

Bramford Substation

4.9.30 An extension would be needed at the existing Bramford Substation. The extension would comprise:

- Extension of the existing site compound with use of existing site access arrangements
- Modifications of the existing external retaining structure
- Equipment up to a maximum typical height of 15 m
- Mix of impermeable concrete ground surfaces surrounded by permeable stone chippings
- Electrified palisade fence typically up to 4 m high
- Exterior[26] and interior lighting to allow for safe movement and the operation (and maintenance) of equipment. Lighting would be designed in accordance with the appropriate design standards. Additional task lighting may be required when undertaking specific maintenance activities.
- Drainage works
- Installation of new, and modifications to existing, apparatus within the footprint of Bramford Substation.

Modifications to Existing Highways

4.9.31 Permanent modifications to existing highways are required as part of the Project. The details of the likely works required are provided below.

Permanent Site Access Points

4.9.32 Permanent site access points are required where permanent access roads would be provided to CSE compounds and new substations. These have been designed in the same way as the temporary site access points and the same typical detail applies.

4.9.33 Permanent site access points are shown on Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B) and comprise:

- JC-B013 permanent site access point on Raydon Road and a new access track to the CSE compound
- TB-B021 permanent site access point on Boxted Road with permanent access to the CSE compound
- TB-B035 permanent site access point on Crabtree Lane to the CSE compound
- TB-B079 permanent site access point on Fairstead Road to the CSE compound
- TN-B011 permanent site access point off High Horse Lane to the CSE compound
- Tilbury North Substation has two options:
  - TN-B007 permanent site access point off Brentwood Road to Tilbury North Substation
  - TN-B014 permanent site access point off Buckingham Hill Road to Tilbury North Substation.

Highway Modifications

4.9.34 The left-turn acceleration lane from the B1070 onto the A12 Ipswich Road would be permanently widened and lengthened. The existing footpath at this location would also be realigned and offset from the back of the kerb with a 2 m proposed verge separation.

4.9.35 The carriageway on Bullen Lane, Bentley Road and Ardleigh Road would also be permanently widened to facilitate future access requirements.

4.9.36 These modifications are shown on Figure 4.2: Proposed Project Design – Permanent Features (document reference 6.4.F2) (Revision B).

4.10 Operation (and Maintenance)

Introduction

4.10.1 This section describes the activities that are anticipated during the operational phase, including site inspections and routine maintenance. It is largely split into overhead lines (including CSE compounds), underground cables, the new EACN Substation and new Tilbury North Substation.

Operational Workforce and Vehicles

4.10.2 Operational and maintenance activity would require a limited workforce. During operation (and maintenance), National Grid would require infrequent access to ensure the operational Project is appropriately surveyed, assessed, and maintained. Access would typically be made by foot, 4x4 or tractor and trailer.

4.10.3 Additionally, National Grid often uses helicopters to survey and monitor the network, as large distances can be covered without requiring access to the land surrounding the transmission infrastructure.

4.10.4 National Grid also has a fleet of drones, which allows inspections of parts of the transmission network that are more difficult or costly to reach.

Assumptions on Materials and Waste During Operation

Materials and Waste During Operation

4.10.5 The Project would require limited materials and generate limited waste during operation, other than at the end of the design life of project components, when these would be replaced. At the end of life of project components, the materials consumed and wastes produced would be similar to those identified during construction. Existing National Grid processes and systems encourage the application of the waste hierarchy on maintenance projects.

Overhead Line (Including CSE compounds)

4.10.6 The typical lifespan of an overhead line would be at least 40 years, depending on use and location. Over this time, the overhead line and CSE compounds would be subject to regular inspection from the ground (on foot or using a small van/4x4 vehicle) or by helicopter to check for visible faults or signs of wear in line with existing maintenance requirements at any point in time. The inspections would confirm when refurbishment is required and indicate if plant/tree growth or development were at risk of affecting safety clearances.

4.10.7 Maintenance activity carried out on lattice pylons would involve climbing the pylon to access the work area (e.g. conductors). Access to the pylons may require temporary access works to gain entry to site.

4.10.8 There are two main types of overhead line refurbishment:

- ‘Fittings only’ refurbishment would be undertaken if the conductors were still in good condition. The refurbishment involves removing and replacing the insulators, their associated fittings and the spacers that keep the conductors separate in the spans between pylons. The insulators and fittings have a life expectancy of approximately 20 to 40 years
- Full refurbishment would typically be needed at the end of the lifespan of the overhead line (40 years, although pylons have a typical life expectancy of 80 years) and works would be subject to separate permissions, to consider the latest site conditions and legislation in force at that time.

4.10.9 Refurbishment would usually be carried out in two stages because the overhead line has two circuits, one on each side of the pylon. This means that work can be undertaken on one side only, so that the other side can be kept ‘live’. Once all the work has been completed on the first side, the circuit would be re-energised. The opposite side would then be switched off so that the work could be carried out on the other side.

4.10.10 The refurbishment works would require temporary access tracks, small compounds and, potentially, scaffolding to protect roads and other features during the work. Vans would be used to carry workers in and out of site and trucks would be used to bring new materials and equipment to site and remove old equipment. Once the Project has been constructed and commissioned, including the temporary installation of

access roads and installation of scaffolding to protect roads, railways and footpaths would be required as necessary (like the initial construction requirements).

4.10.11 The typical design life of a CSE compound would be at least 40 years, depending on use and location. The CSE compounds would contain equipment that would be monitored remotely. Site inspections would include visual checks, for signs of damage or wear, of the condition of non-mechanical equipment, structures, and buildings. Mechanical (manually operated) earth switches would require inspection and servicing as part of these visits. Intermittent upgrades and repairs would be complete as and when required to ensure their ongoing operation.

4.10.12 It is assumed that the maintenance of permanent drainage would be undertaken using agricultural type vehicles (e.g. tractor and trailer, small excavator) when required.

Underground Cables

4.10.13 Underground cables have a typical design life of at least 40 years. Over this time, the cables would be subject to regular checks. Inspections would be undertaken approximately every three years using the fibre-optic cables that were installed alongside the underground cables during construction. This would identify whether cable repairs were required. This would involve light vehicle access to any joint bays along the cable alignment and typically teams of two staff members.

4.10.14 When a repair is needed, the area where the fault is located would be accessed using a temporary access track. A working area would be established, like that used for construction, and the ground would be excavated. If a cable needs to be replaced, then that section of the cable (between two joints) would need to be removed and new joints constructed. A benefit of ducting these cables is that the whole length to be removed does not necessarily need to be excavated depending on the condition of the duct and cable. Staffing and vehicle requirements for maintenance activities would vary depending on the scale of the works.

4.10.15 As outlined in the description of construction activities (Section 4.8), there would be restrictions regarding works directly above the underground cables. For example, trees cannot be planted over the top or within 10 m of underground cables.

4.10.16 For the purposes of the assessment, a permanent easement of 60 m is assumed for opencut installation and 180 m for trenchless installation. This has been reduced in some locations to consider sensitive features or may increase subject to site conditions.

EACN Substation, Tilbury North Substation and Other Substation Modifications

4.10.17 The new EACN Substation, new Tilbury North Substation and other existing substations to be modified as part of the Project would typically be unmanned during periods of general operation. However, routine site visits would be required to visually inspect the condition of the equipment, structure, and buildings for signs of wear and tear. Routine maintenance would also need to be undertaken on a three-year cycle for each circuit. This involves electrical isolation of the equipment and checks to the equipment which may lead to maintenance of certain moving parts, electrical contacts, etc., to ensure the system continues to operate without fault. In addition, there would be maintenance of the auxiliary systems which would be tested

monthly and maintained as required. The proposed works are not likely to change the current activity pattens within the substations. The routine inspections would only require small teams with limited light vehicle movements. During periods of maintenance, staffing and vehicle numbers would increase, varying with the scale of the works required.

4.10.18 It is assumed that the maintenance of permanent drainage would be undertaken using agricultural type vehicles (e.g. tractor and trailer, small excavator) when required.

4.10.19 Under the NETS SQSS, National Grid has a duty, following the occurrence of a secured event on the onshore transmission system, to take measures to resecure the system to the above operational criteria as soon as reasonably practicable. To meet this duty, the permanent site access roads to the new EACN Substation and new Tilbury North Substation would be retained to maintain AIL access to the sites.

4.11 Decommissioning

4.11.1 Paragraph 4.3.5 of NPS EN-1 (DESNZ, 2024a) states that the ES should cover the effects arising from decommissioning of a project. There are currently no specific plans to decommission the Project. It is expected that the transmission of electricity would continue for as long as there is a business case for doing so and that any decommissioning activity would occur decades into the future. To date, relatively few transmission projects have been decommissioned since the main expansion of such infrastructure in the 1950s and 1960s. The cables and pylons for overhead transmission lines are replaced periodically, ordinarily under National Grid's permitted development rights.

4.11.2 The pylons comprise open, lattice structures which can be easily dismantled. It is expected that proposals for decommissioning would be subject to separate consenting procedures, including environmental assessment of the proposed activities, and taking account of the baseline as it exists at the time of decommissioning. Table 4.11 outlines the works likely required to decommission the permanent features of the Project.

Table 4.11 Summary of works required to decommission the permanent Project features

Project Component	Summary
Overhead line (including CSE compounds)	Decommissioning sections of the overhead line would follow the same methods set out in 'modification and removal of existing National Grid pylons' (see Section 4.9), which describes the removal of sections of the existing 132 kV and 400 kV overhead lines during construction of the Project. However, it is unlikely that almost continuous haul roads would be installed – instead existing accesses are likely to be used. The above-ground features of the CSE compounds would be removed by dismantling conductors and removing any other above-ground features. The foundations of the CSE compounds would be excavated to approximately 1.5 m below ground level, and subsoil and topsoil reinstated. Any temporary access tracks and working areas required would be removed and the site reinstated.

Project Component	Summary
Underground cables	Decommissioned underground cables are likely to be left in the ground[27] with any above-ground structures, such as link pillars, removed. These works would be localised and short term in duration. Access to the above-ground features requiring removal would likely be provided by trackway matting or another alternative. Once works are completed, any temporary access tracks and working areas required would be removed and the site reinstated to its former use.
Substations	If the proposed new substations and proposed substation modifications are to be decommissioned, discussions would be held with UKPN to agree alternative requirements for providing power to local communities and businesses. Likewise, arrangements would need to be made with any connected generators to avoid constraining their generation. Typically, the above-ground features of the substations would be removed (unless otherwise agreed). Any above-ground buildings would be demolished and taken off site for suitable disposal along with any other above-ground features. Any temporary access tracks and working areas required would be removed and the site reinstated to its former use. If the Project, or any part of it, is to be decommissioned, a written scheme of decommissioning would be submitted for approval by the relevant Local Planning Authorities at least six months prior to any decommissioning works. The decommissioning works would follow National Grid processes at the time for assessing and avoiding or reducing any environmental effects and risks.

4.11.3 Decommissioning has been scoped out of the ES (Volume 6 of the DCO application), as per the EIA Scoping Opinion (document reference 6.20). However, Table 4.12 summarises the assessment of likely significant effects associated with decommissioning for each environmental topic based on existing information. Potential effects of decommissioning are likely to be similar to construction, but with a lower magnitude of effect. Table 4.12 assumes that standard mitigation measures, such as those set out within the Outline CoCP (document reference 7.2) (Revision G), would be implemented during decommissioning activities, as these would be typical measures employed on large National Grid contracts.

4.11.4 Table 4.12 does not take into account changes to the baseline environment, outside of those noted within the future baseline section of Chapters 6 to 17 (document references 6.6 to 6.17), as there could be a number of scenarios that occur which could change the baseline prior to any decommissioning activities. However, it is noted that the baseline environment could change and would be assessed at the time of decommissioning. Table 4.12 demonstrates that there are unlikely to be any new or different significant effects anticipated during decommissioning than those identified during construction in Chapters 6 to 17. In many cases, the effects are likely to be of a lower significance than during construction due to the anticipated lower magnitude of effects anticipated during decommissioning.

[27] Cables are not oil filled and therefore are not anticipated to pose risk of environmental damage or contamination.

Table 4.12 Summary of environmental effects from decommissioning

Environmental Topic	Assessment Summary
Agriculture and Soils	The removal of the overhead line would not result in effects beyond those as a result of construction. The footprint of any remaining decommissioning works such as those at the CSE compounds or new substations would affect a smaller area than the soils disturbed during construction of the Project. Therefore, there are unlikely to be any significant effects on agriculture and soils during decommissioning.
Air Quality	Emissions to air may be generated during construction activities from sources such as vehicle exhausts and generators. However, at a time when decommissioning takes place (at least 40 years in the future) it is likely that improvements would have been made to vehicles and machinery to limit the emissions they generate. There may also be dust arising from decommissioning activities. However, these effects would be managed by standard good practice measures applied at the time. Therefore, there are unlikely to be significant effects on air quality during decommissioning.
Ecology and Biodiversity	The footprint of any decommissioning works is likely to be smaller than the ground disturbed during construction of the Project and the effects would be no worse than those identified during construction. In addition, decommissioning works are likely to take place within the maintained swathe which would further reduce effects. There could be effects to protected species and habitats at the time of decommissioning; however, these are likely to be managed through standard good practice measures and/or the measures set out in the relevant consents at the time, for example European Protected Species licences. Therefore, there are unlikely to be significant effects to biodiversity during decommissioning.
Contaminated Land, Geology and Hydrogeology	The decommissioning effects are considered to be similar (or less significant) to the construction phase because activities required to complete decommissioning are of a similar nature. In addition, all decommissioning activities would be expected to take place in accordance with UK environmental legislation, good practice control and management measures, and the relevant environmental permitting regime (if appropriate) current at the time.
Health and Wellbeing	The effects due to the removal of the overhead line would be similar to those reported for its construction. Removal of the above-ground features including the overhead lines, CSE compounds and new substations could have beneficial effects. However, these are unlikely to be significant.
Historic Environment	The footprint of any decommissioning works is likely to be smaller than the ground disturbed during construction of the Project. As the ground within this area would already have been disturbed during construction, it is unlikely that archaeological remains would be present. Therefore, there are unlikely to be any significant effects to archaeological remains during decommissioning. Removal of the above-ground features including the overhead lines, CSE compounds

Environmental Topic	Assessment Summary
	and substations are likely to have beneficial effects on heritage assets through the removal of modern development within their setting. Significant adverse effects identified in relation to the Project are likely to be reduced/removed. There is also the potential for decommissioning works to have a temporary adverse effect on heritage assets through the introduction of noise and visual intrusion within their setting during decommissioning. However, this would be temporary and unlikely to be significant.
Hydrology, Land Drainage and Flood Risk	There is the potential for short-term temporary effects to watercourses (e.g. pollution risks associated with ground disturbance to excavate foundations, use of construction plant in proximity) and land drainage (e.g. new temporary impermeable land cover for access tracks) during decommissioning. However, these effects would be managed by standard good practice measures applicable at the time. Therefore, there are unlikely to be any significant effects to the water environment during decommissioning.
Landscape and Visual	Decommissioning activities required for removal of above-ground features, including the overhead line, CSE compounds and substations/substation extensions, would be similar to those reported during their construction. There would be construction vehicles present within the landscape and views, but these would be temporary and transient throughout the Project area. In the longer term, removal of the above-ground features, including the overhead lines, CSE compounds and new substations, could have beneficial effects on views and the landscape character of the area. Significant adverse landscape and visual effects identified in relation to the Project are likely to be reduced/removed.
Noise and Vibration	The activities required during decommissioning, such as removal of buildings within the new EACN Substation and new Tilbury North Substation and the cutting and dismantling of pylons, could generate noise for short periods of time at a local level. However, this is unlikely to exceed the noise levels assessed for the construction phase. In addition, at the time when decommissioning would place (at least 40 years in the future) it is likely that improvements would have been made to vehicles and machinery to limit the noise they generate. If noise levels exceed thresholds, it is assumed that best practicable means, such as screening or the use of alternative methods, would be employed to reduce noise levels. Therefore, there are unlikely to be significant effects on noise and vibration during decommissioning.
Socio-economics, Recreation and Tourism	The potential effects of the removal of the overhead line would be similar to those reported during its construction. Removal of the above-ground features, including the overhead lines, CSE compounds and new substations, could have beneficial effects on recreation and tourism. However, these are unlikely to be significant. Significant adverse effects identified in relation to the Project are likely to be reduced/removed.

Environmental Topic	Assessment Summary
Traffic and Transport	The decommissioning works would generate traffic associated with the construction vehicles required to transport materials off site and associated staff vehicles. The decommissioning works would likely involve a much smaller workforce and qquantity of traffic than during construction (as haul roads would not be installed). Therefore, there are unlikely to be any significant effects on traffic and transport during decommissioning.
Cumulative Effects	The intra-project cumulative effects would depend on the potential effects identified from the different aspects at the time. However, it is unlikely that the effects would be different to those identified during construction, and therefore there would be no new or different significant effects for the decommissioning phase compared to the construction phase of the Project. The inter-project cumulative effects assessment would depend on the proposed developments within the vicinity at the time of decommissioning, so an assessment of inter-project cumulative effects is not possible at the current time.

Abbreviations

Abbreviation	Full Reference
AIL	Abnormal Indivisible Load
AIS	Air Insulated Switchgear
AONB	Area of Outstanding Natural Beauty
BNG	Biodiversity Net Gain
BPA	British Pipeline Agency
CBS	Cement-Bound Sand
CoCP	Code of Construction Practice
CSE	Cable Sealing End
CTMP	Construction Traffic Management Plan
CWS	Country Wildlife Site
DCO	Development Consent Order
DESNZ	Department for Energy Security and Net Zero
EACN	East Anglia Connection Node
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Field
ES	Environmental Statement
FTE	Full Time Equivalent
GIS	Gas Insulated Switchgear
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicles
HVAC	High Voltage Alternating Current
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IDB	Internal Drainage Board
Km	Kilometre
kV	Kilovolt
LED	Light-emitting diode
LEMP	Landscape and Ecological Management Plan
LLFA	Lead Local Flood Authority

Abbreviation	Full Reference
LoD	Limits of Deviation
LTC	Lower Thames Crossing
LVAC	Low Voltage Alternating Current
LWS	Local Wildlife Site
MRN	Major Road Network
NETS SQSS	National Electricity Transmission System Security and Quality of Supply Standard
NMU	Non-Motorised User
NPS	National Policy Statement
NRMM	Non-Road Mobile Machinery
PAR	Primary Access Route
The Project	Norwich to Tilbury
PRoW	Public Right of Way
SRN	Strategic Road Network
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
UK	United Kingdom
UKPN	UK Power Networks

Glossary

Term	Description
Abnormal Indivisible Loads	A large load which cannot 'without undue expense or risk of damage' be divided into two or more smaller loads for the purposes of being transported by road, and which exceeds limits set out in terms of weight (>44 tonnes), length (>18.65 m), and width (>2.9 m).
Additional mitigation measures	Comprises measures over and above embedded and standard mitigation measures to reduce environmental effects. This would include, but not be limited to, mitigation required for protected species.
Alignment	The proposed overhead line and underground cable route.
Ancient woodland	Land that has been continually wooded since at least 1600 in England. Regarded as 'irreplaceable habitat' in national planning policy and guidance. Ancient woodland greater than 2 ha is recorded on the Natural England Ancient Woodland Inventory.
Angle/tension pylon	Pylon where a horizontal insulator string attaches the conductors. Tension or 'angle' pylons are used at points where the overhead line alignment changes direction.
Archaeological remains	The material remains of human activity from the earliest periods of human evolution to the present. These may be buried traces of human activities, sites visible above ground, or moveable artefacts.
Archaeological Mitigation Strategy and Outline Written Scheme of Investigation	Sets out the scope, guiding principles and methods for the planning and implementation of additional archaeological mitigation works associated with the construction of the Project.
Authorised development	The development and associated development described in Part 1 of Schedule 1 (authorised development) of the draft Development Consent Order and any other development authorised by the Order, which is development within the meaning of s32 of the Planning Act 2008.
Bellmouth	A flared vehicular access point connecting a construction site to the public highway, designed to accommodate turning movements by large vehicles.
Best practicable means	A term used under the Control of Pollution Act 1974 and Environmental Protection Act 1990 to refer to measures which are reasonably practicable, having regard to local conditions and circumstances, to the current state of technical knowledge and to financial implications, concerning the mitigation of noise and other potential nuisance.
Biodiversity	The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological

Term	Description
	complexes of which they are part: this includes diversity within species, between species and of ecosystems.
Biodiversity Net Gain	An approach for developments to ensure habitats for wildlife are left in a measurably better state than they were before the development.
Biosecurity	Measures aimed at preventing the spread of harmful organisms (e.g. viruses and bacteria) to crops and livestock in order to reduce the risk of transmission of infectious diseases.
Busbar	The common connection point of two or more transmission circuits.
Circuit	A set of wires along which current flows and returns. It is necessary to have a complete circuit for current to flow. The National Grid standard for overhead lines operating at 400 kV is for pylons to carry two circuits, each consisting of three phases, i.e. a double circuit configuration.
Cable	An insulated conductor designed for underground installation.
Cable Sealing End	Structures used to transfer transmission circuits between underground cables and overhead lines.
Cable Sealing End compound	Electrical infrastructure used as the transition point between overhead lines and underground cables. A compound on the ground acts as the principal transition point.
Cable Sealing End platform	Electrical infrastructure used as the transition point between overhead lines and underground cables. A platform on the pylon acts as the principal transition point.
Catenary Wire	A catenary wire is a tensioned wire rope suspended between two anchor points
Code of Construction Practice	A code of construction practice sets out the standards and procedures to which a developer (and its contractors) must adhere in order to manage the potential effects of construction works.
Commitments	Measures that a developer commits to delivering as part of a project, with the purpose of limiting, mitigating or compensating potential effects of the project.
Conductor	The overhead wire that carries electricity from one place to another, for example the line between two pylons.
Conservation Area	An area of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance as defined in s69(1)(a) in the Planning (Listed Building and Conservation Areas) Act 1990.
Construction Traffic Management Plan	Plan detailing the procedures, requirements and standards necessary for managing the traffic effects during construction of the Project so that safe, adequate and convenient facilities for local movements by all transport modes are maintained throughout the construction process.

Term	Description
Contaminated Land	Land where a substance or contaminant is in or under the land which has the potential to cause significant harm or the significant possibility of significant harm to human health, property or protected species, or significant pollution or the significant possibility of significant pollution to controlled waters.
Corona discharge	An electrical discharge caused by the ionisation of fluid such as air surrounding a conductor carrying a high voltage. It represents a local region where the air (or other fluid) has undergone electrical breakdown and become conductive. A corona occurs at locations where the strength of the electric field (potential gradient) around a conductor exceeds the dielectric strength of the air.
County Wildlife Site	Non-designated areas of land important for their wildlife and nature conservation value.
Culvert	A channel or pipe that carries water below the level of the ground.
Design Appraisal for Site-Specific Infrastructure	Document developed by National Grid to outline the design principles that can be taken forward into the detailed design, set out an approach to the design of site-specific infrastructure of non-linear works, and to detail those elements of the design which have some flexibility in their appearance.
Dewatering	The removal of groundwater (e.g. by pumping) to keep a below-ground works area dry.
Development Consent Order	A statutory instrument which grants consents and other rights to build a Nationally Significant Infrastructure Project, as defined by the Planning Act 2008.
Distribution Network Operator	Companies that own and operate the power lines and infrastructure that connect the National Grid network to individual properties.
Easement	A legal right in perpetuity granting National Grid the right to install, use, maintain, replace, renew and remove its equipment.
Electric and Magnetic Fields	All equipment that generates, distributes or uses electricity produces Electric and Magnetic Fields (EMF), and EMFs also occur naturally. Electric fields are created by differences in voltage: the higher the voltage, the stronger the resultant field. Magnetic fields are created when electric current flows: the greater the current, the stronger the magnetic field.
Embedded design measures	Mitigation measures are those that are intrinsic to and built into the design of the Project.
Environmental Impact Assessment (EIA)	An assessment of the likely effects of a development project on the environment, which is reported in an Environmental Statement that is publicised and consulted on and taken into account in the decision on whether a project should proceed.

Term	Description
Environmental Areas	These are locations identified for environmental embedded measures, mitigation and/or Biodiversity Net Gain/environmental enhancement.
Environmental Statement (ES)	The main output from the EIA process, an ES is the report required to accompany an application for development consent (under the Infrastructure Planning (EIA) Regulations 2017) to inform public and stakeholder consultation and the decision on whether a project should be allowed to proceed. The EIA Regulations set out specific requirements for the contents of an ES for Nationally Significant Infrastructure Projects.
Environmental topic	A subject area covered within the EIA, for example landscape and visual or biodiversity.
Flood Risk Assessment	A Flood Risk Assessment is an assessment of the risk of flooding, particularly in relation to residential, commercial and industrial land use. In England and Wales, the Environment Agency requires a Flood Risk Assessment to be submitted alongside planning applications in areas that are known to be at risk of flooding.
Full-time equivalent	Unit of measurement used to calculate the total full time hours worked by staff.
Full line tension gantries	Types of gantries which allow conductors to connect into a substation or compound directly from a pylon, without requiring a bulky terminal pylon. This allows a larger span between the final pylon and the gantry.
Gantry	An overhead bridge-like structure supporting electrical equipment. A transition point from overhead line equipment to equipment in a compound.
Greenhouse gases	The term ‘greenhouse gases’ refers to a number of chemicals in the earth’s atmosphere such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O).
Groundwater	Water that is in the ground. This is usually referring to water in the saturated zone below the water table.
Habitats Regulations Assessment	The process by which plans and projects are assessed as to whether they are likely to have a significant effect on a European site either alone or in combination with other plans or projects, under the Conservation of Habitats and Species Regulations 2017 (as amended).
Haul road	A route used by construction traffic within the Order Limits to access a working area from a site access point.
Heavy Goods Vehicles	Goods vehicles weighing more than 3,500 kg.
High voltage	275,000 volts and over. National Grid’s transmission lines generally operate at 275,000 and 400,000 volts. Lower voltage lines, such as

Term	Description
	132,000 volts and 33,000 volts, are generally owned by local distribution companies.
High voltage alternating current	The transmission and distribution of electrical energy using alternating current (AC) at high voltage levels.
Horizontal directional drilling	Trenchless method for the installation of pipes, in a shallow arc using a surface-launched drilling rig. In particular, it applies to large-scale crossings in which a fluid filled pilot bore is drilled without rotating the drill string, and this is then enlarged by a washover pipe and back reamer to the size required for the product pipe.
Insulator	Used to attach the conductors to the pylons, preventing electrical discharge to the steelwork.
Kilovolt	1,000 volts
Landscape character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.
Lattice pylon	Pylon type widely used on the national electricity transmission networks. Both standard lattice pylons (approximately 50 m in height) and low hight lattice pylons (approximately 40 m in height) are proposed on the Project.
Light Goods Vehicles	Goods vehicle weighing 3,500 kg or less.
Limits of Deviation (LoD)	LoD allow for adjustment to the final positioning of the permanent features, for example to avoid localised constraints or unknown or unforeseeable issues that may arise. This could include previously unidentified poor ground conditions which require a pylon to be moved slightly for geotechnical reasons, such as ground stability. The horizontal LoD define the parameters within which the position on the ground of proposed permanent features may deviate from the position shown on the plans. This applies to both linear (for example overhead lines and underground cables) and non-linear (for example the new EACN Substation and CSE compounds) proposed infrastructure. Vertical LoD limit the maximum vertical height, or the depth below ground, of any new infrastructure.
Listed building	A measure of a building's special architectural and historic interest. There are three categories of listed buildings, Grades I, II* and II, depending on the level of interest.
Local Nature Reserve	Sites dedicated by the Local Planning Authority under Section 21 of the National Parks and Access to the Countryside Act 1949 for nature conservation which have wildlife or geological features that are of special interest locally.
Major Accidents	A major accident is an event that threatens immediate or delayed serious environmental effects to human health, welfare and/or the environment and requires the use of resources beyond those of the client or its appointed representatives (i.e., contractors) to manage.

Term	Description
	Major accidents can be caused by disasters resulting from both man-made and natural hazards.
Local Planning Authority	The public authority whose duty it is to carry out specific planning functions for a particular area.
Lux	Measurement of the amount of light produced.
Main Works Contractor(s)	Contractor(s) appointed by National Grid to construct the Project
Mitigation	The action of reducing the severity and magnitude of change (impact) to the environment. Measures to avoid, reduce, remedy or compensate for significant adverse effects.
National Electricity Transmission System Security and Quality of Supply Standard	The NETS SQSS sets out a coordinated set of criteria and methodologies that the Transmission Licensees shall use in the planning and operation of the National Electricity Transmission System.
National Landscape (an Area of Outstanding Natural Beauty)	Formally designated under the National Parks and Access to the Countryside Act of 1949 to protect areas of the countryside of high scenic quality that cannot be selected for National Park status due to their lack of opportunities for outdoor recreation (an essential objective of National Parks). As of November 2023, all AONBs became 'National Landscapes'. This reflects ambitions for the areas to play a key part in the international '30 by 30' commitment (to protect and conserve a minimum of 30% of land and sea for biodiversity by 2030).
Nationally Significant Infrastructure Project	Typically a large scale development of national importance that requires development consent from the Secretary of State, under the Planning Act 2008.
Order Limits	The maximum extent of land within which the authorised development may take place.
Overhead line	Conductor (wire) carrying electric current, strung from pylon to pylon.
Overhead Line Craftperson	Person who constructs the overhead line infrastructure
Overhead line refurbishment	Repair and renewal of conductors, pylon painting, earthwire, fittings and insulators and, where necessary, remedial works to the pylon and foundations.
Permanent access	Access required to infrastructure during the operational phase of the Project, for operational and maintenance purposes.
Piling	Engineering process of installing elongated structural elements, known as piles, into the subsoil. This technique is employed to transfer structural loads to deeper, more competent strata, thereby providing stable foundations for construction projects. Essentially, it addresses situations where surface soils lack sufficient bearing capacity to support intended structures.

Term	Description
Primary Access Routes (PAR)	These are the roads on the local road network that would be used by construction vehicles between the strategic road network and the access points within the Order Limits.
Project Section	Geographical 'sections' have been identified that break the Project down into smaller units for ease of description within the documentation. These Project Sections are broken down into eight sections based largely on Local Planning Authority boundaries.
Public Right of Way (PRoW)	A footpath, bridleway or byway accessible to all members of the public.
Pulling site	A site where the winching equipment that is used to pull through the new conductors is located.
Pylon	Structures that support the overhead line (conductors).
Scoping	Scoping is the process of determining the content and extent of matters that should be covered in the Environmental Impact Assessment.
Scoping Report	Report determining the content and extent of matters that should be covered in the Environmental Impact Assessment.
Site access points	A location connecting a construction site to the public highway.
Standard mitigation measures	Comprise management activities and techniques, which would be implemented throughout construction of the Project to limit effects through adherence to good site practices.
Statutory Undertakers	Persons with regulatory powers and duties, such as gas, electricity, water and transport providers or transmitters.
Subsoil	Weathered soil layer extending between the natural topsoil and the unweathered basal layer (geological parent material, either solid or drift) below.
Substation	Substations are used to control the flow of power through the electricity system. They are also used to change (or transform) the voltage from a higher to lower voltage to allow it to be transmitted to local homes and businesses.
Suspension pylon	Pylon where conductors are suspended by a vertical insulator string. Suspension pylons support the conductors on straight stretches of overhead line.
Temporary overhead line diversions and pylons	Temporary diversions of existing overhead line may be required to ensure electricity flows are maintained at all times during construction of the Project to limit the disruption to the electricity network. These typically comprise a short section of overhead line with temporary structures or pylons which electricity flows are diverted along.

Term	Description
Tensioning site	A site where the new conductor is fed out from during construction. This also includes a tensioning winch to keep the conductor off the ground.
Terminal pylon	Pylons erected at the end of the overhead line to terminate the line at substations or where overhead lines are connected to underground cables. Because of the uneven load on one side of the pylons, much deeper and heavier foundations are required on the unloaded side.
Transmission line	A National Grid overhead line and underground cable which transmits electricity between National Grid's substations. Power is transmitted at high voltages (275 kV or above) between power stations where it is generated and the local electricity supply networks of the regional Distribution Network Operators where it is transformed to lower voltages (132 kV or below) for supply via distribution lines to local communities.
Transport Assessment	Transport Assessment is a comprehensive and systematic process that sets out transport issues relating to a proposed development. It identifies what measures will be taken to deal with the anticipated transport effects of the Project. It is separate to Chapter 16: Traffic and Transport (document reference 6.16) (Revision B).
Trenchless crossing	A crossing installation method that has limited above-ground disturbance which is used to avoid a sensitive feature such as an environmental feature.
Triple Araucaria conductors	Triple Araucaria conductor design is the least electrically stressed conductor system that National Grid uses. It is the best design for reducing the effects of line crackle (corona discharge).
Topsoil	Material which developed originally at the top of the soil profile and is characteristically darker in colour and has a higher organic matter content than subsoil material.
Temporary construction compounds	Temporary compounds installed during the construction phase of the Project. Each compound may contain storage areas including laydown areas, soils storage and areas for equipment and fuel, drainage, generators, car parking and offices and welfare areas (portacabins).
UK Power Networks	UK Power Networks (Operations) Limited (registered company number 03870728) and/or its affiliate Eastern Power Networks plc (registered company number 02366906) as applicable.
Underground cable	An insulated conductor carrying electric current designed for underground installation. Underground cables link together two Cable Sealing End compounds.
Value engineering	Value engineering in transmission projects involves a systematic approach to optimising the project's value by finding the most cost-effective way to achieve its essential functions without compromising quality or performance. It is a team effort that examines all aspects of

Term	Description
	the project, from planning to construction, to identify areas where costs can be reduced or improved without sacrificing the project's objectives.
Visibility splay	Areas of tree/vegetation removal, typically where access points are, to enable a driver to see down the road and know when the road is clear.
Voltage	The electrical potential difference between two points.
Water Framework Directive	The Water Framework Directive (2000/60/EC) commits European Union member states to achieve good qualitative and quantitative status of all water bodies. It is transposed into law in England and Wales via The Water Environment (Water Framework Directive) (England and Wales) 2017 Regulations, which were retained via the European Union (Withdrawal) Act 2018.
Working area	Working area required to construct elements of the Project, such as pylons, underground cables, CSE compounds.

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