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# Bramford to Twinstead Reinforcement

Volume 6: Environmental Information

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Alternatives Considered

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nationalgrid

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# Contents

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<b>3.</b>	<b>Alternatives Considered</b>	<b>1</b>
3.1	Introduction	1
3.2	Legal and Policy Background	2
3.3	Approach to Options Appraisal	3
3.4	Identifying the Project Need	4
3.5	Strategic Options	5
3.6	Route Corridors	7
3.7	Alignments Considered	12
3.8	Distribution Network Options	44
3.9	Cable Sealing End Compounds	53
3.10	Alternative Design and Construction Method	62
3.11	Conclusion	68

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# 3. Alternatives Considered

## 3.1 Introduction

3.1.1 This chapter documents the main alternatives considered by National Grid Electricity Transmission (here on referred to as National Grid) in the development of the Bramford to Twinstead Reinforcement ('the project'), and compares the environmental effects associated with these. This document should be read alongside the Evolution of the Project (**application document 7.2.6**), which describes the project history and reporting produced at each stage.

### Structure of this Chapter

3.1.2 Table 3.1 sets out the structure of the chapter, and content of each section.

Table 3.1 – Structure of this Chapter

Section	Content
3.1 Introduction	Introduces the chapter, provides a summary of the relevant policy and describes the National Grid options appraisal process.
3.2 Legal and Policy Background	Sets out the legal and policy requirements for considering alternatives within the ES.
3.3 Approach to Options Appraisal	Sets out the different steps within the options appraisal process that National Grid follow when developing projects.
3.4 Identifying the Project Need	This summarises the need case that provides the driver for the project.
3.5 Strategic Options	Describes the strategic options that were considered and the reasons as to why they were taken forward or dismissed.
3.6 Route Corridors	Describes the route corridors that were identified as part of the high level routing between Bramford Substation and Twinstead Tee.
3.7 Alignments Considered	Describes the different alignments identified within the preferred corridor and the assessment undertaken to identify the preferred alignment.
3.8 Distribution Network Options	Describes the different options considered for providing UK Power Networks (UKPN) with a connection following the proposed removal of the 132kV overhead line between Burstall Bridge and Twinstead Tee.
3.9 Cable Sealing End (CSE) Compounds	Describes the alternative locations considered for the four CSE compounds proposed on the project.
3.10 Alternative Construction Method	Describes the different construction methods that have been considered as part of the options appraisal process.
3.11 Conclusion	Provides a concluding statement that National Grid considers that alternatives have been appropriately considered, and confirmation that the process has taken into account feedback from assessments and consultation.

## 3.2 Legal and Policy Background

- 3.2.1 There is both a legal and policy requirement to report the main alternatives considered during the development of a Nationally Significant Infrastructure Project (NSIP). These are summarised in the following sub-sections. This section also covers the Holford Rules and Horlock Rules, which are guidelines setting out the basis for siting overhead transmission lines and substations respectively.
- 3.2.2 Further details on the planning context (including National Grid's duties under the Electricity Act) can be found in Environmental Statement (ES) Chapter 2: Regulatory and Planning Policy Context (**application document 6.2.2**) and the Planning Statement (**application document 7.1**).

### The EIA Regulations 2017

- 3.2.3 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) requires applicants to document alternative development options considered as part of the application for development consent. Regulation 14(2) states that an ES should include *'a description of the proposed development comprising information on the site, design, size and other relevant features of the development'*.
- 3.2.4 Part 2 of Schedule 4 of the EIA Regulations 2017 requires that the ES includes *'A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects'*.
- 3.2.5 Paragraph 2.3.9 of the Scoping Opinion (**application document 6.6**) requested a discrete section in the ES that provides details of the reasonable alternatives studied and the reasoning for the selection of the chosen option, including a comparison of the environmental effects. The Scoping Opinion also noted that this should include consideration of how much of the route is overhead line and how much is undergrounded.
- 3.2.6 Paragraph 2.3.10 of the Scoping Opinion (**application document 6.6**) also requested that the ES describes the selection process used and decisions made that result in the determination of the final location for the cable sealing end (CSE) compound at Dedham Vale East (covered in Section 3.9) and routing of underground cables at Dollops Wood (covered in Section 3.7). The information requested in the Scoping Opinion in relation to options is presented within this chapter.

### National Policy

- 3.2.7 Where a relevant National Policy Statement (NPS) has effect in relation to an NSIP, the Secretary of State must have regard to that NPS and must determine the application in accordance with the relevant NPS unless certain exceptions apply. In the case of Bramford to Twinstead Reinforcement, the relevant NPSs are the Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a) and the NPS for Electricity Networks (EN-5) (DECC, 2011b). Paragraph 4.4.2 of the Overarching NPS for Energy states *'Applicants are obliged to include in their ES, as a matter of fact, information about the main alternatives they have studied. This should include an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility'*.

- 3.2.8 Draft replacement EN-1 and EN-5 were published for consultation in September 2021 (Department for Business, Energy and Industrial Strategy (BEIS), 2021a,b). These do not introduce any new tests relevant to the consideration of alternatives.

## Holford Rules

- 3.2.9 The Holford Rules are guidelines which form the basis for decisions of siting overhead transmission lines. They were originally set out in 1959 but later updated and remain a valuable tool in selecting and assessing potential route options as part of the environmental assessment process. These have been an important consideration during the development of the project and have informed decisions on whether certain parts of the project should be undergrounded.
- 3.2.10 A summary of the Holford Rules and how these have been considered on the project can be found in Chapter 5 of the Planning Statement (**application document 7.1**). These have been an important consideration during the development of the project and whether certain sections should be undergrounded.

## Horlock Rules

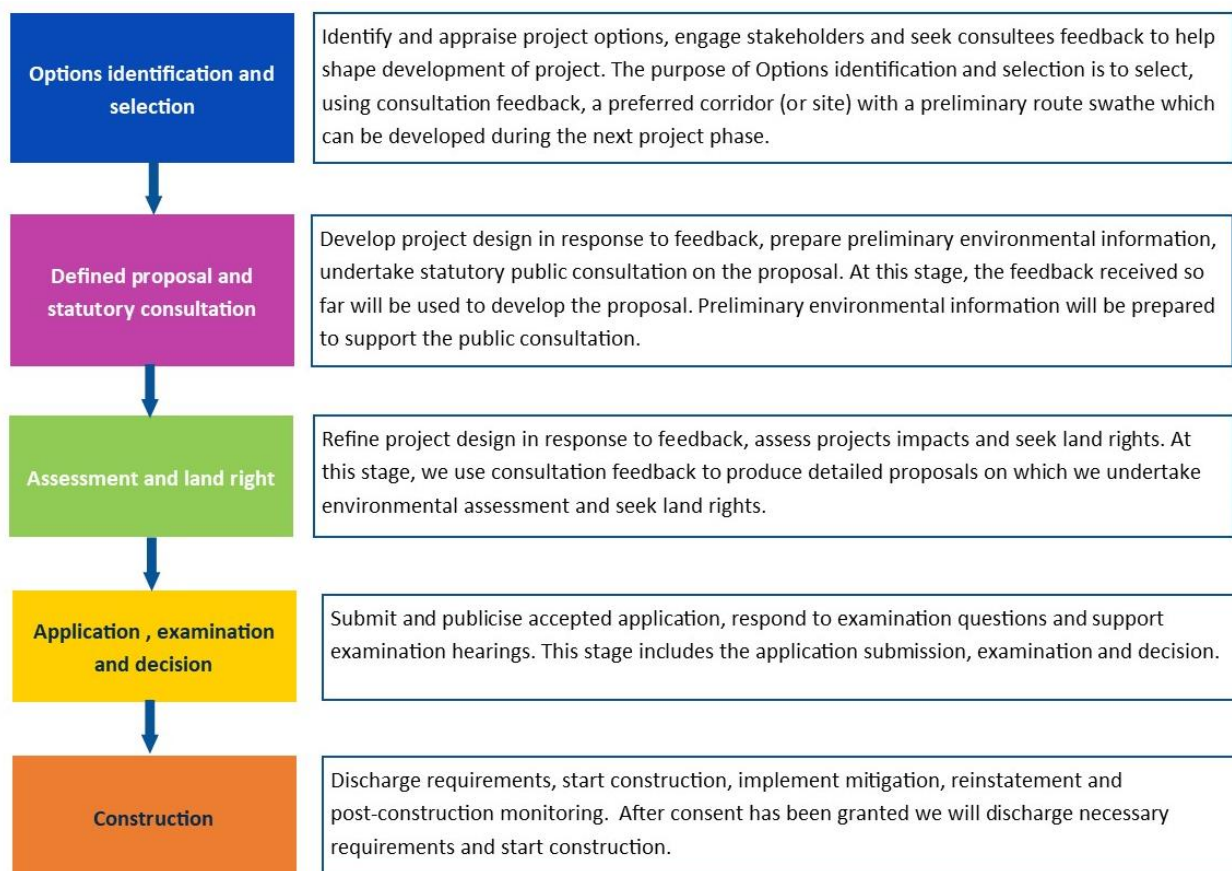
- 3.2.11 National Grid devised the Horlock Rules in 2003, and these were subsequently updated in 2009. The Horlock Rules provide guidelines for the siting and design of new substations, or substation extensions, to avoid or reduce the environmental effects of such developments. In summary, like the Holford Rules, they facilitate consideration of environmental and amenity considerations within the design and siting of new substation infrastructure. These were considered during the identification of potential locations for the proposed grid supply point (GSP) substation near Twinstead. Further details on how the project has considered the Horlock Rules can be found in Chapter 5 of the Planning Statement (**application document 7.1**).

## 3.3 Approach to Options Appraisal

- 3.3.1 National Grid undertakes options appraisal on each new project. There are often a number of different ways that a project could be developed, perhaps involving different locations, technologies or designs. Each project will require judgements and decisions about the best way to achieve the required outcome. The options appraisal process provides information to help inform those judgements.
- 3.3.2 Options appraisal is a robust and transparent process that is used to compare options and to assess the beneficial (positive) and adverse (negative) effects they may have, across a wide range of criteria including environmental, socio-economic, technical and cost factors. The aim is to find a balanced outcome, bearing in mind the range of National Grid's statutory duties. The assessment is documented to provide in a transparent manner, the information on which decisions are based.
- 3.3.3 National Grid's (2022c) current published approach to the design and routing of new electricity lines is shown in Illustration 3.1. While the guidance has been updated throughout the evolution of the project; the key project milestones remain broadly consistent with the earlier guidance documents, which are now superseded (National Grid, 2011 and National Grid, 2012c).
- 3.3.4 At each stage in the options appraisal process, transparent methods have been used to inform decision-making. This has included technical inputs from engineers and

environmental consultants to inform the decisions and design. The assessment has drawn on data and evidence collected from both desk studies and field work. Decision-making has also taken account of feedback from both prescribed bodies and the local community through an extensive programme of engagement and consultation.

Illustration 3.1 – Project Development Staged Process (National Grid, 2022c)



### 3.4 Identifying the Project Need

- 3.4.1 The existing electricity transmission network in East Anglia does not have the capability needed to reliably and securely transport all the energy that will be connected in the future, while working to the required standards.
- 3.4.2 With new offshore wind generation, a new nuclear power station at Sizewell C and greater interconnection with countries across the North Sea being proposed, there will be a large increase in the amount of renewable and low carbon electricity generation connecting along the East coast.
- 3.4.3 This increased generation will play a key role in delivering the UK Government’s net zero ambitions and delivering up to 50GW of offshore wind connected by 2030. To facilitate these ambitions, electricity network infrastructure is needed to ensure that energy can be transported from where it is generated to where it is used.
- 3.4.4 Whilst the transmission system in East Anglia has been sufficient until today, it will soon exceed its current capability. This includes its thermal boundary capability (the physical capacity of the circuits to carry power) and transient stability (the ability to accommodate faults without damaging generators or the network).

- 3.4.5 Increased transmission capability is therefore required in the East Anglia region, to allow National Grid to maintain a robust network, remain in accordance with its licence obligations, and to allow new sources of electricity generation to connect. This is vital to facilitate the ambitious targets set by the Government, for secure, clean and affordable energy for the long term.
- 3.4.6 Further detail of the need that the Bramford to Twinstead reinforcement is addressing is set out in the Need Case (April 2023) (**application document 7.2.1**).

## 3.5 Strategic Options

- 3.5.1 Once the need for the project had been established, National Grid considered the different ways in which this need could be met, to generate a preferred Strategic Proposal. The alternatives considered at this stage comprised different technologies, different geographical connection points, or a combination of the two.
- 3.5.2 The Strategic Options Report (**application document 7.2.2**) considered a short list of four options drawn from a long list of 18 strategic options. The four options, with various sub-options reflecting the potential use of alternative technologies, were each assessed in terms of technical, economic, environmental and socio-economic factors. Table 3.2 contains a summary of the environmental factors considered.

**Table 3.2 – Summary of the Four Shortlisted Strategic Options**

Strategic Option	Environmental Considerations
PS1 Sizewell – Bradwell subsea. This would be achieved by the installation of a new 90km subsea cable circuit and 38km between Sizewell and Bradwell.	<ul style="list-style-type: none"> <li>Constrained by a number of international and national designations including Outer Thames Estuary Special Protection Area (SPA) and Dengie Flats Site of Special Scientific Interest (SSSI). Designated sites cannot be avoided, although significant adverse effects may be avoidable. A Habitats Regulation Assessment would be required to determine the potential for significant adverse effects.</li> <li>Converter station sites at each end of the connection would bring adverse landscape effects and impacts on views, including in the Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB).</li> <li>Requires a new 5km 400kV overhead line between Sizewell and Leiston with effect on landscape and views in AONB and 38km of new 400kV overhead line on route of existing 132kV Bradwell-Rayleigh overhead line with effects on landscape and views.</li> </ul>
PS2: Bramford – Twinstead Tee (c. 28km). This would be achieved by the installation of a new circuit between Bramford and the Twinstead Tee. Overhead line and underground cables were considered as sub-options.	<ul style="list-style-type: none"> <li>(Overhead line) Would pass through approximately 3.6km of Dedham Vale AONB if the 132kV overhead line was removed and the route was used, with effects on landscape and views. If 132kV overhead line route was not used, an additional overhead line would be visible from the AONB with the scale of effects depending on the route.</li> <li>(Both) Constrained by settlements including Hintlesham, Hadleigh, Kersey, Polstead, Boxford, Stoke-by-Nayland and Sudbury.</li> </ul>



Strategic Option	Environmental Considerations
<p>PS3: Bramford – Braintree. This would be achieved by the installation of a new circuit between Bramford and Braintree. This would achieve the same transmission system circuit configuration as PS2 but would involve the installation of approximately 34km of new circuit and would allow removal of approximately 8km of existing 400kV overhead line.</p>	<ul style="list-style-type: none"> <li>• (Underground cable) Effects on the AONB would relate to where trees or woodlands were cleared and could not be replanted. These effects would be less than those anticipated for an overhead line.</li> <li>• (Overhead Line) Would pass through approximately 3.6km of Dedham Vale AONB if 132kV overhead line route was used, an additional overhead line would be visible from the AONB with the scale of effects depending on the route. <ul style="list-style-type: none"> <li>• with effects on landscape and views. Would also pass close to the western edge of the AONB for a significant distance affecting landscape and views.</li> </ul> </li> <li>• (Both) constrained by settlements including Hintlesham, Hadleigh, Kersey, Polstead, Boxford, Stoke-by-Nayland, Colchester, Manningtree and several smaller towns and villages.</li> <li>• (Underground cable) Effects on the AONB would relate to where trees or woodlands were cleared and could not be replanted. These effects would be less than those anticipated for an overhead line.</li> <li>• (Both) the route would run close to the western edge of the Dedham Vale AONB, introducing potentially significant adverse effects on landscape character and views to and from the AONB. This would be most pronounced if overhead line was used but may also occur if an underground option was used due to loss of trees or woodland.</li> <li>• (Both) the route would be required to run through parts of the Stour Valley where there are currently no existing overhead lines.</li> <li>• (Both) would allow 8km of existing 400kV overhead line to be removed (although this would be replaced by new overhead line closer to the AONB)</li> </ul>
<p>PS4: Bramford – Rayleigh. This would be achieved by the installation of a new circuit between Bramford and Rayleigh. This would achieve the same transmission system circuit configuration as PS2 but would require the installation of approximately 90km of new circuit and would allow removal of approximately 22km of existing 400kV overhead line.</p>	<ul style="list-style-type: none"> <li>• Constrained by Suffolk Coasts and Heath AONB and Dedham Vale AONB. Would also travel close to AONB for significant distance.</li> <li>• Constrained by a number of international and national designations (e.g. Stour and Orwell Estuaries Ramsar Site, SPA and SSSI, and numerous scheduled monuments).</li> <li>• Settlements include Brantham, Colchester, Wiltham, Tiptree, Maldon, Danbury, Wickford and several smaller towns and villages.</li> </ul>
3.5.3	<p>The Strategic Options Report (<b>application document 7.2.2</b>) concluded that the preferred option was PS2. While similar to an optimised PS3, PS2 has less interaction with the Dedham Vale AONB and its setting than PS3. Similarly, PS2 would result in lower magnitude of change within the Stour Valley compared to PS3, by allowing the use of the route of the existing 132kV overhead line.</p>
3.5.4	<p>PS2 (i.e. a new 400kV overhead transmission line between Bramford and Twinstead Tee) would achieve a balance between National Grid's technical, economic and environmental obligations and should remain the preferred strategic option. This is taking account of</p>

National Grid's statutory obligations, its licence requirements and all other relevant considerations. However, the report recognised that some sections may need to be placed underground and that this and other mitigation measures would be investigated during the next stage of the project.

- 3.5.5 It is assumed that this reinforcement would operate at least 400kV in a similar way to the majority of the rest of the transmission network. For the purposes of this Chapter, the new overhead line is referenced as the 'new 400kV overhead line' to differentiate it from the existing 400kV overhead line and the UKPN-owned 132kV overhead line.

### Alternative Cable Technology

- 3.5.6 As part of identifying the Strategic Options, National Grid has considered the potential for using alternative cable technology:

- Alternating Current (AC) High Temperature Superconductors (HTS): High temperature superconductors can demonstrate superconducting properties at temperatures above Absolute Zero Kelvin. However, they operate at a temperature of circa -140°C and require cooling by liquid nitrogen. At present the power carrying capacity available using this technology is relatively low. While it is used in different contexts elsewhere, the limited capacity of AC HTS technology makes it currently unviable for major transmission projects such as the Bramford to Twinstead Reinforcement; and
- High Voltage Direct Current (HVDC): HVDC is an expensive option due to the cost of the cable and the need for a converter station at each end to connect the Direct Current (DC) cables into the AC transmission system. This generally makes HVDC technology of any kind uneconomic for distances less than 100km, as is the case for the Bramford to Twinstead Reinforcement. This technology is significantly more expensive than the proposed technology on the Bramford to Twinstead Reinforcement and would not meet National Grid's statutory duty to be economic and efficient. The converter stations would also have potential for landscape and visual effects depending on where these are located.

- 3.5.7 Both alternative cable technologies were identified as not being suitable on the project for the reasons given above, therefore standard cable technology has been chosen.

## 3.6 Route Corridors

- 3.6.1 National Grid considered potential route corridors through which a predominantly overhead line between Bramford Substation and Twinstead Tee could be constructed. Four route corridors were identified, all of which would be technically feasible, and all of which would have connection points at Bramford Substation and the existing tee at Twinstead. These are shown on Figure 3.1: Route Corridors (**application document 6.4**). A high-level environmental assessment (including desk study and site visits) was undertaken on each of the four route corridors to support the options appraisal which is summarised in Table 3.3. Further details can be found in the Route Corridor Study (**application document 7.2.3**).

- 3.6.2 Each route corridor was assessed against how it performed against National Grid's obligations set out in Sections 9 and 38 and Schedule 9 of the Electricity Act 1989 (Section 9 of the Electricity Act relates primarily to a requirement to maintain an efficient, co-ordinated and economical system of electricity transmission, and Section 38 and

Schedule 9 relate primarily to protection of the environment and mitigating potential effects). The assessment also considered how well each route corridor performed against the Holford Rules.

- 3.6.3 Corridors 1 and 2 were identified as ‘opportunity corridors’ as they use the existing overhead line routes (400kV and 132kV overhead lines) which already pass through Dedham Vale AONB.
- 3.6.4 Corridor 1 (a new line parallel to the existing 400kV overhead line between Bramford and Twinstead) was identified as being the lowest cost option, but the introduction of a third overhead line through Dedham Vale AONB was considered to weigh significantly against the option.
- 3.6.5 Corridor 2 (which proposes the removal of the existing 132kV overhead line between Burstall and Twinstead and the adoption of its route for a new 400kV overhead line) was identified as the preferred route corridor as, even though it passes through parts of the Dedham Vale AONB, it would result in the least scale of change to the existing environment. Corridor 2 also provided the opportunity to remove the existing 132kV overhead line, which was seen as a benefit on the landscape and views.
- 3.6.6 Corridor 3 (to the north of Hadleigh) avoids the AONB, and the potential for effects on views from within the AONB were considered to be limited. Corridor 4 also avoids the AONB and would have the least effects on the AONB due to its distance from the AONB. However, both of these options would introduce an overhead line into an area regarded locally as high quality landscape, albeit undesignated, where there is presently no existing electricity transmission infrastructure and were not supported by a number of statutory consultees and the public.
- 3.6.7 Corridor 2 was chosen as the preferred route corridor as it would result in the least scale of change to the existing environment (amongst other considerations) and was considered to be the most direct route of the corridors considered. Corridor 2 would involve the removal of a section of the existing 132kV overhead line, which was seen as a benefit in terms of landscape and visual impact.

Table 3.3 – Summary of the Route Corridor Options

Corridor	Description	Key Environmental Factors Considered During the Selection Process
<p><b>Corridor 1</b></p> <p>A new line parallel to the existing 400kV overhead line between Bramford and Twinstead c. 26km in length.</p>	<p>The electricity transmission line would exit Bramford Substation in a westerly direction lying to the north of Hintlesham village. It would parallel the existing 400kV overhead line through Hintlesham Woods SSSI before continuing to the south of Hadleigh and Polstead Heath. It would pass through approximately 3km of Dedham Vale AONB, in the vicinity of the Box Valley. This corridor would result in an additional electricity transmission line in this designated landscape. It would continue to the south of Assington and Sudbury before crossing the B1508, the railway and the River Stour valley and connecting at Twinstead. The existing 132kV line between Bramford and Twinstead Tee would remain.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Corridor avoids passing through settlement centres.</li> <li>• No direct effect on conservation areas, as effects on setting would be limited due to the location of the conservation areas within settlement boundaries.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• 3km of corridor passes within Dedham Vale AONB parallel to two existing overhead lines (400kV and 132kV).</li> <li>• Crosses Hintlesham Woods SSSI.</li> <li>• Four listed buildings lie within 500m of the corridor and two scheduled monuments within 2km of the corridor with possible impacts on the setting of these.</li> <li>• Existing overhead line crosses (or is very close to) approximately 15 woodlands; avoidance of these woodlands would be difficult if paralleling the existing line.</li> <li>• Crosses Popes Green Farm extraction site (Layham Quarry).</li> <li>• Crosses Belstead, Brett and Stour Valley Special Landscape Area (SLA).</li> </ul>
<p><b>Corridor 2</b></p> <p>This corridor proposes the removal of the existing 132kV overhead line between Burstall and Twinstead and the adoption of its route for a new 400kV overhead line c 29km in length.</p>	<p>The existing 132kV overhead line runs to the south of Bramford Substation and runs close to the existing 400kV overhead line for the majority of the route from a point to the south of Hintlesham Woods where they align, separating only as the 400kV overhead line approaches Twinstead Tee. Like Corridor 1, this would pass through approximately 3km of Dedham Vale AONB, in the vicinity of the Box Valley. This corridor would require a new GSP substation close to Twinstead, which would allow the DNO to continue to operate its network in this area. Two alternative options were identified at the eastern end of Corridor</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Corridor 2A avoids Hintlesham Woods SSSI.</li> <li>• No direct effect on conservation areas, as effects on setting would be limited due to the location of the conservation areas within settlement boundaries.</li> <li>• Corridor avoids passing through settlement centres.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• 3km of corridor passes within Dedham Vale AONB parallel to the existing 400kV overhead line, along the route of the existing 132kV line which would be removed.</li> <li>• Corridor 2B potentially crosses Hintlesham Woods SSSI.</li> </ul>

Corridor	Description	Key Environmental Factors Considered During the Selection Process
	2 (Corridor 2A and 2B). Corridor 2A follows the corridor of the vacated 132kV line to the south of Hintlesham and Corridor 2B parallels the existing 400kV line to the north of Hintlesham.	<ul style="list-style-type: none"> <li>• Five listed buildings lie within 500m of the corridor and two scheduled monuments within 2km of the corridor with possible impacts on the setting of these.</li> <li>• Existing overhead line crosses (or is very close to) approximately 15 woodlands; avoidance of these woodlands would be difficult in achieving close alignment to the existing line.</li> <li>• Crosses Popes Green Farm extraction site (Layham Quarry).</li> <li>• Crosses Belstead, Brett and Stour valley SLA.</li> </ul>
<b>Corridor 3</b> New Route Corridor (Direct option to the north of Hadleigh) c. 26.5km in length.	Corridor 3 sought to take the most direct route between Bramford Substation and Twinstead Tee to the north of Hadleigh, whilst avoiding the key environmental constraints such as Dedham Vale AONB. The corridor leaves Bramford Substation in a westerly direction. It continues to the north of Hintlesham Woods and Hadleigh. It crosses the River Brett in the vicinity of the A1141. Corridor 3 narrows in the vicinity of Groton and Boxford to avoid these settlements before splitting to negotiate the linear development of Sherbourne Street. These corridor sub-options would then re-join to the west of Boxford in the vicinity of the River Box. The corridor continues to the west, avoiding settlements including Newton and Little Conrad. It drops in elevation towards the River Stour valley where it crosses the B1508, the railway and River Stour close to the flat valley floor. It then takes to slightly higher ground to approach Twinstead Tee 2km to the west.	<b>Beneficial:</b> <ul style="list-style-type: none"> <li>• Avoids Dedham Vale AONB and Hintlesham Woods SSSI.</li> <li>• No direct effect on conservation areas, as effects on setting would be limited due to the location of the conservation areas within settlement boundaries.</li> <li>• Corridor includes 20 small woodlands, however these were considered avoidable in identifying detailed alignments.</li> </ul> <b>Adverse:</b> <ul style="list-style-type: none"> <li>• Eight listed buildings lie within 500m of the corridor and seven scheduled monuments within 2km of the corridor with possible impacts on the setting of these.</li> <li>• Corridor passes closely between Groton, Boxford and Sherbourne Street settlements.</li> <li>• Corridor crosses a sand and gravel pit at Peyton Hall Farm.</li> <li>• Elmsett Airfield less than 0.5km to north of corridor.</li> <li>• Crosses Flowton, Brett, Box and Stour Valley SLA.</li> </ul>
<b>Corridor 4</b>	Corridor 4 sought a route that avoided key environmental constraints, such as Dedham Vale	<b>Beneficial:</b> <ul style="list-style-type: none"> <li>• Avoids Dedham Vale AONB.</li> </ul>

Corridor	Description	Key Environmental Factors Considered During the Selection Process
New Route Corridor (Northerly option) c. 30km in length.	AONB. It was designed to take a more northerly route to largely avoid the SLA. This corridor runs in a north-west direction from the substation at Bramford. It splits to avoid Flowton before re-joining to run westwards through open land between Naughton and Whatfield. The corridor splits again around Semer and it continues westwards to the River Box. The corridor continues to the west, avoiding settlements including Newton and Little Conrad. It drops in elevation towards the River Stour where it crosses the B1508, the railway and River Stour close to the flat valley floor. It then takes to slightly higher ground to approach Twinstead Tee 2km to the west.	<ul style="list-style-type: none"> <li>• No direct effect on conservation areas, as effects on setting would be limited due to the location of the conservation areas within settlement boundaries.</li> <li>• Corridor includes 20 small woodlands, however these were considered avoidable in identifying detailed alignments.</li> <li>• Corridor excludes major settlements.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Milden Thicks SSSI within corridor.</li> <li>• 13 Listed Buildings lie within 500m of the corridor and 11 scheduled monuments within 2km of the corridor with possible impacts on the setting of these.</li> <li>• Elmsett Airfield less than 1km to south of corridor. Wattisham Airfield approximately 2km to north of corridor.</li> <li>• The corridor seeks to avoid the SLA, crossing the River Brett SLA at the narrowest section where complete avoidance is not possible.</li> </ul>

## 3.7 Alignments Considered

- 3.7.1 Various alignments have been considered within the preferred corridor. This has included considering both overhead line and underground cable solutions. The current NPS EN-5 (DECC, 2011b) acknowledges that overhead lines are appropriate in many instances. However, there may be specific locations where underground cables are appropriate depending on the sensitivity of the baseline environment. The comparative differences between these two alternatives are presented in Table 3.4.
- 3.7.2 As noted in paragraph 2.8.8 in EN-5 although the Government expects that fulfilling this need through the development of overhead lines will often be appropriate, it recognises that there will be cases where this is not so. Where there are serious concerns about the potential adverse landscape and visual effects of a proposed overhead line, this will have to be balanced against other relevant factors, including the project need, the availability and cost of alternative sites and routes and methods of installation (including undergrounding). Paragraph 2.8.9 continues by saying '*each project should be assessed individually on the basis of its specific circumstances and taking account of the fact that Government has not laid down any general rule about when an overhead line should be considered unacceptable*'. When deciding the balance, EN-5 states that consideration should be given to the landscape in which the proposed line will be set, (in particular, the impact on residential areas, and those of natural beauty or historic importance such as AONB) and the environmental and archaeological consequences of undergrounding, which can disturb sensitive habitats, have an impact on soils and geology, and damage heritage assets, in many cases more than an overhead line would.
- 3.7.3 The options appraisal looked at different alignments within each project section. The sections were first set out within the Connection Options Report (COR) (**application document 7.2.4**). The project sections were based on landscape character and comprised the following, which are listed from east to west:
- Section AB: Bramford Substation/Hintlesham;
  - Section C: Brett Valley;
  - Section D: Polstead;
  - Section E: Dedham Vale AONB;
  - Section F: Leavenheath/Assington; and
  - Section G: Stour Valley.
- 3.7.4 A further section was later added as part of the Statutory Consultation to include consideration of the GSP substation i.e. Section H: GSP Substation.

Table 3.4 – Comparison Between Overhead Line and Underground Cables

Option and Description	Key Environmental Factors
<p><b>Overhead Line</b></p> <p>This consists of steel pylons that support conductors for transmitting electricity. The pylons have a relatively small base with each leg being approximately 10m by 10m in size and pylons typically being 350m apart.</p> <p>Temporary works include excavation of the pylon base to form the foundations and fitting the pylons to the base. The conductors are typically lifted into place using a crane.</p> <p>Relatively little soil stripping is required outside of the pylon bases and temporary access routes.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Overhead lines can span rivers, hedgerows and tree belts with relatively little disturbance to habitats. This means that existing vegetation can be retained in situ in the main, other than at pylon bases and along temporary access routes.</li> <li>• Overhead lines are quicker and cheaper to install than underground cables and allow the land to be reinstated more quickly. Overhead lines are also easy to inspect, repair and maintain, as works can be undertaken to the above ground components with little disturbance to land use.</li> <li>• Overhead lines require a much smaller footprint (limited to pylon bases and temporary access routes). Therefore, they typically have a lower impact on below ground features such as archaeology and groundwater.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Overhead lines have a visual impact which varies depending on the sensitivity of the existing environment and other factors such as presence of other overhead lines or tall structures.</li> <li>• Overhead lines can have an effect on the setting of heritage assets including listed buildings.</li> <li>• Electric and magnetic fields need to be considered as part of the design process.</li> <li>• Vegetation needs to be managed beneath the overhead line to maintain safety clearances and avoid trees interfering with the conductors during operation. This managed swathe can affect the landscape character and can increase fragmentation of habitats.</li> <li>• Pylon construction sometimes require piled foundations in certain ground conditions. Piling can create noise and vibrations during construction and create preferential groundwater pathways.</li> </ul>
<p><b>Underground Cables</b></p> <p>The underground cables are buried in trenches excavated in the ground (unless a trenchless construction technique is used to protect key sensitive features). Once the cable is installed the trench is backfilled and the land reinstated.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Underground cables are predominantly buried underground (other than for example link pillars and where a CSE compound is required), therefore they typically have a low visual impact during operation.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Underground cables typically require an 80m working area within which most vegetation needs to be removed. This can have a large impact on habitats (and the protected species that they support) and landscape during construction. Trees cannot be planted over the top of the underground cables as the roots can dry out the soils surrounding and affect the</li> </ul>



Option and Description	Key Environmental Factors
<p>The cables need to be separated to maintain thermal rating and therefore the permanent footprint is typically 60m wide for a 400kV line depending on the number of cables per phase. The construction working area is typically 80m wide to accommodate temporary soil storage and a temporary access route.</p>	<p>thermal rating of the cables. This can result in long term changes to habitats and landscape character over the top of the cable swathe.</p> <ul style="list-style-type: none"> <li>• A large proportion of the 80m working area has some level of soil excavation and disturbance, which can have a large impact on land use, drainage, archaeology, soil and water quality if not managed correctly and can also generate dust during construction.</li> <li>• As underground cables are buried, they are more difficult to inspect and maintain. Repairs to the cables can involve similar impacts to construction over a localised area.</li> </ul>

## Initial Appraisal of Possible Alignments at Hintlesham Woods within Section AB: Bramford Substation/Hintlesham

- 3.7.5 Given the sensitivity of the interaction with Hintlesham Woods SSSI, an initial options appraisal was undertaken in order to identify the least environmentally constrained option in Corridor 2B that could be taken forward for the next stage of assessment. The initial appraisal considered six options, comprising routes through and around the woods, which are summarised in Table 3.5 and shown in the inset box on Figure 3.2: Connection Options Report Alignments in Section AB (**application document 6.4**). The 'a' and 'b' options for Option 1 northern and Option 1 southern alignments, are not shown on the figure, as these would be the same alignment with the pylons being located either outside (a), or inside (b) the woods.
- 3.7.6 Further details on these options and the environmental assessment that was undertaken can be found in the COR (**application document 7.2.4**).
- 3.7.7 The assessment noted that options that would require a new line to the north of the existing 400kV overhead line would require a transposition, which requires some aspects of the works to be undertaken during electricity outages agreed with the network operator.

Table 3.5 – Initial Appraisal of Possible Alignments in Section AB: Bramford Substation/Hintlesham Options

Option and Description	Key Environmental Factors Considered During the Selection Process
<p><b>OP1 – NL (a) (northern parallel overhead line through the wood with pylons located outside of the woods)</b></p> <p>This overhead line option parallels the existing 400kV overhead line to the north through Hintlesham Woods. The pylon positions would avoid the need to place a pylon in the woods.</p> <p>South-west of the woods the overhead line deviates northward away from the existing 400kV overhead line to avoid oversailing residential properties before re-joining to be closely parallel to the existing 400kV overhead line to the south of Bushey Cooper’s Farm.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This would parallel the existing overhead line through the woods which would reduce the landscape effects.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This would result in a small loss of trees within the woodland and the alignment to the south-west of the woods (around Hadleigh Bee Farm) would not be parallel to the existing overhead line. This would have an adverse effect on the landscape character and on a number of visual receptors.</li> <li>This would have a small adverse effect on the setting of heritage assets, as existing mature trees currently provide screening of the existing overhead line.</li> <li>This would have an adverse effect on the SSSI due to the loss of trees and disturbance to ancient woodland habitats, which could mean that the site would fail to meet the conservation objectives of the SSSI. There would also be temporary disturbance to breeding birds, likely loss of bat roosts and potential to result in loss or fragmentation of habitat for species such as dormouse. There would be habitat fragmentation caused by the vegetation managed beneath the additional overhead line to maintain safety clearances.</li> </ul>
<p><b>OP1 – NL (b) (northern parallel overhead line through the wood with pylons located inside of the wood)</b></p> <p>This option parallels the existing 400kV overhead line to the north through the woods. One pylon would be needed within the woods.</p> <p>South-west of the woods this option follows the deviation described above for OP1 – NL (a) to avoid oversailing residential properties.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This would parallel the existing overhead line through the woods which would reduce the landscape effects. Also, the pylons would be better accommodated within the landscape as they lie within the woodland.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This would result in a small loss of trees within the woodland and the alignment to the south-west of the woods (around Hadleigh Bee Farm) would not be parallel to the existing overhead line and this would have an adverse effect on a number of visual receptors.</li> <li>This would have a small adverse effect on heritage assets, as although the pylon in the woodland would result in the loss of trees within the woodland, the woods would help screen the pylon on the setting on listed buildings.</li> </ul>

Option and Description	Key Environmental Factors Considered During the Selection Process
	<ul style="list-style-type: none"> <li>This would have an adverse effect on the SSSI due to the loss of trees and disturbance to ancient woodland habitats (including land take around the new pylon), which could mean that the site would fail to meet the conservation objectives of the SSSI. There would also be temporary disturbance to breeding birds, likely loss of bat roosts and potential to result in loss or fragmentation of habitat for species such as dormouse. There would be habitat fragmentation caused by the vegetation managed beneath the additional overhead line to maintain safety clearances.</li> </ul>
<p><b>OP1 – SL (a) (southern parallel overhead line through the wood with pylons located outside of the woods)</b></p> <p>This option parallels the existing 400kV overhead line to the south through the woods. The pylon positions would avoid the need to place a pylon in the woods but an additional pylon would be required to the north of the woods.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This would parallel the existing overhead line through the woods and to the south-west of the woods which would reduce the landscape effects.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This would have a small adverse effect on heritage assets as the option would result in the loss of trees within the woodland and the pylon outside the woods would likely be visible from nearby listed buildings. However, the presence of the existing 400kV overhead line results in a lower magnitude of change on the setting of these heritage assets than if the overhead line was not already present.</li> <li>This would have an adverse effect on the SSSI due to the loss of trees and disturbance to ancient woodland habitats, which could mean that the site would fail to meet the conservation objectives of the SSSI. There would also be temporary disturbance to breeding birds, likely loss of bat roosts and potential to result in loss or fragmentation of habitat for species such as dormouse. There would be habitat fragmentation caused by the vegetation managed beneath the additional overhead line to maintain safety clearances.</li> </ul>
<p><b>OP1 – SL (b) (southern parallel overhead line through the wood with pylons located inside the wood)</b></p> <p>This option parallels the existing 400kV overhead line to the south through the woods. One pylon would be needed within the woods.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This would parallel the existing overhead line through the woods which would reduce the landscape effects. Also the pylons would be better accommodated within the landscape as they lie within the woodland.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This would have a small adverse effect on heritage assets, as although the pylon in the woodland would result in the loss of trees within the woodland, the woods would help screen the pylon on the setting on listed buildings.</li> </ul>

Option and Description	Key Environmental Factors Considered During the Selection Process
<p><b>OP2 – NL (north of Ramsey Wood)</b></p> <p>This overhead alignment option runs around the northern edge of Ramsey Wood, continuing southward to re-join a paralleled alignment with the existing 400kV overhead line to the south of Bushey Cooper’s Farm.</p>	<ul style="list-style-type: none"> <li>This would have an adverse effect on the SSSI due to the loss of trees and disturbance to ancient woodland habitats (including land take around the new pylon), which could mean that the site would fail to meet the conservation objectives of the SSSI. There would also be temporary disturbance to breeding birds, likely loss of bat roosts and potential to result in loss or fragmentation of habitat for species such as dormouse. There would be habitat fragmentation caused by the vegetation managed beneath the additional overhead line to maintain safety clearances.</li> </ul> <p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This requires limited works (associated with the reconductoring) within the SSSI designation and therefore avoids direct loss of SSSI habitats.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This would have a moderate adverse effect on the landscape in the vicinity of Hintlesham Woods, as this option is most removed from the closest parallel of the existing 400kV overhead line and it would require an additional angle pylon. This would also have a moderate adverse effect on a number of visual receptors.</li> <li>This would have a small adverse effect on heritage assets, as existing mature trees provide screening.</li> <li>This would avoid direct impacts on the SSSI and its interest features during operation. This would have an adverse effect on ecology due to potential impacts on the SSSI during the construction phase due to soil compaction and root severance and potential disturbance to breeding birds. There are several hedgerows and mature tree lines that may require tree removal during construction.</li> </ul>
<p><b>OP2 – SL (southern overhead line route through the wood at the shortest crossing)</b></p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This makes use of the shortest crossing through the woods to limit the impact on the woodland.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This would have a moderate adverse effect on the landscape in the vicinity of Hintlesham Woods, as this option does not parallel the existing 400kV overhead line through the woods and it would require additional angle pylons. This would extend the effect of overhead lines on this landscape including in the SLA and have a moderate adverse effect on a number of visual receptors.</li> </ul>

Option and Description	Key Environmental Factors Considered During the Selection Process
<p>This deviates south from the existing 400kV overhead line to take the shortest available route to cross the woods before re-joining a southern and closely paralleled alignment to the south-west of the woods. This option does not require any pylons to be constructed in the woods.</p>	<ul style="list-style-type: none"> <li>• This would have a small adverse effect on the heritage assets. The option would result in the loss of trees within the woodland and the alignment would cross the former avenue associated with the vista from Hintlesham Hall. However, the presence of the existing 400kV overhead line results in a lower magnitude of change on the setting of these heritage assets than if the overhead line was not already present.</li> <li>• This would have an adverse effect on the SSSI due to the loss of trees and disturbance to ancient woodland habitats, which could mean that the site would fail to meet the conservation objectives of the SSSI. There would also be temporary disturbance to breeding birds, likely loss of bat roosts and potential to result in loss or fragmentation of habitat for species such as dormouse. There would be habitat fragmentation caused by the vegetation managed beneath the additional overhead line to maintain safety clearances.</li> </ul>

- 3.7.8 OP2-NL was chosen as the least environmentally constrained overhead line, as it would avoid impacts on the ancient woodland (irreplaceable habitat) and on the conservation objectives of the SSSI (national designation). OP2-NL was also considered to have the least adverse effect with regard to cultural heritage because it would avoid adverse effects on the historic woodland compared to options through the woods. OP2-NL would increase the presence of pylons in the settings of two grade II listed buildings, but it was considered that this alignment would not cause a significant effect on those assets. OP2-NL was ranked as having the greatest effect on landscape character and also on visual amenity as it would be the greatest departure from the route of the existing 400kV overhead line route and so would give rise to the largest scale of visual change of the options considered.
- 3.7.9 OP2-NL was taken forward to the next stage of assessment as the least environmentally constrained overhead line route due to it avoiding impacts on Hintlesham Woods SSSI and its interest features (national designation). Further details on the decision can be found in the COR (**application document 7.2.4**) and the Evolution of the Project (**application document 7.2.6**).

## Appraisal of Indicative Alignments

- 3.7.10 Indicative alignments (northern, southern and underground alignment) were developed for each of the sections within Corridor 2. These started by identifying a direct line between Bramford and Twinstead Tee, and then taking into account the Holford Rules, to avoid sensitive sites and residential areas as far as possible. The options appraisal included consideration of options within both Corridor 2A (to the south of Hintlesham) and Corridor 2B (to the north of Hintlesham). The option taken forward in Corridor 2B was OP2-NL as identified during the Initial Appraisal outlined in the previous section.
- 3.7.11 For the remaining project sections, the visual preference was for the existing 400kV overhead line and any proposed 400kV overhead line to run in parallel and close together, to avoid placing overhead lines in areas where there are currently no overhead lines. Health and safety requirements suggested that there should be a minimum separation distance of 85m between the two lines. The proposed overhead line could therefore lie to the north (northern alignment) of the existing 400kV overhead line or lie to the south (southern alignment). There was also a technical preference to avoid the new line from crossing the existing 400kV overhead line between the different sections, as the transposition works would be constrained to be undertaken within planned outages.
- 3.7.12 An underground cable route was also considered for each section. An underground option would have different effects to an overhead line option (as set out in Table 3.4). In addition, as the cable would be underground, it did not necessarily need to run in parallel or close to the existing 400kV overhead lines if a site constraint was present.
- 3.7.13 The alternative alignments are summarised in Table 3.6 along with the environmental effects of each. The alignments are shown on Figures 2 to 11 in the COR (**application document 7.2.4**). The appraisal concluded that in general, a new overhead line should be constructed to the south of the existing 400kV overhead line. A southern alignment would result in a lesser scale of change to landscape and views than introducing a 400kV overhead line to the north where no line currently exists. A southern alignment would also have less of an effect on ecological or heritage features of interest.

Table 3.6 – Summary of the Alignment Options

Alignment Option and Description	Key Environmental Factors Considered During the Selection Process
<b>Section AB: Bramford Substation / Hintlesham</b>	
<p><b>OHL 2A Alignment</b></p> <p>This option would run due south from Bramford Substation to the east of Burstall. From Burstall Bridge, it would follow the route of the existing 132kV overhead line as far as the existing 400kV overhead line, south of Primrose Farm, where it could take either a northern (with a transposition) or southern alignment with the existing 400kV overhead line to the west from Primrose Farm. The option would be approximately 10km.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Removal of part of the existing 400kV overhead line to the east of Primrose Farm and Hadleigh Bee Farm would benefit views from the residential property at Primrose Farm, which is closest to this part of the existing line.</li> <li>• This would avoid Hintlesham Woods SSSI and impacts on the interest features.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• This would introduce a new line to east of Burstall (where no overhead line is present). This would introduce potentially significant adverse landscape and visual effects within the Gipping Valley SLA and a large number of properties in Burstall and surrounding villages. This would increase the magnitude of change and adverse visual effects on a large number of properties in Hintlesham and Chattisham.</li> <li>• The new overhead line to the east of Burstall would introduce potential significant effects on listed buildings within Burstall (including Grade I St Mary’s church) and Fenn Farmhouse near where the existing 132kV overhead becomes overhead line.</li> <li>• This would cross a number of linear areas of woodland, with a minor loss of habitats and potential for fragmentation to habitats, with associated impacts on protected species.</li> <li>• The would have potential adverse effects on recreation activities including public rights of way (PRoW). There is also potential for some significant effects on people walking on PRoW and cycling on National Cycle Network Route 1 in close proximity during construction.</li> </ul>



Alignment Option and Description	Key Environmental Factors Considered During the Selection Process
<p><b>OHL 2B Northern Alignment</b></p> <p>This option would use the alignment of the existing 400kV overhead line for a short section out of Bramford Substation. In order to achieve this, the existing 400kV overhead line entry into the substation would need to be modified. From a point north of Hill Farm, the northern alignment would then broadly parallel the existing 400kV overhead line at an offset distance greater than 85m in order to avoid a residential property.</p> <p>This option would then cross the A1071 and would run around the northern and western edge of Ramsey Wood to avoid effects on the SSSI. The alignment then turns south to follow the western edge of the wood before crossing Pond Hall Road and then would continue in an 85m parallel offset to the north of the existing 400kV overhead line. The option would be approximately 8.6km and would also include 0.9km realignment of the existing 400kV overhead line.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Beneficial effects on views in the vicinity of the existing 132kV overhead line where this is removed and not replaced.</li> <li>• Removal of the existing 132kV overhead line would potentially enhance the setting of two designated heritage assets.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Potential adverse effects on two SLA and two landscape character areas where the northern alignment crosses existing woodland belts and hedgerow trees and potential adverse effect on views.</li> <li>• Potential adverse effect on the setting on five Grade II listed buildings.</li> <li>• Potential adverse effect on Hintlesham Woods SSSI due to temporary disturbance of species and weakened connectivity between SSSI units. Potential construction effects on rootzone of trees around the edge of the SSSI and potential to disturb breeding bird assemblages. Long-term adverse effect on Hadleigh Railway Walk County Wildlife Site (CWS) / Local Nature Reserve (LNR) due to small permanent loss of trees.</li> <li>• Minor disruptions to PRoW and impacts on views from PRoW during construction.</li> </ul>
<p><b>OHL 2B Southern Alignment</b></p> <p>This option would run south-west from Bramford Substation between Canes Farm and Walnut Farm and then take an 85m offset to the south of the existing 400kV overhead line from Mill Farm to College Farm. From here the new overhead line would take the route of the existing 400kV overhead line through Hintlesham Woods and the existing 400kV overhead line circuits would be routed around the northern and western edge of Ramsey Wood to avoid effects on the SSSI. The alignment then turns south to follow the western edge of the wood.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Minor beneficial effects on views in the vicinity of the existing 132kV overhead line where this is removed and not replaced.</li> <li>• Removal of the existing 132kV overhead line would potentially enhance the setting of two designated heritage assets.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Potential adverse effect on two SLA and two landscape character areas where the southern alignment crosses existing woodland belts. Long-term moderate adverse effect on views (although lower magnitude of effect compared to OHL 2B Northern Alignment).</li> <li>• Potential adverse effect on the setting of one Grade I listed building and five Grade II listed buildings.</li> </ul>

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## Alignment Option and Description

Both the existing and new 400kV overhead lines would converge to the east of Primrose Farm where this option would run parallel to the existing overhead line at an 85m offset to the south. The option would be approximately 8km and would also include approximately 2.5km realignment of the existing 400kV overhead line.

## Underground Cable Alignment

The underground cable option would run west from Bramford Substation passing to the south of Burstallhill. It would then take a more direct route to the south-west, avoiding woodland and properties. It would pass to the east of Kate's Hill Farm and would continue southward to avoid buildings, woodland and a CWS, to cross beneath Hadleigh Railway Walk, where it is on a slight embankment. The option would be approximately 8km. The underground cable option would not require a CSE compound at the eastern end of Section AB, as connections could be accommodated within Bramford Substation.

## Key Environmental Factors Considered During the Selection Process

- Potential adverse effect on Hintlesham Woods SSSI due to temporary disturbance of species and weakened connectivity between SSSI units. Potential construction effects on rootzone of trees around the edge of the SSSI and potential to disturb breeding bird assemblages. Potential adverse effect on Hadleigh Railway Walk CWS / LNR due to small permanent loss of trees.
- Minor disruptions to PRow and impacts on views from PRow during construction.

### Beneficial:

- Beneficial effect on landscape and views where the existing 132kV overhead line would be removed and not replaced.
- Removal of the existing 132kV overhead line would potentially enhance the setting of two designated heritage assets.
- This would avoid Hintlesham Woods SSSI and impacts on the interest features.

### Adverse:

- Potential for localised and short-term adverse effects associated with the loss of hedgerow and trees. Potential for localised impacts on some views due to the CSE compound.
  - Potential adverse effect on buried archaeology due to the high probability of encountering known and previously unrecorded archaeological remains. The CSE compound could lead to adverse effects on buried archaeology and the setting of listed buildings.
  - Potential adverse effect on protected species due to loss of habitat at hedgerow crossings and along the Belstead Brook.
  - The CSE compound would be located near Benton End Farm/Hadleigh Railway Walk which could cause disruption to users of the Railway Walk during construction.
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Alignment Option and Description	Key Environmental Factors Considered During the Selection Process
<b>Section C: Brett Valley</b>	
<p><b>OHL Northern Alignment</b></p> <p>This option would closely parallel the existing 400kV overhead line at an 85m offset at the eastern end, crossing the woodland just to the south of Benton End Farm. The alignment would diverge from the existing line northward to avoid Layham Park and would have a maximum separation from the existing line of almost 0.5km at the western boundary to the section. The option would be approximately 1.5km.</p>	<p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Alignment would not closely parallel the existing 400kV overhead line in the western end of the section and would increase the extent of the SLA affected by 400kV overhead lines. Adverse effects on visual receptors within the valley and on the valley sides within the section and to the immediate north and south.</li> <li>Potential adverse effect on the setting of four listed buildings.</li> <li>Adverse effects on protected species such as dormouse, due to loss of habitat at hedgerow crossings and loss of mature plantation woodland at Bentley End Farm.</li> <li>Minor disruptions to PRoW and impacts on views from PRoW during construction.</li> </ul>
<p><b>OHL Southern Alignment</b></p> <p>The southern overhead alignment would broadly parallel the existing 400kV overhead line by following the alignment of the existing 132kV overhead line through the majority of the study area. The new overhead line would more closely parallel the existing 400kV overhead line for a short distance at the eastern extent and in the western half of the section. The option would be approximately 2km.</p>	<p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Alignment would have an adverse effect on the Brett Valley SLA, however the alignment would broadly parallel the existing 400kV overhead line. Adverse effect on visual receptors within the valley and on the valley sides (although a lower magnitude on views than the OHL Northern Alignment).</li> <li>Adverse effect on views to and from approximately 10 Grade II listed buildings at Lower and Upper Layham.</li> <li>The alignment would limit woodland loss, however some tree loss would still occur where removal of hedgerow trees is required for clearance and within the linear plantation in the west of the section with an adverse effect on ecology.</li> <li>Minor disruptions to PRoW and impacts on views from PRoW during construction.</li> </ul>
<p><b>Underground Cable Alignment</b></p> <p>The underground cable alignment would cross Hadleigh Railway Walk and then run northward along the edge of the Railway Walk before following the approximate route of the existing 132kV overhead line across the valley as far as Overbury Hall Road. The option would be approximately 2.5km.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Beneficial effect on landscape and views where the existing 132kV overhead line would be removed and not be replaced.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Potential adverse effect on landscape character due to loss of hedgerows and trees where the route crosses a tree belt near Hadleigh Railway Walk and part of a plantation woodland at the western end of the section. The siting of CSE compounds would lead to some localised landscape effects and localised effects on views.</li> </ul>

Alignment Option and Description	Key Environmental Factors Considered During the Selection Process
	<ul style="list-style-type: none"> <li>• A CSE compound to the east of the Hadleigh Railway Walk could have adverse effects on buried archaeology, and on the setting of listed buildings. Also, there is the potential for adverse effects on the historic landscape through the removal of some historic hedgerows.</li> <li>• Minor disruptions to PRow and impacts on views from PRow during construction.</li> </ul>
<b>Section D: Polstead</b>	
<p><b>OHL Northern Alignment</b></p> <p>This option would start at a point approximately 0.5km north of the existing 400kV overhead line, and to the north of Overbury Hall. From here the option would run to the south-west to a point west of Rands Road from which it would closely parallel the existing 400kV overhead line at an 85m offset. At the western end of the section the alignment would start to deviate northward to avoid properties at Sprott's Farm. The option would be approximately 3.5km.</p>	<p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Adverse effect on the SLA and the wider character of the study area. Some tree losses and hedgerow tree losses where the alignment crosses existing woodland belts that form part of Valley Farm Wood and the northern part of Millfield Wood.</li> <li>• Adverse effect on the setting of two Grade II listed buildings.</li> <li>• Adverse effect on ecology due to permanent tree loss within Valley Farm Wood CWS and Millfield Wood CWS.</li> <li>• Minor disruptions to PRow and impacts on views from PRow during construction.</li> </ul>
<p><b>OHL Southern Alignment</b></p> <p>This option would closely parallel the existing 400kV overhead line. At the eastern end of the section, it would follow the existing 132kV alignment. The option would be approximately 3.5km.</p>	<p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Adverse effect on the SLA and the wider character of the study area.</li> <li>• Adverse effect on the setting of two Grade II listed buildings, Pope's Green Farm and Valley Farm, as well as views to and from Lots Farm and Overbury Hall.</li> <li>• Permanent tree loss within Valley Farm Wood CWS and Layham Pit Woodland and Meadow CWS with an overall moderate adverse effect on ecology.</li> <li>• Minor disruptions to PRow and impacts on views from PRow during construction.</li> </ul>
<p><b>Underground Cable Alignment</b></p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Beneficial effect on landscape where the existing 132kV overhead line would be removed and not be replaced.</li> </ul>

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## Alignment Option and Description

The underground option would run from a point north of Overbury Hall, northward, beyond the corridor and existing overhead lines to avoid Valley Farm Wood and Layham Quarry. The underground route would then turn south and would cross beneath the existing 400kV overhead line and run between the woodland blocks at Millfield Wood. From Millfield Wood the route would stay south of the existing 400kV overhead line but run broadly parallel with it. The option would be approximately 4.5km.

## Key Environmental Factors Considered During the Selection Process

- Beneficial effect on the setting of one Grade II listed building (Pope's Green Farm) through the removal of the existing 132kV overhead line.
- Permanent removal of existing 132kV overhead lines and pylons would lead to improvements to views enjoyed by users of the PRoW and local highway network.

### Adverse:

- Adverse effect on ecology due to loss habitat at hedgerow crossings.
- The CSE compound would have adverse effects on buried archaeology and on the setting of listed buildings, particularly Overbury Hall and Sprott's Farm.
- The CSE compound potentially would result in open views from the PRoW to the south of Hill Farm and the PRoW to south of the sewage works.

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## Section E: Dedham Vale AONB

### OHL Northern Alignment

This option would diverge away from the existing 400kV overhead line for the majority of this section to a maximum distance of approximately 300m to avoid the listed building at Sprott's Farm and the listed building at The Nussteads further west. From the maximum point of separation, the northern overhead alignment would steadily run southward to closely parallel the existing 400kV overhead line south of Peyton Hall, where it would cross Boxford Fruit Farm orchards and would lie just to the south of the processing plant, at the western end of the section. The approximate length of this option would be 3.5km.

### Adverse:

- Adverse effect on Dedham Vale AONB, although the presence of the existing overhead lines in the landscape would limit the magnitude of effect. Adverse effect on views in the long term experienced by a small number of visual receptors of high sensitivity.
- Adverse effect on hedgerows and woodland north of The Nussteads and on an area of woodland near Sprott's Farm. There would also be permanent ancient woodland loss within Broom Hill Wood CWS with an adverse effect on ecology.
- Adverse effect on the setting of three Grade II listed buildings.
- Adverse impacts on PRoW during the construction period. The line would oversail PRoW within the AONB and there would be open views of the overhead line for users of the PRoW network.
- The option would oversail the orchards of Boxford Fruit Farm and run close to the processing operation. The option could result in the loss of areas under permanent cultivation as orchards.

### OHL Southern Alignment

The southern overhead option would closely parallel the existing 400kV overhead line at an 85m offset through

### Adverse:

- Adverse effect on Dedham Vale AONB, although the presence of the existing overhead lines in the landscape would limit the magnitude of effect. Adverse effect on views in the long term experienced by a

Alignment Option and Description	Key Environmental Factors Considered During the Selection Process
<p>this section. This option would cross the orchards at Boxford Fruit Farm at the western end of the section. The approximate length of this option would be 3.5km.</p>	<p>small number of visual receptors of high sensitivity. Views in this study area are generally of moderate importance.</p> <ul style="list-style-type: none"> <li>• Adverse effect on existing woodland to the south of Sprott's Farm, where the option would not precisely align with the existing 132kV overhead line. There could be a small loss of ancient woodland at the northern tip of Bushy Park Wood and tree loss within Dollops Wood with an adverse effect on ecology.</li> <li>• Potential adverse effect on the setting of Polstead Conservation Area.</li> <li>• Adverse impacts on PRoW during the construction period. The line would oversail PRoW within the AONB. There would be open views of the overhead line for users of the PRoW network in many locations including some within the AONB.</li> <li>• The option would oversail the orchards of Boxford Fruit Farm and run close to the processing operation. The option could result in the loss of areas under permanent cultivation as orchards.</li> </ul>
<p><b>Underground Cable Alignment</b></p> <p>The underground option would run from a point within the corridor south of the existing 400kV overhead line through a woodland belt south of Sprott's Farm. At a point south of Whitestreet Green, between Bushy Park Wood and Broom Hill Wood, the underground cable alignment would run southward across the River Box and between a gap in the Boxford Fruit Farm orchards, meeting the B1068 at the western boundary to the study area. The approximate length of this option would be 3km.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Beneficial effect on landscape and views where the existing 132kV overhead line would be removed and not be replaced. There would be improvements to views for users of the PRoW network and visitors travelling to the villages of Stoke-by-Nayland and Polstead in the northern fringe of the AONB.</li> <li>• Beneficial effect on the setting of Polstead Conservation Area due to the removal of the 132kV overhead line.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• There would be loss of hedgerow and hedgerow trees, which would result in localised adverse effects on landscape character and views. There would also be localised adverse landscape effects and effects on views due to the siting of CSE compounds.</li> <li>• Adverse effect on ecology due to loss of hedgerows and trees.</li> <li>• Adverse effect on buried archaeological remains and the historic landscape. CSE compound could have adverse effects on buried archaeology and the setting of historic assets (listed buildings and Polstead Conservation Area).</li> <li>• Minor disruptions to PRoW and impacts on views from PRoW during construction.</li> </ul>

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**Alignment Option and Description****Key Environmental Factors Considered During the Selection Process**

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**Section F: Leavenheath/Assington****OHL Northern Alignment**

This option would diverge from the existing 400kV overhead line to a maximum distance of approximately 250m to avoid oversailing the listed building at Adam's Well. Once it crosses High Road, the option would more closely parallel the existing 400kV overhead line to the south of Assington. The approximate length of this option would be 4.5km.

**Adverse:**

- Adverse effect on the SLA and wider landscape character, although the presence of the existing overhead lines in the landscape would limit the magnitude of effect. Adverse effect on two existing woodland belts associated with watercourses where they are crossed by the new overhead line. Adverse effect on views experienced by a number of visual receptors of high sensitivity. The views in this section are generally of local importance.
- Potential adverse effect on the setting of four Grade II listed buildings.
- Adverse effect on ecology due to permanent tree loss within Ash Ground tree preservation order (TPO), the linear plantation woodland south of Assington, and individual hedgerow trees.
- Minor disruptions to PRoW during construction and the overhead line would oversail a PRoW south of Assington. There would be open views for users of the PRoW network in many locations during the construction period.

**OHL Southern Alignment**

In the main the southern overhead option would closely parallel the existing 400kV overhead line at an 85m offset throughout this study area. The exception to this is for a short section in the centre of the study area, where the southern alignment would deviate to the south to avoid oversailing 'Hill View'. The approximate length of this option would be 4.6km

**Adverse:**

- Adverse effect on the SLA and wider landscape character of the section, although the presence of the existing overhead lines in the landscape would limit the magnitude of effect. Adverse effect on existing linear woodland associated with watercourses. Some tree losses would occur. Adverse effect on views in the long-term, experienced by a number of visual receptors of high sensitivity and the views in this study area are generally of local importance.
- Potential adverse effect on the setting of five Grade II listed buildings.
- Adverse effect on ecology due to permanent tree loss within Ash Ground TPO, the linear plantation woodland south of Assington, and individual hedgerow trees.
- Minor disruptions to PRoW and impacts on views from these during construction. The line would oversail a PRoW south of Assington.

**Underground Cable Alignment****Beneficial:**

- Beneficial effects on landscape and views where the existing 132kV overhead line would be removed and not be replaced. There would be improvements to views experienced by users of the PRoW network and visitors to the village of Assington.
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**Alignment Option and Description**

The underground option would run to the north of Leavenheath, then would run close to and parallel with the existing 400kV overhead line. The approximate length of this option would be 5km.

**Key Environmental Factors Considered During the Selection Process****Adverse:**

- Adverse effects on landscape character due to the loss of woodland where the underground cable route crosses woodland belts associated with watercourses. There would also be loss of hedgerow and hedgerow trees within the section, which would lead to adverse effects on landscape character. The siting of CSE compounds would be likely to lead to some localised landscape effects and effects on views.
- CSE compound could have adverse effects on buried archaeology and on views to and from some listed buildings. Adverse effect on buried archaeological remains and the historic landscape.
- Adverse effect on ecology due to tree loss within Ash Ground TPO and the linear plantation woodland south of Assington. Potential impacts to water quality and bankside vegetation of small watercourses and loss of swamp habitat.
- Minor disruptions to PRow and impacts on views from PRow during construction.

**Section G: Stour Valley****OHL Northern Alignment**

This option would closely parallel the existing 400kV overhead line at an 85m offset through this section to where it would join the Twinstead to Pelham overhead line, one span to the west of the Twinstead Tee. The approximate length of this option would be 5km.

**Beneficial:**

- Beneficial effects in the area to the south of the existing 400kV overhead line as far as the diamond crossing, as the existing 132kV overhead line would be removed.

**Adverse:**

- Adverse effect on the SLA and wider landscape character of the section, although the presence of the existing overhead lines in the landscape would limit the adverse magnitude of effect. The scale of change would be experienced by a relatively high number of visual receptors of high sensitivity and the views in this study area are generally of moderate importance.
  - Adverse effect on ecology due to impact on existing willow plantation close to the river and other potential tree losses that would occur.
  - Potential adverse effect on the setting of ten listed buildings.
  - Minor disruptions to PRow and impacts on views from PRow during construction including open views of the overhead line for PRow users and visitors to Loshes Meadow Nature Reserve.
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Alignment Option and Description	Key Environmental Factors Considered During the Selection Process
<p><b>OHL Southern Alignment</b></p> <p>This option would diverge away from the existing 400kV overhead line from a point to the west of Upper Road. It would then follow the existing 132kV overhead line route as far as the Twinstead to Braintree overhead line at the 132kV overhead line diamond crossing, one span south of the Twinstead Tee. This option would allow for the removal of one span of the Twinstead to Braintree overhead line south of Twinstead Tee. The approximate length of this option would be 5km.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Beneficial effect where a section of the existing 400kV overhead line would be removed between Twinstead Tee and the 132kV diamond crossing.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Adverse effect on the SLA and wider landscape character, although the presence of the existing overhead lines in the landscape would limit the magnitude of effect. The scale of change would be experienced by a relatively high number of visual receptors of high sensitivity and the views in this study area are generally of moderate importance.</li> <li>Adverse effect on ecology due to woodland loss, although this would be limited by following the alignment of the existing 132kV overhead line.</li> <li>Potential adverse effect on the setting of five listed buildings.</li> <li>Minor disruptions to PRow and impacts on views from PRow during construction including open views of the overhead line for PRow users and visitors to Loshes Meadow Nature Reserve.</li> </ul>
<p><b>Underground Cable Alignment</b></p> <p>The underground option would run along the route of the existing 132kV overhead line as far west as the Twinstead to Braintree overhead line at the 132kV overhead line diamond crossing, south of the Twinstead Tee.</p> <p>This option would allow for the removal of one span of the Twinstead to Braintree overhead line south of Twinstead Tee. The approximate length of this option would be 5km.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Beneficial effect on landscape and views where the existing 132kV overhead line would be removed and not be replaced. There would be improvements to views of users of the PRow network and for cyclists on the Sudbury to Bures Circular Cycle Route.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Adverse effects on landscape character and views due to the siting of CSE compounds and due to loss of hedgerow and trees and disturbance to protected lanes.</li> <li>Adverse effect on buried archaeological remains and the historic landscape. The CSE compound could have adverse effects on buried archaeology and on the setting of listed buildings at Sparrow's Farm.</li> <li>Adverse effect on ecology due to loss of habitat at hedgerows and tree loss.</li> <li>Minor disruptions to PRow and impacts on views from PRow during construction. CSE compound could be seen by PRow users and from parts of the Arger Fen and Spouse's Vale Nature Reserve and part of Loshes Meadow Nature Reserve.</li> </ul>

3.7.14 The preferred alignment identified for each section was as follows:

- Section AB: Bramford Substation/Hintlesham: the appraisal concluded that an overhead line on the southern alignment in Corridor 2B was preferred because Section AB is not considered to be regarded as a '*particularly sensitive location*' in the context of paragraph 2.8.2 of EN-5. The benefits of an underground cable would not outweigh the additional costs and other environmental impacts that would result from an underground cable compared to an overhead line solution. Corridor 2B was the preferred choice because an alignment in Corridor 2A would involve constructing new 400kV overhead line in an area where there is currently no existing line (between Bramford Substation and Burstall). Corridor 2A would also pass close to the village of Hintlesham affecting more visual receptors. There are also technical constraints in this corridor associated with an existing 132kV underground cable. Corridor 2B would also allow a greater degree of paralleling with the existing 400kV overhead line and is the more direct alignment and there would be no significant effects on Hintlesham Woods SSSI and its interest features;
- Section C: Brett Valley: the appraisal concluded that an overhead line on a southern alignment was preferred because Section C is not considered to be regarded as a '*particularly sensitive location*' in the context of paragraph 2.8.2 of EN-5. The benefits of an underground cable would not outweigh the additional costs and other environmental impacts that would result from an underground cable compared to an overhead line solution;
- Section D: Polstead: the appraisal concluded that an overhead line on a southern alignment was preferred because Section D is not considered to be regarded as a '*particularly sensitive location*' in the context of paragraph 2.8.2 of EN-5. The benefits of an underground cable would not outweigh the additional costs and other environmental impacts that would result from an underground cable compared to an overhead line solution;
- Section E: Dedham Vale AONB: an underground cable was preferred given its nationally designated status as an AONB;
- Section F: Leavenheath/Assington: the appraisal concluded that an overhead line on a southern alignment was preferred because Section F is not considered to be regarded as a '*particularly sensitive location*' in the context of paragraph 2.8.2 of EN-5. The benefits of an underground cable would not outweigh the additional costs and other environmental impacts that would result from an underground cable compared to an overhead line solution; and
- Section G: Stour Valley: Undergrounding was preferred in Section G: Stour Valley, because of the particular qualities of the landscape and its cultural associations.

## Refinement of the Preferred Alignments

3.7.15 The preferred alignments were presented in the COR (**application document 7.2.4**). The designs continued to evolve based on the results of environmental surveys, technical assessments and feedback from consultation. The following sub-sections outline additional options appraisal work that has been undertaken to refine the alignment. These are described by project section.

## Section AB: Bramford Substation/Hintlesham

### Bramford Approach

- 3.7.16 The original option in Section AB: Bramford Substation/Hintlesham presented in the COR assumed that the existing 400kV overhead line would remain in the same location where it connects to Bramford Substation and that the new 400kV overhead line would run south-west from Bramford Substation between Canes Farm and Walnut Farm.
- 3.7.17 Further work undertaken during 2021 identified a need for two new shunt reactors at the substation to allow for the change in electrical characteristics of the network. There was also a review of the construction methodology at this time, to see whether an alternative alignment would allow for a greater proportion of works to be undertaken offline (i.e. while the existing 400kV overhead line remains in operation), to reduce the need for electrical outages on the existing 400kV overhead line.
- 3.7.18 National Grid reviewed the alignment of both the existing 400kV overhead line and the proposed 400kV overhead line at this location and identified three options, which comprised the following and have a BA (Bramford Approach) prefix for reference. These are shown on Sheet 1 of Figure 3.3: Considered Options (**application document 6.4**):
- BA Option 1: the existing 400kV would stay on the same alignment as presented in the COR (National Grid, 2012). Works to the existing line would need to be undertaken during planned electrical outages;
  - BA Option 2: the existing 400kV would be removed between pylon 4YL1 and 4YL4 and a direct (shorter) alignment would be taken to connect to the substation. The proposed 400kV overhead line would be realigned slightly to connect on the western edge of the substation; and
  - BA Option 3: the existing 400kV would be removed between pylon 4YL1 and 4YL007 and the line would run parallel to the proposed 400kV overhead line to connect to the substation. The proposed 400kV overhead line would be realigned slightly to connect on the western edge of the substation. The majority of works could be undertaken offline (outside of electrical outages).
- 3.7.19 The review identified that all options were broadly similar from an environmental perspective as they would each have pros and cons for different viewpoints and within the context of the overall landscape. BA Option 2 was selected as the preferred alignment and was subsequently presented at the 2022 Statutory Consultation.

### Hintlesham Woods

- 3.7.20 In response to feedback received during the 2021 non-statutory consultation, National Grid undertook a review of the options in and around Hintlesham Woods taking into account all salient factors. The review included a more detailed understanding of the technical engineering requirements, construction methodology, programme and duration. The environmental considerations are presented in Table 3.7 and are shown on Figure 3.2: Connection Options Report Alignments (**application document 6.4**) with the COR options references e.g. OP2 – NL.

Table 3.7 – Options In and Around Hintlesham Woods SSSI

Option and Description	Key Environmental Factors Considered	Taken Forward to Statutory Consultation
<p><b>HW Option 1:</b></p> <p>Overhead alignment to the north of Ramsey Wood (OP2 – NL).</p> <p>This was the COR preferred option and was in the 2021 non-statutory consultation</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This option would not result in any loss of, or new areas of alternative management of ancient woodland habitat, other than the existing management that would be required to facilitate construction works to the existing 400kV overhead line.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This option requires a transposition of the lines and therefore would require some works to be completed during outages and during bird breeding season. This has the potential to cause disturbance to the breeding bird assemblage (SSSI interest feature).</li> <li>This option would have greater landscape effects than options through the woods, due the proposed 400kV overhead line diverting away from the existing overhead line (not parallel) and introducing a new overhead line where there is currently none.</li> </ul>	<p>Yes, taken forward as it would have the least impact on the SSSI and ancient woodland.</p>
<p><b>HW Option 2:</b></p> <p>A parallel overhead line to the south of the existing overhead line with pylons sited outside of the woods (OP1 – SL (a))</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This option would not require a transposition (or outage) so all works could be undertaken outside of bird breeding season.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This option would require a temporary swathe of approximately 40m through the ancient woodland and SSSI to construct the overhead line. The trees would be coppiced to ground level (able to grow back) rather than removed, which would limit the disturbance to soil.</li> <li>This option would require an operational swathe of approximately 25m, where vegetation is managed to a lower height to avoid interference with the overhead conductors. This could cause fragmentation of the canopy and loss of some habitat features.</li> <li>This option would result in loss of trees which provide suitable bat roosts for barbastelle bats, a rare species of bat.</li> </ul>	<p>Yes, whilst this would impact on the SSSI and ancient woodland this was taken forward as it would have the least landscape and visual impact.</p>

Option and Description	Key Environmental Factors Considered	Taken Forward to Statutory Consultation
<p><b>HW Option 3:</b> A parallel overhead line to the north of the existing overhead line with pylons sited outside of the woods (OP1 – NL (a))</p>	<ul style="list-style-type: none"> <li>This option would have landscape effects, as it would introduce a new overhead line within the landscape. However, this would be lower than options around the woods as the new line would parallel the existing 400kV overhead line and the woodland would help screen the line bringing a lower magnitude of effect.</li> </ul> <p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This option would allow the new 400kV overhead line to parallel with the existing 400kV overhead line to the north and north-east of the woods to reduce visual effects to properties at this location.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This option would require a temporary construction swathe of approximately 40m through the ancient woodland and SSSI to construct the overhead line. The trees would be coppiced to ground level (able to grow back), which would limit disturbance to soil.</li> <li>This option would result in loss of trees which provide suitable bat roosts for barbastelle bats, a rare species of bat.</li> <li>This option would require an operational swathe of approximately 25m to where vegetation is managed to a lower height to avoid interference with the overhead conductors. This could cause fragmentation of the canopy and loss of some habitat features.</li> <li>This option would have landscape effects, as it would introduce a new overhead line within the landscape. However, this would be lower than options around the woods as the new line would parallel the existing 400kV overhead line and the woodland would help screen the line bringing a lower magnitude of effect. A closely parallel alignment with the existing 400kV overhead line is not possible to the south-west of the woodland without oversailing residential property at Primrose Farm. The properties at Primrose Farm would be encircled by the two lines.</li> <li>A new angle pylon would be required to the south-west of the woods to allow the alignment to deviate northward away from the existing 400kV overhead line to avoid these properties before re-joining a closely paralleled alignment to the south of Bushey Cooper's Farm. The new angle pylon and deviation in paralleling of the lines would also increase the visual rate of change compared to other options.</li> </ul>	<p>No, due to impacts on the SSSI and ancient woodland and greater landscape and visual effects compared to alternative options.</p>

Option and Description	Key Environmental Factors Considered	Taken Forward to Statutory Consultation
<p><b>HW Option 4:</b> A parallel overhead line to the north of the existing overhead line with pylons inside of the woods (OP1 – NL (b))</p>	<ul style="list-style-type: none"> <li>This option requires a transposition of the lines and therefore would require some works to be completed during outages and during bird breeding season. This has the potential to cause disturbance to the breeding bird assemblage (SSSI interest feature).</li> </ul> <p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This option would allow the new 400kV overhead line to parallel with the existing 400kV overhead line to the north and north-east of the woods to reduce visual effects to properties at this location.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This option would require a temporary construction swathe of approximately 40m through the ancient woodland and SSSI to construct the overhead line. The trees would be coppiced to ground level (able to grow back) rather than removed and there would be limited disturbance to soil to reduce the effects on the habitat.</li> <li>This option would result in loss of trees which provide suitable bat roosts for barbastelle bats, a rare species of bat.</li> <li>This option would also involve a permanent loss of habitat beneath the pylon footprint. This option would also require an operational swathe of approximately 25m to where vegetation is managed to a lower height to avoid interference with the overhead conductors. This could cause fragmentation of the canopy and loss of some habitat features.</li> <li>This option would have landscape effects, as it would introduce a new overhead line within the landscape. However, this would be lower than options around the woods as the new line would parallel the existing 400kV overhead line and the woodland would help screen the line bringing a lower magnitude of effect. Also, a closely parallel alignment with the existing 400kV overhead line is not possible to the south-west of the woodland without oversailing residential property at Primrose Farm. The properties at Primrose Farm would be encircled by the two lines.</li> </ul>	<p>No, whilst the woodland would help to screen the pylons, this would result in a permanent loss of ancient woodland.</p>

Option and Description	Key Environmental Factors Considered	Taken Forward to Statutory Consultation
	<ul style="list-style-type: none"> <li>A new angle pylon would be required to the south-west of the woods to allow the alignment to deviate northward away from the existing 400kV overhead line to avoid these properties before re-joining a closely paralleled alignment to the south of Bushey Cooper’s Farm. The new angle pylon and deviation in paralleling of the lines would also increase the visual rate of change compared to other options.</li> <li>This option requires a transposition of the lines and therefore would require some works to be completed during outages and during bird breeding season. This has the potential to cause disturbance to the breeding bird assemblage (SSSI interest feature).</li> </ul>	
<p><b>HW Option 5:</b> A parallel overhead line to the south of the existing overhead line with pylons inside of the woods (OP1 – SL (b))</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This option would not require a transposition (or outage) so all works could be undertaken outside of bird breeding season.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This option would require a temporary swathe of approximately 40m through the ancient woodland and SSSI to construct the overhead line. The trees would be coppiced to ground level (able to grow back) rather than removed and there would be limited disturbance to soil to reduce the effects on the habitat.</li> <li>This option would result in loss of trees which provide suitable bat roosts for barbastelle bats, a rare species of bat.</li> <li>This option would also involve a permanent loss of habitat beneath the pylon footprint. This option would also require an operational swathe of approximately 25m to where vegetation is managed to a lower height to avoid interference with the overhead conductors. This could cause fragmentation of the canopy and loss of some habitat features.</li> <li>This option would have landscape effects, as it would introduce a new overhead line within the landscape. However, this would be lower than options around the woods as the new line would parallel the existing 400kV overhead line and the woodland would help screen the line bringing a lower magnitude of effect.</li> </ul>	<p>No, whilst the woodland would help to screen the pylons, this would result in a permanent loss of ancient woodland.</p>

Option and Description	Key Environmental Factors Considered	Taken Forward to Statutory Consultation
<p><b>HW Option 6:</b></p> <p>Deviates south from the existing 400kV overhead line to take the shortest available route to cross the woods (no pylons in the wood) before re-joining a southern and closely paralleled alignment to the south-west of the woods (OP2 – SL);</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This option would not require a transposition (or outage) so all works could be undertaken outside of bird breeding season.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This option would require a temporary construction swathe of 40m through the ancient woodland and SSSI to construct the overhead line. The trees would be coppiced to ground level (able to grow back) and there would be limited disturbance to soil to reduce the effects on the habitat.</li> <li>This option would result in loss of trees which provide suitable bat roosts for barbastelle bats, a rare species of bat.</li> <li>This option would require an operational swathe of approximately 25m to where vegetation is managed to a lower height to avoid interference with the overhead conductors. This could cause fragmentation of the canopy and loss of some habitat features.</li> <li>This option would require two new angle pylons to the south and south-west of the woods, which along with the non-parallel lines in this location would introduce a greater magnitude of effect (scale of change) than the other options.</li> </ul>	<p>No, this would impact on the SSSI and ancient woodland and bring no better landscape benefits than other options.</p>
<p><b>HW Option 7:</b></p> <p>An option to the south of Hintlesham Woods north of Duke Street</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>This option would not result in any loss of, or new areas of alternative management of ancient woodland habitat, other than the existing management that would be required to facilitate construction works to the existing 400kV overhead line.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This option would require a series of angle pylons to route the overhead line to the north of the properties on Duke Street and follow the boundary of the wood. At the east of the woodland the route would need to be realigned with the existing 400kV line to avoid Hintlesham Park</li> <li>This option would be located within 100m of the residential properties on the northern side of Duke Street, in proximity of Grade II listed buildings and Hintlesham Village.</li> </ul>	<p>No, due to the landscape and visual impact on properties on the northern side of Duke Street.</p>



- 3.7.21 Two options were presented at the Statutory Consultation in January 2022 to gather feedback from consultees on which option should be taken forward. These are shown on Sheet 2 of Figure 3.3: Considered Options (**application document 6.4**) and comprised:
- HW Option 1 (formerly OP2-NL): North and west of Ramsey Wood – The existing 400kV overhead line would be diverted on new pylons to the north and west of the woodland. The proposed 400kV overhead line would use the existing pylons through the woodland; and
  - HW Option 2 (formerly OP1-SL): A parallel overhead line south of the existing 400kV- The existing 400kV overhead line would remain in situ. The proposed 400kV overhead line would be constructed parallel to the existing overhead line to the south on new pylons located outside of the woodland.
- 3.7.22 National Grid received a number of responses at the Statutory Consultation regarding the pros and cons of both options. Further details can be found in Chapter 7 of the Consultation Report (**application document 5.1**).
- 3.7.23 Surveys were also undertaken during spring and summer 2022 to gather additional baseline information on the SSSI interest features at the woods. This included breeding bird surveys, and bat surveys which indicated that the woods were likely to contain a maternity roost for barbastelle bats. Further details can be found in see ES Appendix 7.7: Bat Survey Report (**application document 6.3.7.7**).
- 3.7.24 Overall, National Grid decided to not take forward Hintlesham Woods Option 2 in the application for development consent. The decision to remove Option 2 was based on several factors including the avoidance of direct and significant effects on the ancient woodland (irreplaceable habitat) and on the conservation objectives of the SSSI (national designation). This was in addition to consultation feedback, engagement with stakeholders and landowners, the findings of environmental surveys, planning policy considerations and further design and engineering studies.

### **Section C: Brett Valley**

- 3.7.25 No alternative options have been identified for refining the alignment within this section.

### **Section D: Polstead**

- 3.7.26 No alternative options have been identified for refining the alignment within this section.

### **Section E: Dedham Vale AONB**

- 3.7.27 The COR (**application document 7.2.4**) identified the preferred option as an underground cable in Section E: Dedham Vale AONB. The proposal was for this to be direct crossing of Dollops Wood using a trenchless crossing. Dollops Wood is a CWS and was identified as an important habitat that should be avoided.
- 3.7.28 Ground investigations undertaken since the COR was produced indicated that a trenchless crossing at this location could have high construction and environmental risks due to the topography and the ground conditions. As a result of these risks, National Grid identified an alternative alignment that went to the north around the woodland identified as DW (Dollops Wood) Option 2a. The environmental factors considered are summarised in Table 3.8 and shown on Sheet 3 of Figure 3.3: Considered Options (**application document 6.4**). Sub options i and ii show different locations for the CSE compound.

Table 3.8 – Section E: Dedham Vale AONB, Dollops Wood Options

Option	Key Environmental Factors Considered
<p><b>DW Option 1:</b> COR Option (trenchless crossing beneath the wood)</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Would run beneath the wooded valley containing Dollops Wood, which would reduce landscape and visual effects on the AONB.</li> <li>• Would avoid tree loss at Dollops Wood and disturbance to protected species within the woodland during construction and operation.</li> <li>• Would result in one fewer line (132kV) in the landscape during operation.</li> <li>• The trenchless crossing would pass below the anticipated level of archaeology and therefore there would be a limited risk of encountering archaeology outside of the footprint of the drill pits.</li> <li>• Would avoid closure of PRow within the woodland during construction.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• The geotechnical studies indicated that there is a high risk of frack-out, which if this was to occur, could lead to a break out of drilling muds at the surface within the woodland habitats and groundwater receptors.</li> <li>• Temporary noise and vibration impacts associated with the trenchless crossing activities e.g. drilling.</li> </ul>
<p><b>DW Option 2a*:</b> To north of Sprott's Hall</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Route around the woodland would reduce the length of construction required within Dedham Vale AONB, although there would be temporary impacts on landscape character and views during construction.</li> <li>• Temporary views of opencut underground cable construction would be limited from nearby receptors due to field boundary hedgerows and scattered woodland.</li> <li>• Would result in one fewer line (132kV) in the landscape during operation.</li> <li>• Limited effects on habitats and protected species as alignment is predominantly through arable land.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Potential for short term adverse effects on the setting of four Grade II listed buildings at High Trees Farm during construction.</li> <li>• There is a risk of undiscovered archaeology as a result of excavation of the trenches during construction.</li> <li>• Temporary disturbance to PRow during construction.</li> </ul>

\* Two sub options (i. and ii) were considered for DW Option 2a which looked at different locations for the Dedham Vale East CSE compound. Further details on these alternatives can be found in Section 3.9 and Table 3.13.

3.7.29 DW Option 2a was identified as the preferred option as it avoided environmental and technical risks associated with the trenchless crossing and avoided impacts on the woodland. DW Option 2a was subsequently presented at the 2022 Statutory Consultation.

## Section F: Leavenheath/Assington

- 3.7.30 Following feedback received during consultation on the project, National Grid undertook a back check and review to see if there was justification to extend the underground cable through Section F: Leavenheath/Assington. This came to the same conclusion as the COR, that Section F is not designated and is not considered to be particularly sensitive in the context of paragraph 2.8.2 of EN-5.
- 3.7.31 The back check further identified, that although parts of Section F lie within the setting of the AONB, the magnitude of change associated with the reinforcement of the 132kV overhead line is considered to be small, when seen in the context of the existing 400kV overhead line. Therefore, undergrounding the reinforcement within Section F is considered to be disproportionate given that the landscape outside of the AONB is not designated or particularly sensitive, although it is within the area identified as part of the setting. National Grid has concluded that when taking into account all of their duties and the baseline environment in this section, that overhead lines should remain the preferred approach in Section F: Leavenheath/Assington.

## Section G: Stour Valley

- 3.7.32 A number of responses were received during the Statutory Consultation in 2022 regarding the alignment of the project in the Stour Valley. The responses were concerned about the proximity of the routeing to the residents of Alphamstone and also on the habitats and land use along the cable route to the south of Henny Back Road. National Grid undertook further options appraisal of this section, including consideration of the alignments suggested during the consultation.
- 3.7.33 Eight options were appraised as part of a long list of potential options and initial screening (to see whether they were technically viable or any key environmental constraints), to identify a short list of options. The eight options are listed in Table 3.9, with reasons for taking forward or not for further assessment and shown on Sheet 5 of Figure 3.3: Considered Options (**application document 6.4**) and are given an SV prefix for reference.

Table 3.9 – Long List for Section G: Stour Valley

Option	Progressed to Short List?
<b>SV Option 1:</b> Alignment presented at the non-statutory consultation crossing the valley near Culverdown with the CSE compound to the south of Henny Back Road. This assumes a trenchless crossing beneath the River Stour and railway line.	Yes. See Table 3.10.
<b>SV Option 2:</b> Alignment presented at the Statutory Consultation to the north of Alphamstone with the alignment and CSE compound to the south of Henny Back Road. This assumes a trenchless crossing beneath the River Stour and railway line.	Yes. See Table 3.10.
<b>SV Option 3:</b> The alignment went south from a new proposed location for the Stour Valley East CSE (south of Appletree Wood) to the north of Bures Green. It then crossed the Sudbury Branch Railway Line before heading south-west to join the existing 400kV overhead line near	No. The main constraint on these options was the need to relocate a high-pressure gas main, which would be expensive, and the longer

Option	Progressed to Short List?
Lamarsh Park. This assumes a trenchless crossing beneath the River Stour and railway line.	construction programme would mean that National Grid would be unlikely to meet delivery of the project by 2028. These are longer routes than the other options which terminate further to the south and would have increased cost and do not meet the parameters of reinforcing the line between Bramford and Twinstead.
<b>SV Option 4:</b> This included three sub-options (a, b and c) which all headed south-west from a new proposed location for the Stour Valley East CSE (south of Appletree Wood) to join the existing 400kV overhead line either to the north or south of Cleeshall Great Wood and Peyton Hall. This assumes a trenchless crossing beneath the River Stour and railway line.	
<b>SV Option 5:</b> This included two sub-options (a and b) which headed north-west from the Stour Valley East CSE compound to the north of the existing 400kV overhead line to join a CSE compound near Loshes Meadow (in a similar location to the COR option). This assumes a trenchless crossing beneath the River Stour and railway line.	No. This was discounted as the CSE compound would have potential for significant environmental effects on listed buildings and habitats near Sparrows Farm.
<b>SV Option 6:</b> This headed west from the Stour Valley East CSE compound before passing between Ansell's Grove and Culverdown and on to the CSE compound to the south of Henny Back Road. This assumes a trenchless crossing beneath the River Stour, the railway line and to the south of Ansell's Grove.	Yes. See Table 3.10.
<b>SV Option 7:</b> This included two sub-options (a and b) which both headed west from the Stour Valley East CSE compound before passing to the south of Ansell's Grove to the CSE compound to the south of Henny Back Road. This assumes a trenchless crossing beneath the River Stour, the railway line and to the south of Ansell's Grove.	Yes. See Table 3.10.
<b>SV Option 8:</b> This headed west from the Stour Valley East CSE compound before passing to the south of Ansell's Grove and south to the CSE compound to the south of Henny Road. This assumes a trenchless crossing beneath the River Stour, the railway line and to the south of Ansell's Grove.	Yes. See Table 3.10.

3.7.34 The short-listed options were taken forward for further assessment including a detailed review in terms of the cost, technical feasibility and environmental acceptability. The results of this are shown in Table 3.10 and the alignments are on Sheet 5 of Figure 3.3: Considered Options (**application document 6.4**)

Table 3.10 – Summary of the Short List Options for Section G: Stour Valley

Option	Key Environmental Factors Considered
<p><b>SV Option 1:</b> Alignment presented at the non-statutory consultation crossing the valley near Culverdown with the CSE compound to the south of Henny Back Road.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• A relatively direct route primarily through arable fields.</li> <li>• Benefits from the removal of five spans of pylons from within the Stour Valley.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Potential impact on landscape character and views (limited number of receptors) due to the loss of woodland at Culverdown.</li> <li>• Potential effects on Moat Lane (Protected Lane) where the cables cross.</li> <li>• Potential habitat loss at Alphamstone Meadows Local Wildlife Site (LWS).</li> </ul>
<p><b>SV Option 2:</b> Alignment presented at the Statutory Consultation to the north of Alphamstone with the CSE compound to the south of Henny Back Road.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• A relatively direct route primarily through arable fields.</li> <li>• Benefits from the removal of five spans of pylons from within the Stour Valley.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Potential habitat loss at Alphamstone Complex (mosaic habitat), Pebmarsh House (grassland) and Moat Farm/Burnt House Marsh (woodland) LWS.</li> <li>• Potential effects on Moat Lane (Protected Lane) where the cables cross.</li> <li>• Closer to Alphamstone village receptors and also potential effects to a number of PRoW during construction.</li> <li>• Impacts to land under higher level stewardship to the north of Henny Back Road.</li> </ul>
<p><b>SV Option 6:</b> This headed west from the Stour Valley East CSE compound before passing between Ansell's Grove and Culverdown and south to the CSE compound to the south of Henny Road.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Trenchless crossing would avoid habitat loss to the south of Ansell's Grove.</li> <li>• Benefits from the removal of five spans of pylons from within the Stour Valley.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Potential effects on Moat Lane and Henny Back Road (Protected Lanes) where the cables cross.</li> </ul>

Option	Key Environmental Factors Considered
<p><b>SV Option 7:</b> This included two sub-options which both headed west from the Stour Valley East CSE compound before passing to the south of Culverdown and south to the CSE compound to the south of Henny Road.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Trenchless crossing would avoid habitat loss to the south of Ansell’s Grove.</li> <li>• Benefits from the removal of five spans of pylons from within the Stour Valley.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Closer to Alphamstone village receptors and also potential effects to a number of PRow during construction.</li> <li>• Potential habitat loss at Alphamstone Complex (mosaic habitat) and Pebmarsh House (grassland) LWS.</li> <li>• Potential effects on Moat Lane and Henny Back Road (Protected Lanes) where the cables cross.</li> <li>• The longer trenchless crossing would be more technically challenging with increased risks to groundwater and surface water receptors.</li> </ul>
<p><b>SV Option 8:</b> This extends west from the Stour Valley East CSE compound before passing to the south of Ansell’s Grove using a trenchless crossing and south to the CSE compound to the south of Henny Road.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Trenchless crossing would avoid habitat loss at Alphamstone Meadows LWS.</li> <li>• Benefits from the removal of five spans of pylons from within the Stour Valley.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Potential effects Moat Lane and Henny Back Road (Protected Lanes) where the cables cross.</li> </ul>
<p>3.7.35</p>	<p>SV Option 8 was chosen as it avoids areas identified as technically challenging due to the geology it uses a trenchless crossing to avoid effects on vegetation and habitats at Alphamstone Meadows LWS.</p>

## 3.8 Distribution Network Options

### Introduction

- 3.8.1 The Order Limits incorporates the route of an existing 132kV overhead line, which is part of the electricity distribution system owned and operated by UKPN. This 132kV overhead line runs from Burstall Bridge (2.5km to the south of Bramford Substation), to Twinstead Tee. The project would involve removing the existing 132kV overhead line in order to accommodate the alignment of the 400kV network reinforcement. Following the removal of the 132kV overhead line, additional work would be required to maintain the local connection and the current security of supply to local homes and businesses.

### Strategic Options

- 3.8.2 Work was undertaken by the Distribution Network Operator, UKPN, which identified eight options (some with sub-option variations) to maintain the security of local electricity supplies to enable the removal of the 132kV overhead line. It was concluded that developing a GSP substation in the vicinity of Twinstead Tee was the preferred option to replace the existing electricity transmission capacity lost following the removal of the existing 132kV overhead line.
- 3.8.3 Consideration of these options took account of the Holford Rules, the Horlock Rules, and likely compliance with NPS EN-1 and EN-5. A summary of the options and the key environmental factors that were considered in the appraisal is presented in Table 3.11.
- 3.8.4 The National Grid options appraisal concurred with the work undertaken by UKPN by confirming that the preferred strategic option was to develop a new GSP substation to the west of Twinstead Tee (referred to as UKPN Option 6). The report concluded that this represented the most efficient, coordinated and economical option, whilst giving rise to fewer overall environmental effects than the other options considered.

Table 3.11 – Strategic Options Considered to Maintain Security of Electricity Supply

UKPN Option	Environmental Factors Considered During the Selection Process
<p><b>UKPN Option 1</b> Do Nothing</p>	<p>n/a – This is the ‘do nothing’ option, which the other options were compared to. This would mean that it would not be possible to remove the 132kV overhead line.</p>
<p><b>UKPN Option 2</b> Replace 132kV circuits underground between Twinstead and Burstall Bridge</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• There would be no long-term effect on the landscape following reinstatement works after installation of the underground cables.</li> <li>• No direct effects on heritage assets, and no long-term effects on setting following reinstatement.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Option would cross Dedham Vale AONB and the Stour Valley, Box Valley, Brett Valley and Belstead Brook. During construction there would be temporary adverse effects on the landscape and on views from properties.</li> <li>• Option would cross Hadleigh Railway Walk LNR. There would be some habitat loss resulting from cable installation, including hedgerow and hedgerow trees, which may also result in adverse effects on protected species.</li> <li>• Potential for adverse effects on the historic landscape through the removal of historic hedgerows, and there is high potential for buried archaeology throughout the corridor.</li> </ul>
<p><b>UKPN Option 3 – Overhead or underground connection between Lawford/Abberton Substation and Twinstead Tee – two sub-options</b></p>	
<p><b>UKPN Option 3.1</b> Twinstead – Lawford 132kV substation: overhead line (Option 3.1.1) or underground cable (3.1.2) from Twinstead Tee to Lawford substation requiring the installation of two 132kV circuits along a 24km route.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Option 3.1.2 would have no long-term effect on the landscape following reinstatement, although the cable route crosses Dedham Vale AONB, and crosses the Stour Valley twice. During construction there would be temporary adverse effects on views from properties, although with reinstatement there would be no long-term effects.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• There is potential for effects on views from and to Dedham Vale AONB. Options 3.1.1 runs closest to the AONB and the new 132kV overhead line would give rise to adverse effects on landscape character and views, and to localised effects on landscape features where vegetation clearance may be required.</li> <li>• Option 3.1.1 has the potential for adverse effects on habitats resulting from construction where vegetation clearance may be required for safety clearances. Habitat loss within four CWS likely. Option 3.1.2 would have some habitat loss resulting from cable installation, including hedgerow and trees, which may also result in adverse effects on protected species.</li> </ul>



UKPN Option	Environmental Factors Considered During the Selection Process
	<ul style="list-style-type: none"> <li>• Potential for adverse effects on the setting of heritage assets. Option 3.1.1 passes close to Ardleigh Conservation Area which could affect its setting. There would be no long-term effects on setting following reinstatement. High potential for buried archaeology throughout the corridor. Option 3.1.2 has the potential for adverse effects on the historic landscape through the removal of historic hedgerows.</li> <li>• Option 3.1.1 the overhead line close to Dedham Vale AONB may have adverse effects on tourism.</li> </ul>
<p><b>UKPN Option 3.2</b></p> <p>Twinstead – Abberton 132kV substation: overhead line (Option 3.2.1) or underground cable (Option 3.2.2) from Twinstead Tee to Lawford substation requiring the installation of two 132kV circuits along a 24km route.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• There would be no long-term effects on the landscape following reinstatement.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• There would be temporary adverse effects on landscape character and views from some properties. It would also give rise to localised effects on landscape features where vegetation clearance may be required to achieve safety clearances.</li> <li>• Option 3.2.1 crosses Abberton Reservoir SPA, Ramsar site and SSSI. Both options have the potential for adverse effects on habitats and protected species due to vegetation clearances for safety clearances.</li> <li>• Potential for adverse effects on the setting of heritage assets although there would be no long-term effects on setting following reinstatement. Option 3.2.2 has the potential for adverse effects on the historic landscape through the removal of historic hedgerows. High potential for buried archaeology throughout the corridor.</li> <li>• Option 3.1.2 has the potential minor impact on tourism as a result of a further overhead line.</li> <li>• Option 3.2.2 has the potential for short-term effects on traffic and transport would occur where the underground cable crosses a number of major roads and a railway.</li> </ul>
<p><b>UKPN Option 4</b></p> <p>33kV Network Reinforcement</p>	<p>n/a – this option was dismissed at the first stage as it was non-compliant with the standards by which UKPN and National Grid are required to operate and was therefore not assessed further.</p>
<p><b>UKPN Option 5</b></p> <p>Reinforce Braintree GSP substation</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Options lie close to woodland, which may provide opportunities for screening. Option 5.1.1 would have no long-term effect on the landscape following reinstatement.</li> <li>• Option 5.1.2 would have no long term effect following reinstatement on views from heritage assets.</li> </ul>

UKPN Option	Environmental Factors Considered During the Selection Process
<p>This option would require modifications to be made to existing 132kV pylons near Belchamp Tee (Rushley Green) and the existing overhead line near Bramford. Overhead line (5.1.1) and underground circuit (5.1.2) options.</p>	<p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Option 5.1.1 would have adverse effects on landscape character and views in areas where there are presently no high voltage overhead lines. It would also give rise to localised effects on landscape features where vegetation removal may be required to achieve safety clearances.</li> <li>Option 5.1.2 would result in habitat loss resulting from cable installation, including hedgerow and trees, which may also result in adverse effects on protected species.</li> <li>Option 5.1.1 would have the potential for adverse effects on the setting of heritage assets and on buried archaeology. Option 5.1.2 would have a temporary adverse effect on views from properties, on one registered park and garden and one scheduled monument during construction. Option 5.1.2 would have the potential for adverse effects on the historic landscape through the removal of historic hedgerows and there is a high potential for buried archaeology throughout the corridor.</li> <li>Potential for some minor impacts on tourism receptors, including in and around Braintree.</li> </ul>
<b>UKPN Option 6 – Substation west of Twinstead Tee. Three sub-options</b>	
<p><b>UKPN Option 6.1</b></p> <p>Butler’s Wood and Waldegrave Wood: substation close to the existing 400kV overhead line and near the A131 where Butler’s Wood and Waldegrave Wood offer opportunity to screen views.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Option close to mature woodland, which would provide opportunities for screening the substation.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>There may be some hedgerow and hedgerow tree loss but generally limited effects on biodiversity as the adjacent arable land is of low ecological value.</li> <li>Potential for effects on the setting of listed buildings and potential for effects on buried archaeology.</li> <li>Limited loss of Grade 2 agricultural land.</li> </ul>
<p><b>UKPN Option 6.2</b></p> <p>Delvyn’s Lane: substation close to the existing 400kV overhead line where Ramacre Wood would screen some views.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Option close to Ramacre Wood, which would provide opportunities for screening some views. Also limited properties nearby so limited visual receptors.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>There may be some hedgerow and hedgerow tree loss but generally limited effects on biodiversity as the adjacent arable land is of low ecological value.</li> </ul>

UKPN Option	Environmental Factors Considered During the Selection Process
<p><b>UKPN Option 6.3</b></p> <p>Colne Valley: substation in the Colne Valley close to the existing 400kV overhead line and near the A1017, where the valley sides would limit wider views.</p>	<ul style="list-style-type: none"> <li>• Potential for effects on the setting of listed buildings and potential for effects on buried archaeology.</li> <li>• Limited loss of Grade 2 agricultural land.</li> <li>• The setting of a self-catering tourist facility at Pannells Ash could be affected.</li> </ul>
<p><b>UKPN Option 7</b></p> <p>New GSP substation at Coggeshall. 132kV overhead line connection (Option 7.1) and 132kV underground circuit (Option 7.2) options.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Limited effects on biodiversity as the area is largely arable with little ecological value.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Several properties in close proximity to the site which could have views of a substation.</li> <li>• Potential effects on the setting of listed buildings and one scheduled monument, and potential for effects on buried archaeology.</li> <li>• Parts of the area are within Flood Zones 2 and 3.</li> <li>• Potential disturbance during construction to visitors to Colne Valley Railway and Hedingham Castle.</li> </ul> <p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Topography and woodland offer opportunity to provide screening to reduce effects on the wider landscape.</li> <li>• There are relatively few properties in the area around the proposed substation location.</li> <li>• No designated sites within the study area.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Option 7.1 would have the potential for adverse effects on landscape character and views and localised effects on landscape features. Option 7.2 would have temporary adverse effect on views from properties during construction.</li> <li>• Option 7.1 could result in the loss of woodland as the route is defined by the existing overhead line. Option 7.2 would have habitat loss from cable installation, which may result in adverse effects on protected species.</li> <li>• Potential effects on the setting of listed buildings and potential effects on buried archaeology. Option 7.2 has the potential for some adverse effects on the historic landscape through the removal of sections of hedgerow, and there is high potential for buried archaeology throughout the corridor.</li> </ul>

UKPN Option	Environmental Factors Considered During the Selection Process
<p><b>UKPN Option 8</b></p> <p>New substation at Earls Colne. A connection would also be required between the GSP substation and the overhead line between Twinstead Tee and Pelham. 132kV overhead line connection (Option 8.1) and 132kV underground circuit (Option 8.2) options.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Topography and woodland offer opportunity to provide screening to reduce effects on the wider landscape.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Option 8.1 could result in the loss of woodland as the route is defined by the existing overhead line. Potential for adverse effects on landscape character and views and localised effects on landscape features. Option 8.2 would result in short term effects during installation on landscape and views but there would be no long-term effect following reinstatement.</li> <li>• Option 8.1 runs close to Chalkney Wood SSSI and crosses the Colne Valley LNR and Ansell’s Grove LoWS and is likely to result in habitat loss. Option 8.2 crosses Colne Valley LNR and Ashgrove/Ansell’s Grove LoWS, requiring potential use of a trenchless crossing or other mitigation to avoid effects. There may also be adverse effects on protected species.</li> <li>• Both options have potential effects on the setting of listed buildings and a conservation area. There is also high potential for buried archaeology. Option 8.2 has potential adverse effects on the historic landscape through the removal of historic hedgerows.</li> <li>• Area of identified flood risk runs along the River Colne through the centre of the substation study area.</li> <li>• Access to the substation would be via the minor road network, which could result in the need for road improvements.</li> <li>• Potential to have an adverse effect on the setting of Earls Colne and tourism.</li> </ul>

## GSP Substation Siting

- 3.8.5 Following the selection of the preferred strategic option (UKPN Option 6) to develop a new GSP substation to the west of Twinstead Tee, National Grid then identified potential sites for the GSP substation between Twinstead Tee (in the east) to Thaxted (in the west). The proposed sites were focused along the 400kV overhead line to enable the connection into the existing network.
- 3.8.6 An initial desk-based study identified eight potential sites (Substation Study Areas) and three (Study Area A, B and C) were taken forward for further investigation. National Grid identified individual locations (for example C1, C2, C3 and C4 within Study Area C) within each of the Substation Study Areas, which were taken forward for more detailed appraisal. All options were assessed against the following criteria: technical implications; environmental effects; socio-economic impacts; and cost.
- 3.8.7 A summary of the options considered and the key environmental factors that were considered in the appraisal is presented in Table 3.12 and these are shown on Figure 3.4: GSP Substation Study Areas (**application document 6.4**).

Table 3.12 – Summary of the GSP Substation Sites

Site and Location	Key Environmental Factors Considered
<p><b>Study Area A</b></p> <p>Land north of Colne Valley Farm Park (Site A1)</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Benefits from good access off the A1017.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Temporary adverse effects on landscape character and potential for long-term adverse effects due to tree loss to achieve safety clearances beneath the temporary overhead lines. Temporary overhead line diversion would have adverse effects on views and potential cumulative effects on visual receptors that could see both the new pylon and the substation.</li> <li>• Potential for tree loss and other habitats including neutral grassland during construction.</li> <li>• Substation and underground cable connection could have an adverse effect on previously unknown buried archaeology. There is high potential for buried archaeology at this location.</li> <li>• Potential for construction traffic to impact upon business operations of the Colne Valley Railway. Also substation may affect views from views from visitors to the railway or from nearby footpaths on the eastern valley side.</li> </ul>
<p><b>Study Area B</b></p> <p>Land at Delvyn’s Lane (Sites B1-B5)</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Benefits from existing screening.</li> <li>• Would require minimal spans of new overhead line to connect to the substation.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• All sites would introduce a new and incongruous feature in a predominantly rural setting. Depending on the exact route there are likely to be adverse effects due to tree loss beneath the temporary overhead lines. There would also be views of the 132kV pylon from nearby properties and footpath users. Potential cumulative effects on visual receptors that could see both the pylon and the substation. Locations B3 and B4 would have the greatest impact in terms of views.</li> <li>• Potential tree losses on Delvyn’s Lane and to the north of Ramacre Wood may be required beneath the temporary overhead lines. Permanent loss of a section of species-rich hedgerow, and a small loss of field ditch at locations B1 and B2.</li> <li>• Potential for adverse effects on the setting of heritage assets and potential for buried archaeology at each of the locations. There is potential for adverse effects on historic landscape character at locations B1, B2, B4 and B5.</li> </ul>

Site and Location	Key Environmental Factors Considered
<p><b>Study Area C</b></p> <p>Land at Butler's Wood and Waldegrave Wood (Sites C1-C4)</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Benefits from good access off the A131.</li> <li>• Benefits from existing screening due to the adjacent woodland and topography.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Changes to the openness as a result of a substation at locations C3 and C4. Views of the substation would be screened by the woodland at location C2. Temporary overhead line diversion would be required at locations C3 or C4, which would have temporary adverse effects on landscape character and views. There could be cumulative effects on visual receptors that could see both the pylon and the substation.</li> <li>• There may be a fragmentation of habitats due to constructing the substation between the two woodland blocks.</li> <li>• Moderate potential for buried archaeology within the corridor of the cable connection (Locations C2 and C4). Potential adverse effect on the setting of Butler's Farmhouse (Location C3) and on Butler's Farmhouse and Nether House Farm and on historic landscape character (Location C4).</li> </ul>

- 3.8.8 The study concluded that a substation between Butler's Wood and Waldegrave Wood (Location C2) was preferred, as it would have the least impact on the landscape character of the area, visual amenity, ecology and the historic environment due to the screening provided by the existing woodland. This option would also be the least constrained from a technical perspective and would have the shortest access road (off the A131).
- 3.8.9 Since re-launching the project in 2020, National Grid has undertaken further discussions with UKPN to ensure the previous proposals are still appropriate. UKPN has confirmed a requirement for two transformers at the GSP substation site (the original 2012 work assumed one transformer). This would require a larger footprint than assumed within the Substation Options Appraisal Study (**application document 7.2.5**). Further work including site surveys, have confirmed that the preferred substation site is still Location C2 at Butler's Wood, for the reasons outlined above and in Table 3.12, and that this site can accommodate the larger footprint associated with the two transformers.
- 3.8.10 It should be noted that due to wider programme requirements to meet government objectives as described in the Need Case (**application document 7.2.1**), National Grid applied for planning permission in April 2022 for the GSP substation under the Town and Country Planning Act (TCPA) from Braintree District Council. National Grid obtained planning consent for the GSP substation under the TCPA in October 2022 (planning reference 22/01147/FUL). Construction at the GSP substation is anticipated to commence in spring 2023 (i.e. prior to DCO consent). Further details can be found in the Planning Statement (**application document 7.1**).

## 3.9 Cable Sealing End Compounds

- 3.9.1 The key environmental factors considered during the options appraisal for the alternative CSE compound locations are set out in Table 3.13. The options are given a prefix comprising the initials of the CSE compound (for example DVE would be Dedham Vale East) for ease of reference.



Table 3.13 – Summary of the Options Considered for the CSE Compounds

Site and Location	Key Environmental Factors Considered
<b>Dedham Vale East (see Sheet 3 of Figure 3.3 (application document 6.4))</b>	
<p><b>DVE Option 2ai</b></p> <p>Located immediately to the east of Dedham Vale AONB and Dollops Wood.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Would make use of existing screening at Dollops Wood to limit the landscape and visual effects.</li> <li>• Negligible effects to the setting of listed buildings due to distance and intervening screening.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• There would be some close views of the CSE compound from the AONB and it would lie within the setting. There would be close views from PRoW and disturbance to users during construction.</li> <li>• Potential disturbance to species within Dollops Wood.</li> </ul>
<p><b>DVE Option 2aii</b></p> <p>Located between the two woodland blocks at Millfield Wood.</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Would make use of existing screening at Millfield Wood to limit the landscape and visual effects. Located further from the AONB boundary to reduce effects on setting but still located in the open field and would require additional screening.</li> <li>• Located away from Dollops Wood so would have limited effects on the woodland habitats and species.</li> <li>• Located away from Polstead Conservation Area, reducing the effects on setting. Negligible effects to the setting of listed buildings due to distance and intervening screening.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Potential disturbance to species within Millfield Wood.</li> <li>• Longer open-cut cable section could have greater impact on archaeology.</li> </ul>
<p><b>DVE Option 2b</b></p> <p>West of Heath Road located in the field to the west of Heath Road</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Would avoid direct effects on the AONB and it lies further away from the boundary, reducing the effects on its setting. Would make use of existing screening to limit the landscape and visual effects.</li> <li>• Located away from Dollops Wood so would have limited effects on the woodland habitats and species.</li> <li>• Located further away from Polstead Conservation Area, reducing the effects on setting. Negligible effects to the setting of listed buildings due to distance and intervening screening.</li> </ul>

Site and Location	Key Environmental Factors Considered
<b>DVE Option 2c</b> Located at Layham Quarry.	<p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This overlies a principal aquifer (bedrock) and a secondary aquifer (superficial geology). The groundwater vulnerability is classed as medium to high. There is a risk of pollution to the aquifer during construction.</li> </ul>
<b>DVE Option 2d</b> Located outside of the AONB in the field to the west of Holt Road.	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Would make use of existing screening to limit the landscape and visual effects. Located further from the AONB boundary to reduce effects on setting.</li> <li>Located further away from Polstead Conservation Area, reducing the effects on setting. Negligible effects to the setting of listed buildings due to distance and intervening screening.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Increased cost due to extended underground cable length.</li> <li>Potential risks associated with historic landfill.</li> <li>Longer length of underground cable would have greater risk of encountering archaeology.</li> <li>Potential effects on Layham Pit Woodland CWS and Meadow and Valley Farm Wood CWS and disturbance to protected species.</li> </ul> <p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Would result in a shorter cable section with less land disturbance and reduced cost.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Although the CSE compound would be located outside of the AONB, this option would require overhead line within the AONB to the east of Holt Road, which would affect the nationally designated landscape and views.</li> <li>The initial archaeological surveys indicated a high risk of archaeology at this location.</li> </ul>
<b>Dedham Vale West (see Sheet 3 of Figure 3.3 (application document 6.4))</b>	
<b>DVW Option 1</b> Located to north of B1068	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Located further from the AONB boundary to reduce effects on setting and benefits from young trees to screen the site. This location would also be better aligned with the existing 400kV overhead line tower which would permit wider synchronicity which would be preferable in terms of landscape impact.</li> </ul>

Site and Location	Key Environmental Factors Considered
	<ul style="list-style-type: none"> <li>Limited effects on ecology, as it is in an arable field.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Underground cable would have a risk of encountering archaeology.</li> </ul>
<p><b>DVW Option 2</b></p> <p>Located immediately adjacent to the AONB boundary</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Limited effects on ecology, as it is in an arable field.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>This option would be closer to the AONB boundary and would lie within the setting. This option would also have less synchronicity with the existing 400kV overhead line with greater landscape and visual effects.</li> <li>This option requires a longer access road from the B1068.</li> </ul>
<b>Stour Valley East (see Sheet 4 of Figure 3.3 (application document 6.4))</b>	
<p><b>SVE Option 1</b></p> <p>Located south of Sawyers Farm</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Located in a natural depression in the landform and the presence of hedgerows and a parcel of woodland to the immediate south would help screen the site. There are relatively few visual receptors within the immediate surrounding landscape, as views are restricted by landform and vegetation.</li> <li>Limited effects on ecology, as it is in an arable field.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Minor adverse effects on the setting of Grade II* listed building Sawyers Farm, which is located approximately 380m to the north and may be mitigated by existing intervening vegetation. Moderate/minor adverse effects on archaeology associated with Sawyers Road medieval track to Sawyers Tye.</li> <li>Requires construction off relatively long (c. 750m) permanent access from St Edmund's Hill.</li> </ul>
<p><b>SVE Option 2</b></p> <p>Located adjacent to St Edmunds Hill</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Location takes advantage of the presence of hedgerows and a parcel of woodland to the immediate north to help screening.</li> </ul>

Site and Location	Key Environmental Factors Considered
<b>SVE Option 3a</b> Located south-east of Sawyers Farm	<p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• There would be longer distance views towards the CSE compound including across the Stour Valley from St Edmund Way to the west. Some cut and fill would also be required to construct the compound area on the sloping ground, together with some potential localised removal of trees accommodate the CSE compound in this location.</li> <li>• This option falls within pasture land. The permanent access road is likely to require a cutting through one or more of the hedgerows / tree belts with the potential to impact protected species. There may be short term adverse effects as a result of disturbance or displacement impacts on breeding birds and bats during the construction phase due to hedgerow and tree loss.</li> <li>• Potential effects on archaeology.</li> <li>• This site lies within a Source Protection Zone II, which may require additional measures to reduce the risks to groundwater when constructing the foundations during construction.</li> </ul>
	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Location lies within a relatively flat local landform which takes advantage of the presence of woodland to the immediate west and nearby woodland to the south-west and north for screening. There are relatively few visual receptors within the immediate surrounding landscape, as views are restricted by landform and vegetation.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Although the CSE compound would lie within an arable field, a small area of woodland would be affected where the underground cables would tie into the site. There may be short term adverse effects as a result of disturbance or displacement impacts on breeding birds and bats during the construction phase due to tree loss.</li> <li>• Limited effects on the setting of Grade II* listed building Sawyers Farm, which is located approximately 0.4km to the north and mitigated by existing intervening vegetation. Moderate/minor adverse effects on archaeology associated with Sawyers Road medieval track to Sawyers Tye.</li> <li>• This site requires construction of permanent access track of approximately 1km from Upper Road along a footpath. The access road would join the public highway near to Dorking Tye House which is close to a curve on the road.</li> </ul>
<b>SVE Option 3b</b>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Would require a shorter access track than other options.</li> </ul> <p><b>Adverse:</b></p>

Site and Location	Key Environmental Factors Considered
<p>Located south-east of Sawyers Farm (further east)</p>	<ul style="list-style-type: none"> <li>• The CSE compound would lie within an arable field with an absence of natural screening. It would be visible from Upper Road to the east.</li> <li>• Potential effects on the setting of Grade II* listed building Sawyers Farm, which is located approximately 0.6km to the north-west, although this may be partly mitigated by existing intervening vegetation. Moderate/minor adverse effects on archaeology associated with Sawyers Road medieval track to Sawyers Tye.</li> <li>• This site requires construction of permanent access track of approximately 0.7km from Upper Road along a footpath. The access road would join the public highway near to Dorking Tye House which is close to a curve in the road.</li> </ul>
<p><b>SVE Option 4</b> Located to the east of Upper Road</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Located outside of the Stour Valley Project Area.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• There is an absence of natural screening and prominence in views from Upper Road.</li> <li>• Underground cable would have a risk of encountering archaeology.</li> <li>• Requires a short permanent access track to link to Upper Road, which is a narrow country road unsuitable for large vehicles.</li> </ul>

Site and Location	Key Environmental Factors Considered
<p><b>SVE Option 5</b></p> <p>Located adjacent to Chestnut Grove</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Location takes advantage of natural screening provided by a wooded valley immediately to the west, and woodland at Chestnut Grove to the south-east. There are few visual receptors within the immediate surrounding rural landscape and woodland along the valley to the west, Chestnut Grove to the south-east and extensive woodland within Assington Thicks would restrict views of the CSE compound from the surrounding landscape.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>Although the CSE compound would lie within an arable field, an area of broad-leaved woodland would be affected where the underground cables would tie into the site from the west. Within this woodland, there is a tributary of the River Stour and the cable crossing could result in impacts on the aquatic ecology habitat as well as woodland habitat. This could result in moderate adverse effects to habitats and species.</li> <li>Underground cable would have a risk of encountering archaeology.</li> <li>Requires a short permanent access track to link to Bures Road, which is a narrow country road unsuitable for large vehicles.</li> </ul>
<b>Stour Valley West (see Sheet 5 of Figure 3.3 (application document 6.4))</b>	
<p><b>SVW Option 1</b></p> <p>Located near pylon 4YLA001</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Landform and existing mature landscape features would assist in screening the site within the landscape. The presence of existing overhead line would reduce the magnitude of the effect.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>The CSE compound would be located within the Stour SLA and there would be near views from Sparrow's Farm and more distant views from properties to the south.</li> <li>There would be a permanent loss of semi-improved pasture and access to the compound could result in potential adverse impacts to the hedgerow. It also lies adjacent to the Loshes Meadow Nature Reserve, which supports a great variety of plant species, as well as being important for nesting skylarks, grey partridges and nightjars.</li> <li>Could have adverse effects on buried archaeology and on the setting of listed buildings at Sparrow's Farm (Grade II listed).</li> </ul>
<p><b>SVW Option 2</b></p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>Existing mature landscape features would assist in screening the site within the landscape, which would result in limited views other than nearby property.</li> </ul>

Site and Location	Key Environmental Factors Considered
<p>Located near pylon 4YLA004 and to north of Henny Back Road</p>	<ul style="list-style-type: none"> <li>• This option would result in three existing 400kV pylons (and intervening overhead line) being removed, which would have benefits on the landscape character and views in the Stour Valley.</li> <li>• The setting of listed buildings further north (including Sparrow's Farm) would benefit from the 400kV overhead line removal.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Could have adverse effects on buried archaeology and on the setting of listed buildings Ansell's Farm and Moorcot (Grade II listed buildings).</li> </ul>
<p><b>SVW Option 3</b>            Located near pylon 4YLA005 and to the north of Henny Back Road</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Existing mature landscape features would assist in screening the site within the landscape, which would result in limited views other than nearby property.</li> <li>• This option would result in three existing 400kV pylons (and intervening overhead line) being removed, which would have benefits on the landscape character and views in the Stour Valley.</li> <li>• The setting of listed buildings further north (including Sparrow's Farm) would benefit from the 400kV overhead line removal.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Could have adverse effects on buried archaeology and on the setting of listed buildings Ansell's Farm and Moorcot (Grade II listed buildings).</li> </ul>
<p><b>SVW Option 4</b>            Located near pylon 4YLA005 and to the south of Henny Back Road</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• This option would benefit from vegetation screening the site from Henny Back Road and also would rely on cutting into the landform due to the topography of the site, which would further help screen the site over the long term.</li> <li>• This option would result in five existing 400kV pylons (and intervening overhead line) being removed, which would have benefits on the landscape character and views in the Stour Valley.</li> <li>• The setting of listed buildings further north (including Sparrow's Farm, Ansell's Farm and Moorcot) would benefit from the 400kV overhead line removal.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• This option would cross more hedgerows and impacts are likely to include fragmentation effects on the habitat mosaic. It also lies close to and could potentially affect Alphamstone Complex LWS.</li> </ul>

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**Site and Location****Key Environmental Factors Considered**

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- Could have adverse effects on buried archaeology and also involves the underground cables crossing Henny Back Road (a Protected Lane).
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3.9.2 The sub-sections below summarise the reason for selection at each location.

### Dedham Vale East

3.9.3 A key principle in the options appraisal for this location was that the CSE compound should be located outside of Dedham Vale AONB to avoid conflict with national policy. In addition, Dollops Wood was identified as an important habitat that should be avoided.

3.9.4 The option selected was DVE Option 2aii, as this is located away from the AONB boundary and the setting of Polstead Conservation Area. It is located away from Dollops Wood therefore avoiding effects on the woodland habitats and species. It also makes use of the existing woodland screening at Millfield Wood to reduce visual effects on surrounding receptors. National Grid has concluded that when taking into account all of its duties, that the CSE compound should be located at 2aii.

### Dedham Vale West

3.9.5 A key principle in the options appraisal for this location was that the CSE compound should be located outside of Dedham Vale AONB to avoid conflict with national policy. National Grid considered that given the screening provided by the existing landform and planting that DVW Option 1 would be the most suitable location for the Dedham Vale West CSE compound.

### Stour Valley East

3.9.6 The option selected was SVE Option 1 as this makes use of existing woodland and the natural topography to partly screen the compound site to help mitigate the landscape and visual effects. It was also cheaper than some of the alternatives such as SVE Option 3a, due to the shorter cable length. National Grid considered that given the screening provided by the existing landform and planting and considering its duties, that SVE Option 1 would be the most suitable location for the Stour Valley East CSE compound.

### Stour Valley West

3.9.7 The location of the Stour Valley West CSE compound has partly been determined through the route alignment through the Stour Valley. The preferred location is SVW Option 4 with the location near pylon 4YLA005 as this site benefits from a depression in the existing landform and vegetation to help screen the site and would allow for additional pylons (and the intervening overhead line) to be removed from the Stour Valley.

## 3.10 Alternative Design and Construction Method

### Introduction

3.10.1 This section sets out the alternative design and construction methods that have been considered on the project and the reasons why options were taken forward or discounted. Further design considerations can be found in ES Appendix 4.1: Good Design (**application document 6.3.4.1**).

### Opencut, Ducting and Trenchless Crossings

3.10.2 National Grid has considered the choice of construction method for installing the underground cables as part of the options appraisal for identifying the preferred alignment

and this has been refined since based on the results of environmental surveys, technical assessments (including ground investigations) and feedback during consultation.

- 3.10.3 Opencut trenches were used as the starting point for the assessment, as these are quicker and cheaper to install than trenchless crossing, allowing land to be reinstated quicker. In addition, National Grid has continued to consider the use of trenchless crossing techniques, which although more expensive and time consuming to undertake, can avoid impacts on specific features such as rivers, railways and habitats. However, trenchless techniques have the potential to introduce different environmental effects including noise, groundwater effects and an increased risk of break out of drilling mud during construction. Therefore, the use of a trenchless techniques need to be carefully considered alongside environmental and technical surveys (particularly ground conditions) to identify if it is a suitable method at a given location.
- 3.10.4 Table 3.14 compares the environmental effects of the two installation techniques. Opencut is proposed in the majority of locations where underground cables are proposed. Trenchless crossings are proposed at four locations where there are particular sensitive constraints which have been identified through the environmental surveys and consultation responses:
- River Box: This is to avoid impacts on the river and the marginal habitats;
  - River Stour: This is to avoid impacts on the river, the marginal habitats and people using the River Stour for water-based recreation;
  - Sudbury Branch Railway Line: This is to avoid impacts on the railway line and its services during construction; and
  - South of Ansell's Grove: This is to avoid impacts on the habitats and woodland
- 3.10.5 National Grid is proposing to use a ducted solution where opencut trenching has been identified. This is where a trench is dug, then a duct (pipe) is placed into the trench, the cable can then be pulled through the ducts at a later date. The impacts of a ducted solution are similar to a standard opencut method except that it allows the subsoil to be replaced more quickly than with standard opencut methods. A ducted solution can also mean lower interventions during operation and maintenance, as the cables can be pulled through ducts at specific locations rather than excavating the whole trench, as would be required in a standard opencut method.

Table 3.14 – Underground Cable Installation Techniques

Technique	Key Environmental Factors Considered
<b>Opencut trenching</b>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Relatively quick to construct the trenches (compared to a trenchless method) but the construction programme may require trenches to be open for a long period of time before the land can be reinstated.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Results in vegetation loss where the trench crosses hedgerows, woodlands and other habitats.</li> <li>• Disturbance to land use including agricultural operations during construction.</li> <li>• Potential closures and diversion of roads and PRow during construction.</li> <li>• Natural drainage and run off need to be managed within the excavated area during construction.</li> <li>• Trenches are excavated so have an increased risk of encountering archaeological remains during construction.</li> <li>• Trenches can create a preferential pathway for groundwater flows, which can affect groundwater-based habitats and archaeology.</li> </ul>
<b>Trenchless crossing techniques</b>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Reduced effects on landscape character, visual amenity, biodiversity, setting of historic assets and surface water due to being able to retain (and leave relatively undisturbed) vegetation and land use above the trenchless crossing.</li> <li>• Cables are installed beneath tree roots so trees can remain above the cables and can be avoided during construction, which has landscape and visual benefits.</li> <li>• Limited excavation (mainly associated with drill pits) compared to an open trench as the drill profile can pass beneath archaeological remains.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Trenchless crossings take longer to install compared to opencut methods due to the number of drills required.</li> <li>• Trenchless crossings are not suitable in all geology and can have an impact on groundwater both during construction and by creating a preferential pathway for groundwater flow during operation. This can affect the water table in groundwater-based habitats.</li> <li>• There is an inherent risk of breakout of drilling mud at the surface associated with some trenchless crossing methods which needs to be managed and mitigated.</li> <li>• Trenchless crossings require drilling, which is a noisy activity and certain activities associated with the drilling cannot be stopped once commenced, which can lead to increased noise levels at night at nearby receptors.</li> </ul>

## Full Line Tension Gantries

- 3.10.6 A review of the design identified that there would be benefits in using full line tension gantries on the project at the CSE compounds. These would be approximately 15m in height as described on the table of parameters provided as part of the Works Plans (**application document 2.5**). This would have landscape and visual benefits compared to a terminal pylon alternative, which would be c. 54m in height. Full line tension gantries are proposed at all four CSE compounds (embedded measure EM-P06) on the project. This will remove the need for four terminal pylons across the project.

## Temporary Access Route vs Local Road Network

- 3.10.7 The project is located in an area of Essex and Suffolk where there are a number of narrow lanes which in some locations are unsuitable for construction traffic, particularly the very large low loading lorries (abnormal indivisible loads) required for the delivery of cables drums to the underground cable locations. Some of the lanes within Essex (Braintree District) are also identified as Protected Lanes under planning policy. These are typically single lane and some sections have historic hedgerows and banks along the roads that form part of their character.
- 3.10.8 National Grid has undertaken studies as part of the development of the construction routing strategy to look at current restrictions on the local road network. The study sought to balance the impacts associated with modifications to the local road network compared to impacts associated with the construction of a temporary access route.
- 3.10.9 A site visit was completed by a specialist access consultant to identify and review an abnormal indivisible load delivery route from the A131 to the Stour Valley West CSE compound. The findings of the inspection concluded that whilst use of the public highway from the A131 could possibly be made to be suitable for proposed cable drum delivery vehicles, significant remedial works would be required at various locations. This option would also require civil design requirements and utility services (telephone poles, and below ground services) to remove any constraints.
- 3.10.10 In response to this, and from feedback received at the statutory and targeted consultations, National Grid considered other options for accessing the western side of the working areas within Section G: Stour Valley. Alternatives included the use of a temporary off-highway access route through agricultural land and also a hybrid option comprising part use of the road network and part off-highway temporary access route. The environmental considerations of the different options considered are summarised in Table 3.15 and have been given a TAR (Temporary Access Route) prefix. The options are shown on Sheet 6 of Figure 3.3: Considered Options (**application document 6.4**).

Table 3.15 – Construction Traffic Routeing to Stour Valley West CSE Compound

Site and Location	Key Environmental Factors Considered
<b>Use of the Existing Highway Network</b>	
<p><b>TAR Option 1</b></p> <p>A131 via Collins Road, Oak Road and Cripple Corner to Stour Valley West CSE Compound (involving road improvements to make suitable for construction vehicles)</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Avoids impacts on land use, land drainage and soil.</li> <li>• Reduces number of construction vehicles required to import materials for construction tracks.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Likely to require enabling works such as moving and protecting existing services and utility connections.</li> <li>• Likely to require widening works to the existing highway, passing places, straightening out bends and traffic management for the duration of construction activities, which would result in loss of roadside vegetation and altering of the character of protected lanes.</li> <li>• Increase in traffic on the narrow lanes would create disturbance to adjacent properties and local businesses. It would also require construction vehicles to use the same roads as local traffic, cyclists and pedestrians.</li> <li>• Construction traffic would increase traffic on roads not designed for high numbers of vehicles.</li> </ul>
<b>Use of a Temporary Access Route Off the A131</b>	
<p><b>TAR Option 2a</b></p> <p>Temporary access route off A131 near Collins Road</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Avoids the need for modifications to the existing road network and to Protected Lanes.</li> <li>• Avoids construction traffic using the local road network, with less disruption to residents and businesses. It would also allow separation of construction vehicles off the local road network avoiding local traffic, cyclists and pedestrians.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Would result in vegetation loss where the route crosses hedgerows, although gaps would be used where practicable.</li> <li>• Requires use of imported stone for the temporary access route and soils stripping to avoid compaction of soil.</li> <li>• Would be visible from adjacent properties, listed buildings and crosses three public rights of way.</li> <li>• Temporary watercourse crossings would be required.</li> </ul>

Site and Location	Key Environmental Factors Considered
<p><b>TAR Option 2b</b></p> <p>Temporary access route off A131 near Lodge Farm</p>	<p><b>Beneficial:</b></p> <ul style="list-style-type: none"> <li>• Avoids the need for modifications to the existing road network and to Protected Lanes.</li> <li>• Avoids construction traffic using the local road network, with less disruption to residents and businesses. It would also allow separation of construction vehicles off the local road network avoiding local traffic, cyclists and pedestrians.</li> </ul> <p><b>Adverse:</b></p> <ul style="list-style-type: none"> <li>• Would result in vegetation loss where the route crosses hedgerows, although gaps would be used where practicable.</li> <li>• A large area of land crossed by the proposed temporary access route is listed on the Historic Environment Record and notes ‘Cropmarks of former field boundaries’, with a potential risk of archaeology.</li> <li>• Requires use of imported stone for the temporary access route and soils stripping to avoid compaction of soil.</li> <li>• Would be visible from adjacent properties, listed buildings and crosses seven public rights of way.</li> <li>• Temporary watercourse crossings would be required.</li> </ul>
<p><b>Hybrid Routes (Part Local Road Network / Part Temporary Access Route)</b></p>	
<p><b>TAR Option 3</b></p> <p>A131 via Collins Road, Oak Road then temporary access route to the south of Lorkin’s Farm</p>	<p>This is a hybrid of the options above and therefore would have similar effects to both combined and traffic may need to be managed while construction traffic enters and exits the local road network.</p>

- 3.10.11 The options appraisal identified that the preferred option is for a temporary access route off the A131 (TAR Option 2a). This was selected as it would avoid interventions on the local road network, which would disruption traffic and access. It would also avoid loss of vegetation and other features associated with the Protected Lanes, which contributes to the character of the landscape in this area.
- 3.10.12 The proposed temporary access route would be built towards the start of construction and would be made of imported stone. It would be removed once construction is complete, with the land reinstated to its original condition.

## 3.11 Conclusion

- 3.11.1 This chapter has set out how the environmental effects of the reasonable alternatives considered as part of the project development. A wide range of alternatives have been considered during the evolution of the project design, influenced by the environmental impact assessment process, ground investigations, various consultation stages and feedback received from consultees both through formal consultation feedback and through project meetings. The appraisal has taken into account technical, economic and environmental factors, which have been balanced alongside National Grid's duties.
- 3.11.2 National Grid has undertaken back check and review of the assessments of alternatives throughout the project development, to ensure that decision-making remained valid and to identify any options to further optimise the proposals, as presented within this chapter. This process has enabled National Grid to be confident that the design presented within the application is the optimum alignment taking into account the feedback from the assessments and consultation undertaken on the project. Further details can be found in the Evolution of the Project (**application document 7.2.6**).
- 3.11.3 ES Chapter 4: Project Description (**application document 6.2.4**) sets out the description of the project that emerged from the alternatives process.

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