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Bramford to Twinstead Tee Connection Project

Substation Siting Options Appraisal

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1 INTRODUCTION

Purpose of report

1.1 In July 2011, National Grid announced its preferred corridor for developing a scheme for a 400kV connection between Bramford substation in Suffolk (west of Ipswich) and Twinstead Tee in Essex (south of Sudbury). This corridor (Corridor 2) incorporates the route of a 132kV overhead line (the PCB line) comprising part of the electricity distribution system owned and operated by the Distribution Network Operator UK Power Networks (UKPN).

1.2 The preferred corridor, Corridor 2, would involve removing the existing 132kV overhead line between Burstall Bridge, 2.5km to the south of Bramford substation, and Twinstead Tee in order to accommodate the 400kV connection. Further works would then be required to ensure security of supply to the local electricity distribution network.

1.3 Following discussions between the then Distribution Network Operator EDF and National Grid, a Substation Siting Study [1] had been carried out in 2009 by environmental consultants TEP for National Grid which examined options for locating a new substation in the area west of Twinstead as a means of providing a connection to the local electricity distribution network. The study considered a number of options within this area and assessed them against high level environmental and planning constraints with the aim of identifying the least environmentally constrained options. The high level operational requirements of a substation, for example the design, proximity to existing 400/132kV connections, layout parameters and access were also factors in the location selection process. Three potential options for siting a substation were identified.

1.4 In accordance with a commitment made in the preferred corridor announcement and the Statement of Community Consultation, National Grid has been undertaking further technical and environmental studies relating to these options to supplement those undertaken in 2009. Given on-going consultation, the project is subject to a continuous process of backcheck and review in the pre-application stages.

1.5 Meanwhile, UKPN has undertaken further studies which considered a range of options for maintaining local electricity supplies, including the construction of new 132kV overhead lines or underground cables between different points on its network as well as proposals

[1] TEP: "Bramford to Twinstead Connection, Grid Supply Point Siting Study": October 2009.

for new substations. In July 2012 UKPN confirmed that a new substation to the west of Twinstead Tee would be its preferred option.

1.6 Eight strategic options were identified in the UKPN report[2]. National Grid has reviewed these options and a separate Distribution System Options Report[3] demonstrates how each option has been assessed in accordance with National Grid's guidelines on Options Appraisal. The report concludes that the strategic option to be taken forward for further appraisal is that of a substation to the west of Twinstead.

1.7 This report therefore considers options for the siting of a substation in detail and demonstrates how statutory duties, policy considerations, environmental, socio-economic, technical and cost issues have been taken into account. Three study areas have been identified and specific locations within the three substation study areas are considered in order that a more detailed assessment may be carried out.

1.8 A specific consultation will be held to obtain views on the strategic options and on the substation options in accordance with the Statement of Community Consultation. Representations received as part of this consultation will help to inform the development of a detailed connection design. Further engagement will take place regarding detailed substation siting and design. Following this, the detailed connection design, including substation, will be further developed and subject to environmental impact assessment, National Grid will formally publicise, and consult upon its proposed application and preliminary environmental information in accordance with the Planning Act 2008 requirements. An application for Development Consent will then be finalised, having regard to consultation feedback, and submitted to the Planning Inspectorate[4].

Structure of report

1.9 The report is structured as follows:

- Chapter 2 - summarises the findings of the substation siting study carried out in 2009 by TEP. This chapter highlights three possible areas for siting a substation and the reasons for their selection;
- Chapter 3 - identifies representations made about the substation in consultations to date;

[2] UK Power Networks '132kV network reconfiguration to accommodate wider systems work' July 2012.
[3] National Grid: "Distribution System Options Report": February 2013.
[4] From April 2012 the duties of the Infrastructure Planning Commission, including the processing of applications for Development Consent Orders under the Planning Act 2008, were transferred to the Planning Inspectorate.

- Chapter 4 – outlines further technical and other studies undertaken in 2011 and 2012 and defines the content of the substation;

- Chapter 5 – sets out the basis of the Substation Siting Options Appraisal;

- Chapters 6, 7 and 8 - present the results of the Substation Options Appraisal for each of the study areas considered;

- Chapter 9 - draws conclusions from the Substation Options Appraisal and explains how a decision on the approach to the siting and design of the substation will be integrated with other design decisions and how the results of consultation will be taken into account before finalising an application for Development Consent.

2 SUBSTATION SITING STUDY

Background

2.1 The Route Corridor Study[5] for the Bramford to Twinstead Tee Connection identified four possible corridors for the connection, of which Corridor 2 would involve removing the existing 132kV overhead line between Burstall and Twinstead Tee to accommodate the installation of a new 400kV overhead line. Discussions with the then Distribution Network Operator EDF had indicated that, in the event that this corridor were to be selected, a new Grid Supply Point (GSP) substation would be required between Twinstead and Thaxted.

2.2 In October 2009, TEP was appointed by National Grid to carry out an environmental and planning assessment of the viability of siting a new substation in this area. The purpose of the study was to examine the options for locating a new substation and to describe the environmental, transport and planning constraints affecting the choice of options. It also identified the next steps in the process towards securing the necessary consents. The siting study was provided to assist consultees in having a better understanding of the implications of the Corridor 2 option. It was retained in draft form as it was recognised that further investigations would be required in the event that the need for such a substation was confirmed.

2.3 The study was undertaken using desk-based information supplemented by site visits and used a number of documents to establish the baseline criteria for assessing feasibility and defining the significance of environmental constraints. These included National Grid's environmental guidance including its Schedule 9 Statement under the Electricity Act 1989[6], National Grid's 'commitments when undertaking works in the UK – Our stakeholder, community and amenity policy'[7], and the 'Horlock Rules'[8].

Study Area

2.4 The study area extended from Twinstead Tee (approximately 4.5km to the south of Sudbury) to Thaxted (approximately 14.5km north-west of Braintree) and was focussed

[5] National Grid: "Bramford to Twinstead, Route Corridor Study Report": October 2009.
[6] "Electricity Act": 1989.
[7] National Grid: "Commitments when undertaking works in the UK – Our stakeholder, community and amenity policy" February 2010.
[8] National Grid: "Horlock Rules": March 2003.

along the 400kV overhead line between Twinstead Tee and Thaxted. The study area falls within the boundaries of Braintree District Council and Essex County Council.

2.5 The area is characterised by rolling landscapes with some level areas providing views across arable fields. There is little evidence of industrial or employment development in the area. The main transport routes in the area are the A131 linking Sudbury and Braintree, and the A1017 which passes through the villages of Great Yeldham, Castle Hedingham and Sible Hedingham within the study area. There are few large roads with the study area mainly being accessed via small lanes and B roads. The closest motorway is the M11 approximately 25 miles to the west of the study area.

2.6 The principal environmental constraints in each study area assessed were:

- Designated heritage assets (Scheduled Monuments, Listed Buildings, Conservation Areas)
- Settlements
- Flood risk areas
- Registered Parks and Gardens
- Airports/Airfields
- Woodlands including Sites of Special Scientific Interest (SSSIs)
- Protected Lanes

2.7 Topography and landscape character were also considerations.

2.8 In September 2009 National Grid commissioned an access study[9] which indicated that the area west of the A1017 at Castle Hedingham could not be accessed without substantial highway works to allow the delivery of large equipment. The nature of the works would alter the character of the area and the study area was therefore refined to the area between the A1017 and the A131 near Twinstead.

Options considered

2.9 Following an initial desk based study, eight potential sites were identified. These areas were visited and the study described the sites as follows:

Site 1 – Butler's Wood and Waldegrave Wood

2.10 At the intersection of the A131 and the 400kV overhead line close to Butler's Wood, west of Wickham St Paul, this site provides good access from the A131 with elements of good screening due to the two woods, topography and existing hedgerows. Woodlands to the

[9] Wynns Independent Transportation Consultants: Abnormal Indivisible Load Investigations and Route Inspection: November 2009.

north and south provide screening from long distance views, although land east of the woodland is flat and open and the proximity of properties would result in potential impacts on views and residential amenity.

Site 2 - Delvyn's Lane, north-west of Castle Hedingham

2.11 This site would require improvements to be made to the B1508 involving negotiation with land owners along the route. The site would be relatively well screened other than some potential impact on the amenity of Parkgate Farm and Pannells Ash Farm. The site would require minimal spans of new overhead lines to connect into the substation.

Site 3 - 132kV 'Diamond crossing' at Rushley Green

2.12 The access lane would require significant upgrading including tree and vegetation removal on Rosemary Lane at Rushley Green which would increase the impact of the development on the surrounding landscape. There are likely to be views from the important historic feature and Scheduled Monument, Hedingham Castle, with potential effects on its setting. This site was therefore discounted.

Site 4 - At the intersection of the A1017 and the 400kV line north of Colne Valley Farm Park, Castle Hedingham

2.13 This site can be directly accessed from the A1017 but would require careful screening as it is close to the entrance of a recognised tourist attraction. Part of the site falls within an area of flood risk and this would need to be investigated further to establish the viability of the site given the potential for flooding. Whilst the site is relatively close to residential properties, the existing tourist attraction separates the site and these properties.

Site 5 - West of Jeckyll's Farm to the north of Little London

2.14 Access to this site is severely restricted and not suitable for the delivery of transformers. The proposal is likely to impact on the amenity of Jekyll's Farm and could affect the amenity of Cornish Hall and Whitley Cottage and the setting of Scheduled Monuments. This site was therefore discounted.

Site 6 - North of West Wood

2.15 This site is adjacent to the SSSI at West Wood, although the substation is unlikely to have a direct impact on the woodland. An 800m permanent access road from the main road (B1051) would need to be created and access from the wider road network is severely restricted. Whilst views are not expansive due to the large woodland blocks, the

new 132kV overhead lines would need to circumnavigate West Wood as well as other blocks of woodland. This site was therefore discounted.

Site 7 - West of West Wood

2.16 Views of the site are not expansive due to surrounding woodland blocks. There may be a requirement for some tree removal at West Wood (SSSI) to provide clearances for equipment. A new permanent access approximately 400m long would need to be created from the B1051 and access from the wider road network is severely restricted. This site was therefore discounted.

Site 8 - Existing low voltage substation at Boyton End

2.17 This site is close to a Scheduled Monument and listed buildings at Terriers Farm and is likely to be harmful to amenity at this property. A new 1.2km section of 400kV overhead line would be needed to provide connection to the site. Access to the site is severely restricted. This site was therefore discounted.

Shortlisted options

2.18 After assessing the eight study areas, three were shortlisted for further investigation:

- Site 1 – Butler's Wood and Waldegrave Wood: being close to a main road and having natural screening;
- Site 2 - Delvyn's Lane, north-west of Castle Hedingham: being well screened and close to the existing overhead lines;
- Site 4 - North of Colne Valley Farm Park, Castle Hedingham: being close to a main road and in an urban fringe location.

2.19 A fourth site at Rushley Green was shortlisted as part of the 2009 study but later discounted as further investigations identified difficulties in accessing the site for the delivery of the transformer.

3 CONSULTATION TO DATE

Stage 1

3.1 The Stage 1 Consultation relating to the proposed route corridor for the Bramford to Twinstead Tee Connection was carried out in October 2009. This stage of the consultation process invited the views of statutory and non-statutory consultees and members of the public living in the vicinity of the proposed works, on the four broad route corridor options which were identified at Stage 1 of the Project.

3.2 At this stage, some comments were received in relation to the need for an associated substation. Some were sensitive to the need for, and potential impact of, a substation, noting for example that it would be of concern to residents in the immediate area. A small number of individuals expressed an opinion on where it should be sited, for example close to the A131 road or away from Castle Hedingham. The need for screening the substation was highlighted as an issue, and there were concerns that EDF (now superseded by UKPN) might want to connect new 132kV lines to the substation. There were also concerns about noise during the operation of the substation and traffic disturbance particularly regarding the impact on local roads during construction.

3.3 National Grid responded that the Substation Siting Study, made available at the beginning of the Stage 1 Consultation, had identified three potential locations and had considered technical and environmental constraints. The use of a GIS design would enable the substation to be reduced in size. The substation would not be permanently staffed, resulting in minimal traffic movements once the site is operational. National Grid emphasised the fact that if Corridor 2 were selected for the connection, the likely effects of a substation would be considered and further consultation would take place to identify the most suitable location. It noted that access studies had ruled out any location west of the A1071 near Castle Hedingham and the potential site at Rushley Green, as the required improvements would result in an unacceptable degree of harm to the character of the area.

Stage 2

3.4 In December 2011, National Grid held three public information drop-in events as well as a separate Councillor briefing event. These were not consultation events; however, as a result of these information events, some responses were received from residents.

Concerns were raised in relation to visual impacts, noise, proximity to property, property values, environmental impacts and health.

3.5 Comments at the Councillor briefing event included a request that further consideration be given to the substation location at Rushley Green, which had been discounted in the substation siting study due to difficulties of access and vegetation clearance that would be required. In 2012, National Grid instructed Wynn's Independent Transportation Consultants to assess each potential substation site (as reviewed in the 2009 Substation Siting Study) in more detail. Wynn's produced the 'Schedule of Works and Surveys'[10] which concluded that the right turn from the B1058 at OS Reference TL 7926 3568 into Rosemary Lane would not be negotiable for the 14 axle girder frame trailer required. The swept path assessment drawings confirmed that third party land would be required to facilitate access and significant vegetation removal would be needed. Rosemary Lane would require widening as well as removal of some vegetation. For these reasons, this study area was discounted.

3.6 Additional comments received at the Twinstead Community Forum workshop included a suggestion to locate a substation in the M11 area – Quendon, Ugley and Henham. Concerns in relation to the existing 132kV overhead line not being removed between the Tee and the substation and relating to asymmetric pylons were raised. Comments relating to complete undergrounding with no substation and the importance of views from and historical significance of Castle Hedingham were also received.

3.7 National Grid has considered these comments. In relation to the suggestion of a substation in the M11 area, this has not been followed through to options appraisal. If the existing 132kV overhead line between Bramford and Twinstead is dismantled, alternative arrangements have to be put in place in order to maintain the current level of security of supply of the local Network. Work to date between the Distribution Network Operator UKPN and National Grid indicates that a new GSP substation to the west of Twinstead is the optimum alternative and the Distribution Network Operator has identified that the new substation has to be located between Twinstead and Thaxted.

3.8 In the case of a substation west of Thaxted (for example in the M11 area), should one of the 132kV circuits feeding demand to the east need maintenance and therefore be out of service and the other circuit is automatically taken out of service due to a fault, approximately 140MW of demand would be lost. A substation in the Thaxted to Twinstead Tee area provides a greater degree of demand security as if the same 132kV

[10] Wynns: "Schedule of Works and Surveys": 2012.

connection is lost then power would continue to be supplied from the National Grid network.

3.9 Environmental baseline information for the three substation study areas was gathered during the latter part of 2011. This was presented to the Landscape and Views, Cultural Heritage and Biodiversity Thematic Groups for comment.

3.10 The Stage 2 Consultation also related to the proposed route corridor for the Bramford to Twinstead Tee Connection. It sought views on the Connections Options Report[11] and a consultation period ran for eight weeks from 29th May to 27th July 2012. The consultation invited the views of statutory and non-statutory consultees and local communities in the vicinity of the proposed works, on options for a 400kV connection between Bramford substation in Suffolk (west of Ipswich) and Twinstead Tee in Essex (south of Sudbury).

3.11 At this stage, some comments were received in relation to the siting of a new substation in the Twinstead area. Representations queried whether the substation was necessary and whether it would need to expand in the future. Suggestions for alternative solutions, such as undergrounding from Bramford to Belchamp substation or from Bramford to Braintree were put forward. Comments relating to the cost of undergrounding compared to the cost of a substation were also submitted. Other concerns were raised such as visual impact on the surrounding landscape and residential properties, cultural, environmental and ecological harm caused by the siting of a substation, noise disturbance (given the quiet rural character of the area) and lack of transparency in the consultation process in determining where the substation is to be sited.

3.12 The UKPN report[12] considered a number of options for maintaining connectivity with the local distribution network, including construction of underground 132kV circuits between Bramford and Twinstead Tee (with connection to Belchamp) and between Braintree and Rushley Green. The cost of underground cable options are presented in that report for comparison with the costs of a substation west of Twinstead Tee.

3.13 The findings of the Distribution System Options Report and the Substation Siting Options Appraisal Report will help to inform public consultation and will incorporate the issues raised in representations to date. The consultation will last for at least 28 days and public events will be held in local village halls. Dates and locations will be published on the project website and local residents and parish councils will be notified by letter in advance.

[11] National Grid : "Bramford to Twinstead Tee Connection – Connection Options Report" : May 2012
[12] UKPN: "132kV network reconfiguration to accommodate wider systems works": July 2012.

3.14 Following the selection of a preferred substation site, the proposal will be developed in greater detail and be subject to environmental impact assessment. The substation and associated works will be designed to minimise effects on the surrounding environment.

3.15 With regard to noise, National Grid takes account of the British Standard for rating industrial noise affecting mixed residential and industrial areas[13].

3.16 National Grid has considered the strategic options identified in the UKPN report published in July 2012 through a separate assessment of the potential impacts of each option, as reported in the Distribution System Options Report. Where options have been discounted, an explanation has been given.

3.17 After having reviewed these options, taking comments into account, and confirming the option of a substation to the west of Twinstead, National Grid has considered in more detail the siting and design of the substation and its effects on the local environment, in particular the likely effects on nearby properties and on the local road network. These considerations have been incorporated in the Options Appraisal which follows.

[13] BS4142 : 1997

4 SUBSTATION PARAMETERS

Technical Development

4.1 National Grid and UKPN have now established the technical system operating parameters for a Grid Supply Point (GSP) as part of the Bramford to Twinstead project. These parameters are defined by the technical standards required for the holder of the UK Transmission Licence (National Grid) and the corresponding Distribution Licence holder (UKPN).

4.2 The proposed GSP will consist of a National Grid 400kV substation and a UKPN 132kV substation contained within a 2.4m high palisade fence. There will be an internal fence to separate the National Grid and UKPN operational areas. An access road will be constructed to the nearest public highway. The 400kV substation will be connected to the existing 4YL 400kV overhead line and will contain a single 400/132kV transformer and associated switchgear to reduce the operating voltage from 400kV to 132kV for onward transmission to UKPN. The UKPN 132kV substation will then be connected by underground cables and a 132kV sealing end platform tower to the existing PCB 132kV overhead line. The area for the GSP will be approximately 1.5 hectares and additional land may be acquired for landscaping and planting if required.

4.3 Schematic layouts for the GSP, connections to the 400kV and 132kV overhead lines and potential landscaping can be found at the end of the report.

4.4 Through the consultation process, National Grid has been asked to provide layouts for gas insulted switchgear substations (GIS) as well as air insulated switchgear substations (AIS) for the 132kV component of the GSP as in most cases, this would provide a smaller footprint for the substation. The 132kV GIS substation option has an alternative arrangement which comprises a portal frame building to accommodate the GIS switchgear and its associated equipment which is insulated by SF_6 gas and would be housed in a building of approximately 110m^2 which, due to operational requirements, would be up to 13.5m high.

4.5 For the purposes of this report and the assessment of which location would be the most suitable to accommodate a substation, an AIS substation layout has been assumed in the assessment of each option. In terms of the likely environmental effects, a GIS substation would be likely to have a greater impact on views and landscape character

due to the height and scale of the building surrounding the equipment. A GIS substation would have a lesser impact on ecology and archaeology due to the smaller footprint.

4.6 An emerging design for Highly Integrated Switchgear (HIS) or "Hybrid" has also been given some consideration. This would also make use of the insulating properties of SF_6 gas to produce a more compact substation, which would not require a large building. However, this type of design is still under development and its use will therefore be kept under review as the project develops. The landscape and visual effects of an HIS substation are likely to be less than those of a GIS substation. However, its use would not be determinative of which location should be preferred for a substation.

4.7 In developing the substation options, engineers considered:

- individual site characteristics, environmental constraints and existing infrastructure to determine the appropriate location and orientation of the substation;
- the most appropriate form of connection to the 400kV network;
- the most appropriate route of the 132kV cable connection taking account of environmental constraints;
- the most appropriate route for a permanent access road;
- the need for temporary works including overhead line diversions.

Other studies

4.8 In order to inform the Options Appraisal, a number of other studies were undertaken in 2011 and 2012.

4.9 Environmental studies were undertaken to assess the potential effects of the substation options on landscape and visual amenity, the historic environment and ecology. Information was also gathered on flood risk and local economic activity. The environmental studies included:

- a review of existing information contained in the previous study 'Bramford to Twinstead Connection: Substation Siting Study' October 2009 (Draft);
- a desk top review of designations and other environmental data; and
- field study.

(Environmental baseline information and assessment plans to accompany the options appraisal can be found on the project website http://www.bramford-twinstead.co.uk/library-stage-2.aspx.)

4.10 The size of some of the equipment for the substation means that when it is imported by road to the site it would be categorised as an abnormal indivisible load (AIL) by virtue of its weight. An Abnormal Indivisible Load Investigation[14] was carried out for National Grid by Wynns Independent Transportation Consultants in March 2012 which comprised land transport feasibility investigations into gaining access for Special Order movements of above 150te gross weight. The report considered the relevant legislation, transport configurations, policy requirements, recovery of excessive maintenance costs, and removal and replacement of street furniture.

4.11 This report concluded that the most suitable site in terms of access is that at Butler's Wood, given its location adjacent to the A131. The other two sites would require further investigation into route negotiability and suitability in terms of structural stability. The report did not consider specific route negotiability and further discussions with police and highways authorities would be necessary to confirm access requirements in more detail.

4.12 In September 2012, Wynns published a further report[15] which looked at the three (Butler's Wood, Delvyn's Lane, Colne Valley Farm Park) potential substation study areas in greater detail in terms of access requirements as well as considering the access requirements to Rushley Green as described in paragraph 3.5. This document identifies the nearest Common Heavy Load Route, the suggested route from the nearest Common Heavy Load Route to each study area, any known structural problems for AIL access, and any known negotiability problems for AIL access. The document also identifies any actions required to be carried out by National Grid to enable access as well as making recommendations as to whether the study area is suitable for the delivery of a transformer.

[14] Wynns Independent Transportation Consultants: Abnormal Indivisible Load Investigations Transportation of 240MVA 400/132kV Transformer to a proposed new substation (various sites) connection in Essex,: March 2012.
[15] Wynns Independent Transportation Consultants: Schedule of Highway Works Required to enable Abnormal Indivisible Load Access of 169te Transformers to Potential Substation Locations: September 2012.

5 SUBSTATION OPTIONS APPRAISAL TOPICS

Topics to be considered in the appraisal

5.1 Options Appraisal provides a framework which allows National Grid to identify and balance technical, socio-economic, environmental and cost considerations in selecting options.

5.2 For the purpose of this study, the following topics were considered:

Technical

- Technical Complexities
- Construction/Project delivery issues

Environment

- Landscape
- Visual Amenity
- Historic Environment
- Ecology
- Water Recourses
- Noise and Vibration

Socio-economic

- Traffic and transport
- Local economic activity

Cost

- Capital cost
- Lifetime cost

5.3 Technical complexities, deliverability and connections are important factors in determining the merits of different options. Each site has different technical issues to overcome and these are described in the following chapters.

5.4 Effects on landscape and visual amenity are recognised as important factors in determining the merits of different options. This was confirmed by representations during the Stage 1 consultation. Impact on heritage assets was also raised in representations. This included the potential effect on the setting of the castle at Castle Hedingham and on other listed properties. Impacts on ecological resources including habitats associated with hedgerows and woodland.

5.5 Within the environmental assessment, reference is made to magnitude of effect (scale of change) which is a judgement of the scale of change that would arise through the proposed development compared to the baseline landscape. A scale of change rating is judged to be high, moderate, low or negligible. Considerations in making this judgement about scale of change includes:

- how great a change would arise as a consequence of a development compared to the baseline conditions;
- the nature of the change (positive or negative); and
- the duration of effect, whether temporary, short, medium or long term.

5.6 This information on magnitude of effect (scale of change) is combined with the value or sensitivity of the receptor to determine the overall effect on the receptor. Impacts upon receptors of higher value or sensitivity are given greater weight than impacts upon receptors with a lower value or sensitivity. These considerations result in an overall judgement of either neutral, minor, moderate or major effects can be negative or positive. The assessment of effects on landscape, visual amenity, historic environment and ecology considers these effects prior to mitigation. Mitigation measures are then described and the effects are reassessed taking mitigation into account.

5.7 Further details of the methods for environmental assessment are provided in Appendix B.

5.8 Once operational, substation options would not have significant effects on water resources. During construction there is the potential for different effects on surface water and groundwater, depending on the nature and extent of construction activity. However, such differences would be insufficient to be material differentiators in options selection. The issue of flood risk may, however, be material in determining whether an option should be pursued. Representations raised this as a specific concern relating to the site north of Colne Valley Farm Park, Castle Hedingham. A flood risk assessment has been carried out[16].

[16] RSK: Substation Site A, 400kV/132kV Substation West of Twinstead Tee, Flood Risk and Drainage Assessment: November 2012.

5.9 The substation would be designed to avoid any perceptible increase in background noise levels at residential properties. This would include enclosure of the transformer and the use of low noise cooler fans. Other than at Location A1, where the construction of a solid structure near to the transformer cooler would be required, no other mitigation would be needed. As noise would not be a differentiating factor between the options for the substation location, it has been scoped out of the options appraisal.

5.10 Once operational, the effects on traffic and transport would be negligible for all options. The local road infrastructure is generally sufficient for the traffic movements required to construct and maintain the substation. The transport network in the vicinity of options would have different characteristics and the impact would vary slightly in relation to traffic flows associated with construction activities and the AIL movements necessary to install the plant and equipment.

5.11 For all options, the construction of the substation is expected to commence, subject to the granting of consent, in Spring 2015. The construction is expected to involve civil works, mechanical and electrical works and 132kV cable works. All construction traffic will be planned to occur during normal working hours and a detailed traffic management plan identifying the predicted number of vehicle movements will be produced. Some sections of the road network may require careful negotiation by construction vehicles due to sharp bends or limited width.

5.12 If the fill material is of insufficient quantity to provide landscaping and site bunding, then additional vehicle movements would be required to import the required additional volume of landscaping material. If the fill material is not suitable then additional vehicle movements would be required to dispose of the material. There would be deliveries for additional items such as concrete. All options are approximately the same in terms of quantity of concrete required. Pre-works for the mechanical and electrical works within the substation compound would involve the delivery of plant and equipment over the duration of the construction phase.

5.13 Once operational, it is expected that there would be a weekly visit by one field operative in a van for routine checks. Minor maintenance works would take place annually, and involve two to three vans daily for a couple of weeks. Major maintenance would take place approximately every twelve years for two – three months normally during the period between April and October. During operation, vehicle movements are expected to be minimal. In view of the location options, there appears to be no discernible advantages between options for the post construction phase.

5.14 The Stage 1 Consultation emphasised the importance of assessing the effects of the new connection on the local economy, including tourism. The potential for local economic effects would vary depending on the proximity of options to local businesses and tourism receptors and the degree of potential temporary disturbance during construction or longer term effects on business premises and operations or visitor attractions. This is considered further in the options appraisal which follows.

5.15 National Grid considers both capital and lifetime costs in its investment decisions. However, it is not considered that lifetime costs would assist in deciding between the individual options assessed in this report because substations themselves have almost zero loss costs and the variance would therefore be minor. Capital costs only are therefore used in this report. The capital cost for each option takes into account the cost of the substation equipment together with the cost of modifications to the 400kV overhead line, and the provision of 132kV cable connections and access roads. Some additional costs are likely for factors such as procurement and licensing but these costs are unlikely to be a determinative factor when comparing sites. Total capital costs for each of the options are not expected to exceed the budget figure of £30.4m quoted in the Distribution System Options Report. Design development has resulted in capital costs lower than this budget figure. However, this would not affect the conclusions of that report.

Compliance with Policy

Planning Policy

5.16 The need for new energy infrastructure is confirmed in National Policy Statement (NPS) EN-1[17] and the policy relating to electricity infrastructure in NPS EN-5[18].

5.17 This options appraisal has been undertaken in accordance with EN-5 which refers to factors influencing site selection and the need for electricity network companies, as regulated monopolies, to develop and maintain economical and efficient networks whilst having regard to various non-financial considerations. EN-5 makes reference to the importance of considering such factors as landscape and visual impacts as well as the historic environment, noise and vibration and biodiversity.

5.18 The Braintree Core Strategy[19] aims to "*make sure the landscape character of the countryside, biodiversity, wildlife habitats (including those of European importance*

[17] National Policy Statement EN-1: July 2011
[18] National Policy Statement EN-5: July 2011
[19] Braintree District Council : Local Development Framework Core Strategy : September 2011

outside the District), agricultural land, historic towns, villages and buildings are protected and enhanced for future generations."

5.19 Policy CS8 states that "*all development proposals will take account of the potential impacts of climate change and ensure the protection and enhancement of the natural environment, habitats and biodiversity and geo-diversity of the District*". This encompasses protection of :

- the best and most versatile agricultural land;
- the natural environment of the District, and in particular designated sites of national importance and locally designated sites identified on the Proposal Map;
- development from the risk of flooding.

5.20 As all sites involve land which is classed as Grade 2 agricultural land, the development of a substation in any location would not be consistent with this policy. There is potential for flooding in Study Area A from the River Colne, although the flood risk assessment concluded that this would not prevent the development of a substation.

5.21 The policy states that development must have regard to the character of the landscape and its sensitivity to change and where development is permitted it will need to enhance the locally distinctive character of the landscape in accordance with the Landscape Character Assessment. The options appraisal and consideration of mitigation measures have taken account of landscape character.

5.22 Policy CS9 includes measures to promote and secure the protection and enhancement of the historic environment in order to respect and respond to the local context, especially in the District's historic villages, where development affects the setting of historic or important buildings, conservation areas and areas of highest archaeological and landscape sensitivity. The appraisal has taken effects on the historic environment into account.

5.23 The Core Strategy replaces some of the policies in the Local Plan[20]. Other policies are retained until other elements of the Local Development Framework are in place. Saved Policy RLP 161 states that "*proposals for development required for the operational needs of utilities serving the public will be supported and approved where applicable, subject to their acceptability on environmental and amenity grounds in terms of the other policies in this Plan. In considering proposals the Council will take into account existing levels of*

[20] Braintree District Council : Braintree District Local Plan Review: July 2005

infrastructure, technical and operational requirements and opportunities for the sharing of sites, facilities and installations".

Compliance with Horlock Rules

5.24 The Horlock Rules provide guidance on the siting of substations and have been followed in developing the options. None of the sites are located within designated landscapes (Rule 2). The majority of the locations can take advantage of screening which is provided by existing tree belts and woodland areas (Rule 8). Effects on neighbouring land uses in terms of agricultural uses and tourism is likely, notably the Colne Valley Railway and Hedingham Castle both during construction and when operational, with some scope for mitigating these effects (Rules 5 and 6). The Horlock Rules can be found at Appendix A.

6 APPRAISAL – STUDY AREA A

6.1 A single location is put forward for options appraisal within Substation Study Area A (Location A1) shown on Figure 1. This is to the eastern side of the A1017 Dickett's Hill in a field to the north of the entrance to the Colne Valley Railway.

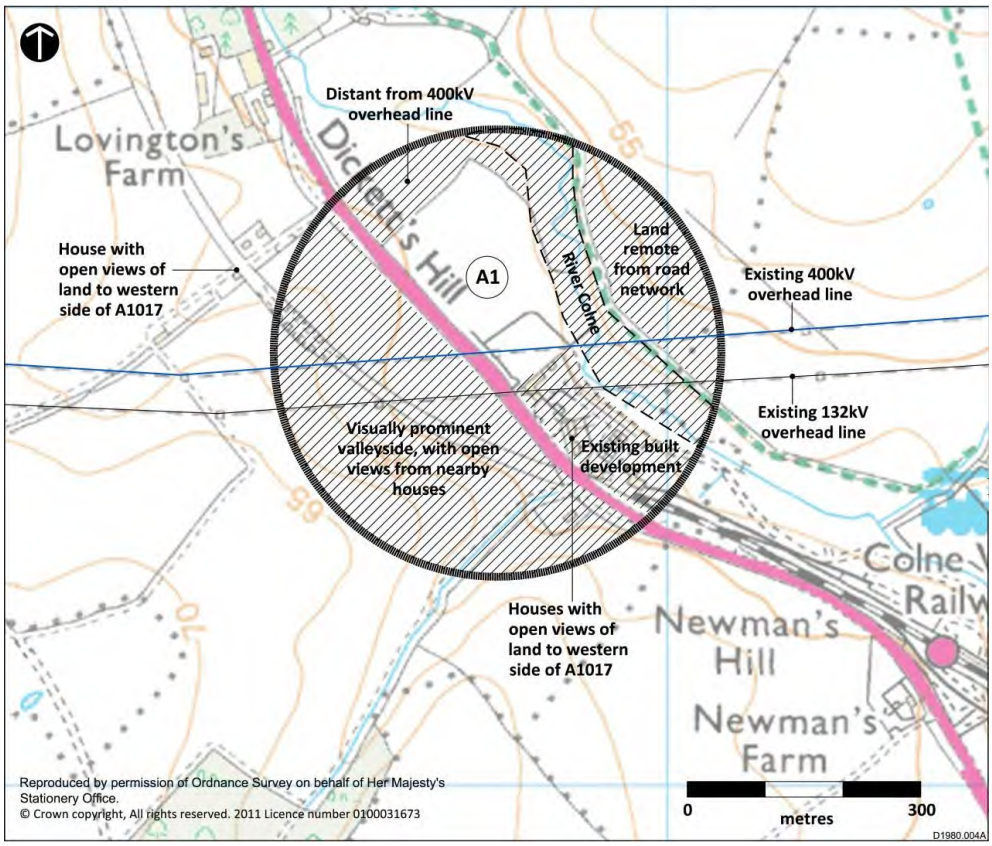


Figure 1. Substation Study Area A – Hatching indicates land discounted

Other options considered but discounted

6.2 Substation locations to the western side of the A1017 Dickett's Hill were discounted as land on this side of the main road forms part of the valley side. A substation in an elevated location would result in greater landscape effects and would be more visually prominent for residents in some nearby houses who would have some open and direct views and for road users on the A1017.

6.3 The remaining land within the substation study area circle and on the eastern side of the A1017 would be less suitable for substation development as it either already contains built development; forms part of the River Colne and its floodplain; is distant from the

existing 400kV overhead line; or, in the case of land on the eastern side of the River Colne, is too remote to easily connect to the road network (which would be needed for construction and maintenance).

APPRAISAL LOCATION A1

Site

6.4 Location A1 is east of the A1017, adjacent to the access to the Colne Valley Railway visitor attraction. The site is between the villages of Castle Hedingham and Great Yeldham, directly adjacent to the existing 400kV overhead line and close to the existing 132kV overhead line.

6.5 An AIS substation in this location would have a footprint of approximately 10000m² and can be found at the end of the report.

6.6 The orientation and layout of the 132kV AIS substation is driven by technical requirements for equipment (clearances, and operational and maintenance requirements), existing landscaping and the flood plain, incoming 132kV busbar from the Super Grid transformer (SGT) in the 400kV substation, and access road requirements.

6.7 It is proposed that the connection to the substation from the 400kV transmission line would be via a gantry type structure inside the compound with downleads between this gantry and a transmission line pylon located outside the substation compound.

6.8 A new 400kV "in-line" pylon would have to be built for this option to replace the existing pylon as the existing pylon (4YL101R) cannot be adapted for a tee-connection. In order to construct the replacement "in-line" pylon, a series of system outages would be required as well as a temporary overhead line diversion for which one temporary pylon would be required. The purpose of the temporary diversions is to allow the transfer of the high voltage conductors from the existing line in order that the new "in line" pylon can be constructed. On completion of the new pylon, the high voltage conductors would be transferred back from the temporary overhead line diversion to the new pylon. The temporary overhead line diversions would then be removed.

6.9 The new 'in-line' 400kV pylon position allows for a gantry to be constructed at the substation location as shown on the layout drawing. The gantry would be located to provide the necessary clearances for the 400kV downleads as they cross the existing roadway. The substation entrance road would be taken from the Colne Valley Railway

entrance roadway to provide the required site access for heavy vehicles to/from the site. The roadway would then continues into the 132kV substation.

6.10 With the gantry positioned as shown, the overhead outdoor AIS 400kV substation equipment would be positioned in a linear manner ensuring that the necessary clearances are achieved for operational and maintenance requirements in accordance with approved National Grid design standards. The layout also includes the necessary spatial allowances for the associated ancillary plant and equipment required for a substation of this type.

6.11 Connection to the 132kV overhead line would be by way of 132kV underground cables running approximately 400m from the substation compound to a new pylon (PCB123A), to replace the existing pylon north-west of the A1017 upon which a sealing end platform would be constructed. An extensive temporary diversion of the 132kV overhead line would be required to facilitate these works.

Technical Complexities

6.12 The protection system required is a standard National Grid solution. This option would require the construction of a new 400kV pylon and the removal of an existing pylon which would need an outage period on the existing 400kV network to accommodate a 400kV temporary diversion.

6.13 A double circuit system outage would be required on the UKPN system in order to construct the 132kV overhead line pylon. However, such an outage may not be achievable due to operational constraints.

Landscape

Baseline conditions

6.14 There are no landscape designations in or around the substation study area and therefore the landscape is considered to be of local value.

6.15 The Colne Valley in the study area and its vicinity comprises a mix of farmland and existing development, including the Colne Valley Railway visitor attraction. Farmland generally includes rough grazing and arable land. There are some hedgerows with trees marking the boundaries. There are blocks of woodland present. The grazing land is typically in the valley bottom with arable land on the sloping valley sides. The landscape in this area has a mixed character which is affected by existing features such as overhead lines, the Colne Valley Railway and buildings. The varied character of this area

is typical of semi-rural and urban fringe landscapes where there are different land uses present. This affects the quality of the landscape and reduces its sensitivity to change. The condition of the landscape is affected by development and consequently its character is not intact.

6.16 The landscape has an enclosed character created by the valley landform, which would minimise effects of future development on the wider landscape. This area has capacity to accommodate some change although large scale developments in this narrow valley could dominate and adversely affect overall character. The study area landscape has moderate capacity to accommodate a substation.

Assessment of Effects Prior to Mitigation

6.17 The development of a substation and its connections at Location A1 would require an extensive 132kV temporary diversion across approximately 4.5km of the landscape. A short 400kV temporary diversion with a single tower to the north of the existing 400kV overhead line would also be required during substation construction.

6.18 In general, temporary overhead line diversions would have temporary negative effects on landscape character, although depending on the exact route there are likely to be some longer term negative effects due to the cutting back of trees and some tree losses to establish clearances beneath the temporary overhead lines. This would contribute to the magnitude of effect (scale of change) on landscape experienced prior to mitigation.

6.19 A substation development at Location A1 would increase built development and sense of enclosure in the valley, further adding to the mix of land uses. A substation in this location would increase development in the break between villages of Great Yeldham and Castle Hedingham. There would be a moderate to high magnitude of effect (scale of change) prior to mitigation on the character of this part of the Colne Valley with effects potentially extending into the area of higher ground to the west.

Potential for mitigation

6.20 Space to carry out supplementary screen planting at Location A1 is more limited compared with other substation location options. The proposed downleads across the entrance to the Colne Valley Railway visitor attraction between the existing 400kV overhead line and substation and the 132kV underground cable route would restrict planting to the south-eastern side of the substation. Re-positioning of the Colne Valley Railway entrance would create space to include new planting, but this would be subject to discussion with the relevant landowners, Colne Valley Railway and the highway

authority and cannot be assumed in this assessment. Dense woodland planting right up to the river-side would not be appropriate in this flood plain location, although hedgerow planting to the outside of the substation compound and the 132kV underground cable route, and a belt of tree planting with low earth mounds (approximately 1m high), with scattered trees and groups of trees beyond this, would be broadly in keeping with the existing landscape character and would help to minimise effects on landscape.

6.21 There would be scope to strengthen the existing hedge line and introduce a belt of woodland planting, scattered trees and earth mounding (approximately 1m high) to the north-western edge of the substation site. There would be no benefit to supplementing the existing vegetation screening on the road-side of the substation as this would require the substation to be located further to the north-east, extending built development into the valley bottom. However, tree planting to replace any losses resulting from the 400kV temporary tower diversion would help to minimise effects in the long-term.

Assessment of Effects Following Mitigation

6.22 Following 15 years' establishment of mitigation measures, the magnitude of effect (scale of change) would be reduced to moderate negative, on a landscape which has a moderate capacity to accommodate this development. Effects on landscape character would generally be restricted to a localised area by the valley landform. The overall effect of a new substation on landscape character in this location would be minor to moderate negative with mitigation.

Visual Amenity

Baseline conditions

6.23 There is some vegetation along the banks of the River Colne, although this part of the valley bottom is relatively open. The valley sides assist in limiting views further east and west.

6.24 Existing views of Location A1 are from the A1071 which runs in a southerly direction from Great Yeldham to Castle Hedingham, houses on the A1071 at the southern edge of Great Yeldham, public rights of way to the east of Location A1 and the Colne Valley Railway visitor attraction to the south-east of Location A1, which utilises a disused section of railway in the valley bottom. The public footpath to the immediate east of Location A1 is part of Edgar Eastall's Church Fields Way published long distance walking route. Views from Castle Hedingham are prevented by intervening mature vegetation

and the Colne Valley Railway site to the south, although part of Hedingham Castle (a visitor attraction) is visible from the study area.

6.25 There are a number of engines and carriages within the Colne Valley Railway site and there are glimpsed views of these from the surrounding area, as well as views of the existing overhead lines, the A1071 and associated ribbon development.

6.26 Given the qualities of the landscape in and surrounding Study Area A and the commonplace nature of the views, views are generally of local importance. The exceptions to this are the views from Hedingham Castle, which are of greater importance.

Assessment of Effects Prior to Mitigation

Temporary Overhead Line Diversions During Construction

6.27 The development of a substation and its connections at Location A1 would require an extensive 132kV temporary diversion across approximately 4.5km of the landscape. A short 400kV temporary diversion with a single tower to the north of the existing 400kV overhead line would also be required during substation construction.

6.28 In general, temporary overhead line diversions would have temporary negative effects on views. However, depending on the exact route, views experienced from some locations on completion could be influenced by the cutting back of trees and some tree losses to establish clearances beneath the temporary overhead lines. Where this is anticipated it has been taken into account in the assessment which follows.

132kV sealing end platform tower

6.29 Siting a substation at Location A1 would require the replacement of an existing 132kV suspension tower (pylon), which is in the field on the valley side to the west of the A1017, with a 132kV sealing end platform tower in a similar location. The sealing end platform tower would be constructed of thicker steel and would include a platform partway up the pylon with downleads connecting to it. The greatest change to views would be from the nearest section of the A1017 to the entrance to the Colne Valley Railway and the houses and offices to the immediate south of this. In the long term, the magnitude of effect (scale of change) on visual receptors would generally range from low negative to negligible.

6.30 A sealing end platform tower at this location would have cumulative effects on visual receptors that could see both the pylon and the substation, which excludes the houses and offices on the A1017 closest to the new 132kV pylon. However, the sealing end

platform tower would make little contribution to the overall effect on views of a new substation.

Substation

6.31 Prior to mitigation the greatest change to views, high negative and moderate to high negative respectively, would be experienced from the access road to Colne Valley Railway and from the public footpath nearest the site (part of a published long distance route) on the eastern side of the River Colne.

6.32 A moderate negative magnitude of effect (scale of change) would be experienced prior to mitigation by users on sections of the wider public right of way network to the east and north and by road users on the A1017. The magnitude of effect (scale of change) on views from houses at and near Poole Farm would be low to moderate negative.

6.33 A low negative magnitude of effect (scale of change) would be experienced prior to mitigation by visitors within the Colne Valley Railway visitor attraction and by residential properties on the western side of the A1017 at the southern edge of Great Yeldham.

6.34 Visitors to the upper storeys of Hedingham Castle would experience a negligible magnitude of effect (scale of change) prior to mitigation.

Potential for mitigation

6.35 The potential for mitigation in relation to visual amenity is described at paragraphs 6.20 and 6.21.

Assessment of Effects Following Mitigation

132kV sealing end platform tower

6.36 Given that off-site planting to mitigate for changes to views as a result of the installation of a 132kV sealing end tower cannot be guaranteed, the low negative to negligible magnitude of effect (scale of change) anticipated for visual receptors ranging in sensitivity from low to high would result in minor negative to neutral overall effects on views in the long term.

Substation

6.37 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of the visual receptors, a moderate negative overall effect on views would be experienced from the access road to Colne

Valley Railway and from the public footpath nearest the site (part of a published long distance route) on the eastern side of the River Colne.

6.38 A minor to moderate negative overall effect on views would be experienced by visitors to the Colne Valley Railway visitor attraction, users of the public footpath network to the east and north of Location A1 and residents at houses at and near Poole Farm.

6.39 A minor negative overall effect on views would be experienced by users of the A1017.

6.40 A neutral to minor negative overall effect on views would be experienced from houses on the western side of the A1017 at the southern edge of Great Yeldham (Lovington Farmhouse, 'Crossing Cottage', 'Windermere' and a further bungalow).

6.41 A neutral overall effect on views would be experienced by visitors to the upper storeys of Hedingham Castle following 15 years' establishment of mitigation measures.

6.42 Following 15 years' establishment of mitigation measures, the overall effect on views of a substation at Location A1 would be minor to moderate negative.

Historic Environment

Baseline conditions

6.43 There are two Grade II Listed Buildings within Study Area A and a buffer of 250m from the study area boundary (Lovington's Farmhouse and Old Dramwell Cottage) and a further two within 300m (Poole House and Barn). Poole House and Barn are separated from the study area by the A1017 (Poole Street/ Dickett's Hill). Due to intervening vegetation there is very limited intervisibility between the listed buildings, or their curtilage, and the study area. Lovington's Farmhouse is separated from the study area by the A1017, and intervisibility between the curtilage of this listed building and the study area is also limited by intervening vegetation. However, given the association between a farmhouse and the agricultural landscape in which it is situated, the setting of these buildings includes the study area. The setting of Old Dramwell Cottage includes the curtilage of the building and agricultural land to the north and south, but the listed building is separated from the study area by the A1017 and the setting is limited to the north-east by the modern developments of Dramwell Houses and the Council depot. The setting of Old Dramwell Cottage does not therefore include the study area.

6.44 Hedingham Castle is approximately 1.5km from the study area; the Castle is a Scheduled Monument and Grade I listed building with further Grade II* and Grade II listed buildings in the grounds. It has a prominent position and there is intervisibility

between the upper storeys of Hedingham Castle and Study Area A. The Castle's significance includes its prominent position and the setting includes the wider landscape viewed from the Castle, encompassing Study Area A.

6.45 Buried archaeology recorded within the study area includes the non-designated site of a Roman cremation burial found in 1953 at Dickett's Hill. This asset is of moderate sensitivity. This also indicates that additional buried archaeology of the same date can be expected in this area. The A1017 is also the putative line of a Roman road. While this asset is of low sensitivity in itself, it is also an indicator of associated buried archaeology.

6.46 The Colne Valley Railway, opened in 1862 and closed 1965, passes through the study area where a disused section of the railway is visible as a cropmark. This asset is of moderate sensitivity.

6.47 A former Toll House (now Toll Cottage) is not listed and is of low sensitivity. The cropmark evidence for former field boundaries on land to the west of the A1017 is a heritage asset of negligible sensitivity. The record of a milestone 'on A604' may be wrongly located by the source, but if correctly located is of low sensitivity.

6.48 The historic landscape character comprises enclosure of a pre-18th century character (small, irregular fields). Intact hedgerows within the study area are therefore treated as 'important' in terms of the Hedgerow Regulations[21].

Assessment of Effects Prior to Mitigation

6.49 Given the orientation of Lovington's farmhouse, the separation of Location A1 and the listed building by the A1017 trunk road, and the intervening vegetation, the magnitude of effect (scale of change) of a substation at Location A1 would be very low. The overall scale of effect, for either layout, is neutral to minor negative.

6.50 The distance of separation between Location A1 and Hedingham Castle is also such that the magnitude of effect (scale of change) of a substation would be very low on this receptor. The overall scale of effect, for either layout, would be neutral to minor negative.

6.51 Given the distance of separation and intervening vegetation Location A1 would have a neutral effect on the setting of Poole House and Barn.

6.52 Location A1 would not affect the setting of Old Dramwell Cottage.

[21] Hedgerow Regulations: 1997

6.53 A substation at Location A1 could have a negative effect on previously unknown buried archaeology. The potential for buried archaeology associated with the previously recorded Roman cremation and Roman road is high. The magnitude of effect (scale of change) will be low to high on assets of low to high sensitivity. The substation would also require an underground cable connection to the existing 132kV overhead line. This also has a potential to affect buried archaeology, including the Roman road between Godmanchester and Colchester, projected to follow the course of the A1017. The estimated overall scale of effect in relation to known and potential buried archaeology would be moderate negative, due to the high potential for buried archaeology at this location.

6.54 A substation at Location A1 can be accommodated within an existing field boundary, with no hedgerow removal or change to historic landscape pattern necessary. The overall scale of effect on the historic environment would be neutral.

Potential for Mitigation

6.55 For a substation at Location A1 (including the area of proposed planting and the 132kV buried cable route), a programme of archaeological investigation, mitigation and monitoring would be required to mitigate effects on buried archaeology. The planting proposed as mitigation for landscape and visual effects would involve planting in the area of the recorded Roman cremation. This would require investigation, as root action from the planting could be damaging to buried archaeology if present.

Assessment of Effects Following Mitigation

6.56 Planting, while potentially damaging to buried archaeology, would lessen the predicted neutral to minor negative effect on the setting of Grade II listed Lovington's Farmhouse.

6.57 A substation at Location A1 would have a neutral to minor negative effect on the setting of Hedingham Castle and following 15 years' establishment of mitigation, a neutral effect on all other designated heritage assets.

6.58 Because of the potential negative effect on buried archaeology, the overall scale of effect of Location A1 in relation to the historic environment would be moderate negative. While mitigation of negative effects on buried archaeology is achievable, they are a finite and non-renewable resource and preservation in situ is preferred.

Ecology

Baseline conditions

6.59 Study Area A is situated north-west of Castle Hedingham on the A1017. This road divides Study Area A into two parcels of land; arable fields dominate the area west of the road whilst a mix of habitats including managed and unmanaged farmland and the Colne Valley Railway attraction comprise land to the east.

6.60 There are no wildlife designations within or adjacent to Study Area A.

6.61 The only two small woodland areas within Study Area A are a strip of plantation along the eastern verge of A1017 in the north and a block of plantation to the rear of Drawell Cottage in the south. There are a number of scattered trees within Study Area A, mainly associated with the banks of the River Colne and the verges of the A1017. These habitats are valued at the local level.

6.62 There is only one mature hedgerow within Study Area A; this is a species-poor hedgerow bordering the horse pasture and arable fields east of the River Colne. There are several recently planted hedgerows around the entrance to the Colne Valley Railway. Several bat species have been recorded in the wider area, but given the limited extent of this habitat it is unlikely to have a significant connective function and is valued at the local level.

6.63 The River Colne flows across the eastern side of Study Area A. There are no ponds in the study area but there are a few field ditches which may periodically hold water. There are no records of riverine species within 1km of the study area but otter have been recorded within 10km. Due to the extensive range of this species, otter could also use the watercourse within Study Area A. Due to the potential to support an otter holt, the river is valued at the district level.

6.64 The study area is dominated by farmland, with large arable fields to the west of the A1017 and east of the River Colne. A small area of semi-improved pasture lies along the east bank of the river and an area of unmanaged grassland (previously arable) is situated in the north. The intrinsic value of these grassland habitats is generally low, although there are records for harvest mouse and badger in the wider area and these species along with farmland birds may use the fields in Study Area A. These habitats are valued at the local level.

Assessment of Effects Prior to Mitigation

6.65 The construction of a substation at Location A1 would require a 132kV temporary diversion of approximately 4.5km. A short 400kV temporary diversion with a single tower to the north of the existing 400kV overhead line would also be required during substation construction. Depending on the exact route of the diversions there may be some tree losses to achieve safety clearances beneath the temporary overhead lines. It is anticipated that subject to the avoidance of woodland blocks, this would result in a moderate negative permanent magnitude of effect.

6.66 Location A1 would result in losses to the young hedgerows on both sides of the Colne Valley Railway access road. These losses would be required to create a wider access off the A1071, to create the access to the substation and to install the 132kV underground cable (which would run from the new substation to the 132kV overhead line west of the A1071). This would result in a low negative, permanent magnitude of effect.

6.67 There would be a small loss of dry ditch to create a wider access off the A1071. This would result in a low negative, medium-term magnitude of effect.

6.68 There would be a permanent loss of neutral grassland for construction of the substation, the access road and the 400kV pylon and a small loss of arable land for the 132kV pylon. This would result in a low negative, permanent magnitude of effect.

6.69 In combination the low magnitude of effects on receptors of local to district value would lead to an overall moderate negative effect on ecology as a result of Location A1 prior to mitigation.

Potential for Mitigation

6.70 The hedgerow removal required for the wider access from the A1071, the entrance to the substation and the 132kV underground cable would be mitigated by planting a new hedgerow along the verge of the new access layout and across the permanent easement of the 132kV on completion of the works. The young age of hedgerows means that this would be considered appropriate mitigation for the losses.

Assessment of Effects Following Mitigation

6.71 Replacement hedgerow planting would reduce impacts on ecology and overall the effect of Location A1 would be minor negative.

Water resources

Baseline conditions

6.72 The site has the River Colne running to the north-east which results in part of the site lying within the flood risk zone. The river is within a relatively shallow valley with steep valley sides.

Assessment of effects

6.73 A flood risk assessment (FRA) was prepared by RSK in 2012[22] for the proposed development. Location A1 is located within Flood Zone 1 according to the latest Environment Agency flood zone maps and the detailed mapping carried out within this FRA, indicates that the site is not at risk from fluvial or tidal sources. Suitable mitigation can be incorporated to ensure that flood risk to the proposed development remains low and meets the requirements of the NPPF. The substation would be located 600mm above the predicated 1 in 1000-year flood level. This equates to approximately 46.6m above ordnance datum (AOD). The FRA places the site at low risk of flooding from other sources. In accordance with the NPPF and local policy, this FRA has considered the impact on the surface water regime in the area should development occur. It concludes that development of the site should be possible without raising existing ground levels and with measures implemented for surface water run-off.

Potential for mitigation and summary

6.74 Due to the topography of the site and the surrounding area, there needs to be careful management of runoff water to maintain the current levels of flood risk further downstream. Based on the information available the flood risk to the proposed development is low and development should not be precluded on flood risk grounds.

Traffic and transport

Baseline conditions

6.75 Location A1 lies immediately adjacent to the A1017 which runs between Braintree and Haverhill. The nearest motorway to the study area is the M11. In terms of the delivery of a 169te transformer, the route suggested by Wynns would take junction 8 from the M11 onto the A120 via Braintree and onto the A131. From the A131, the transformer would

[22] RSK: Flood Risk and Drainage Assessment. Substation site A, 132kV Substation West of Twinstead Tee: August 2012.

travel through Gosfield and Sible Hedingham on the A1017 with an access to the study area north of Colne Valley Railway.

6.76 Currently there is an access from the A1017 which serves the Colne Valley Railway site, although this is not suitable for AILs.

Assessment of effects

6.77 Access to Location A1 could be taken direct from the A1017 which provides a good standard of route for construction traffic. This would need to be designed to accommodate AIL delivery vehicles. Access for AILs is considered further below.

6.78 Structures on the A131 have been assessed by Essex County Council and advised as acceptable for the proposed AILs. The A1017 has been assessed by Essex County Council as unsuitable for the proposed AILs. Gosfield Bridge No 4 is limited to 44te gross loads only. Temporary measures could be considered such as bridge rafting although the alignment of the bridge could restrict the installation of any bridging system and detailed traffic management plans of diversionary routes would be necessary as any operation would need to be undertaken under a road closure to be agreed by the highway authority and the police. The highway authority has no plans to strengthen the bridge as it is acceptable for general traffic requirements. A budget cost for full replacement of the bridge is estimated to be in the region of £1m. An alternative route through Halstead has been assessed. However, this route would also require road closures and the removal of street furniture along part of the route. The transformer delivery vehicles would have to travel very close to a scheduled monument (war memorial) and a number of buildings in this part of the village. In addition to potential effects on third parties, this alternative would also result in significant disruption.

6.79 There are other culverts on the A1017 that are of concern for loads of the weight expected for transformer delivery and which would require further assessment by Essex County Council. Should this route be used, identification of these structures would be necessary. Essex County Council is not obliged to assess such structures and have no detailed records of them.

6.80 The 44te restriction on the A1017 would also have an impact on site construction traffic moved at Special Types General Order (STGO) which although not as heavy as the transformers would still not be permitted to use this road if above 44te gross vehicle weight. The A1017 is a single carriageway with areas which would need to be carefully negotiated by construction vehicles due to tight bends. There is also a series of roundabouts along the A131 which would need to be negotiated by HGVs.

6.81 The use of the A131 would require careful planning, especially where full occupation of the road is required.

Potential for mitigation

6.82 Significant and costly engineering solutions would be required to overcome the A1017 44te gross vehicle weight limit.

6.83 Traffic Management Plans would need to be agreed with Essex County Council and Essex Police in terms of the management of AIL movements on the A131 and A1017 including possible road closures.

6.84 The site access road would need to be designed to enable AILs to turn from A1017 into the site.

Baseline conditions

6.85 Location A1 lies close to the settlement of Castle Hedingham which is a local service centre with a range of small businesses. The most relevant receptor is the Colne Valley Railway which is directly adjacent to the proposed substation. The Colne Valley Railway consists of a short section of standard gauge operational railway as well as a miniature railway and other items of railwayana, a shop and catering facilities. In addition to its normal operations, the site offers a range of special events and educational visits. It has received awards for its tourism offers.

6.86 Hedingham Castle is located to the south-east of the proposed substation site with some views of the study area from upper floors of the castle. The castle itself is a Grade I listed building and it has gardens and other listed buildings within its grounds. The castle is open to the public for the majority of the year for around 5 days a week. Events take place throughout the year and particularly through the school summer holidays. The castle and grounds may also be used as a wedding venue.

6.87 Other tourism receptors and local businesses are located at Great Yeldham and Sible Hedingham, within 5km of the site.

6.88 Alderford Mill is a white painted timber watermill set on the River Colne in Sible Hedingham. The Mill opens on the second Sunday of the month April to September as well as some specific days for events at other times of the year.

6.89 Yeldham Transport Museum is located to the south-west of Yeldham on the Hunnable Industrial Estate. The museum preserves and restores old railway carriages and buses.

6.90 There are a number of footpaths in the area and there are arranged local walks around Castle Hedingham and Sible Hedingham.

6.91 The study area is located within Grade 2 agricultural land, which is defined as the Best and Most Versatile (BMV) agricultural land.

Assessment of effects

6.92 The proposed substation in this location has the potential to impact upon the business operations of the Colne Valley Railway. It is considered likely that some short term adverse effects linked to disturbance to access would occur during construction. Although views from within this visitor attraction would be limited, the views of the substation when entering the attraction are likely to have a negative impact on visitors to the railway.

6.93 The views from Hedingham Castle would be limited due to the woodland surrounding the castle. There would be views from the upper storeys, although the substation would be viewed within the context of the surrounding built development including the adjacent Colne Valley Railway. The impacts on Hedingham Castle would be minor.

6.94 Impacts on other tourist attractions in the area would be negligible given the distances from the study area. Other built development would prevent views of the substation and impacts on the business operations of these attractions are likely to be limited.

6.95 Views from nearby footpaths on the eastern valley side are open and are likely to be impacted upon prior to mitigation.

6.96 The development would result in the loss of a small area of the best and most versatile agricultural land.

Potential for mitigation

6.97 Potential for mitigation is described in paragraphs 6.20 and 6.21.

Cost

6.98 The estimated capital cost for Location A1 is £21.9m.

Summary of Study Area A

6.99 The overall effect of a new substation on landscape character in this location would be minor to moderate negative with mitigation. With mitigation, Location A1 would have a

minor to moderate negative effect on visual amenity in the long-term. The overall scale of effect of Location A1 on the historic environment would be moderate negative, given the potential for effects on buried archaeology of both the substation and associated planting. Ecological impact would be minor negative with replacement hedgerow planting. With mitigation, Location A1 would have a minor to moderate negative effect on visual amenity in the long term.

6.100 This location is likely to be the most complex of all options from a transport point of view with significant and costly engineering solutions likely to be required to facilitate transformer movements. There would also be impacts on local economic activity surrounding and in close proximity to the study area, notably the Colne Valley Railway tourist attraction. For these reasons, National Grid considers that Location A1 should not be taken forward.

7 APPRAISAL – STUDY AREA B

7.1 Study Area B – Delvyn's Lane is in Braintree District in the county of Essex. The study area is shown at Figure 2.

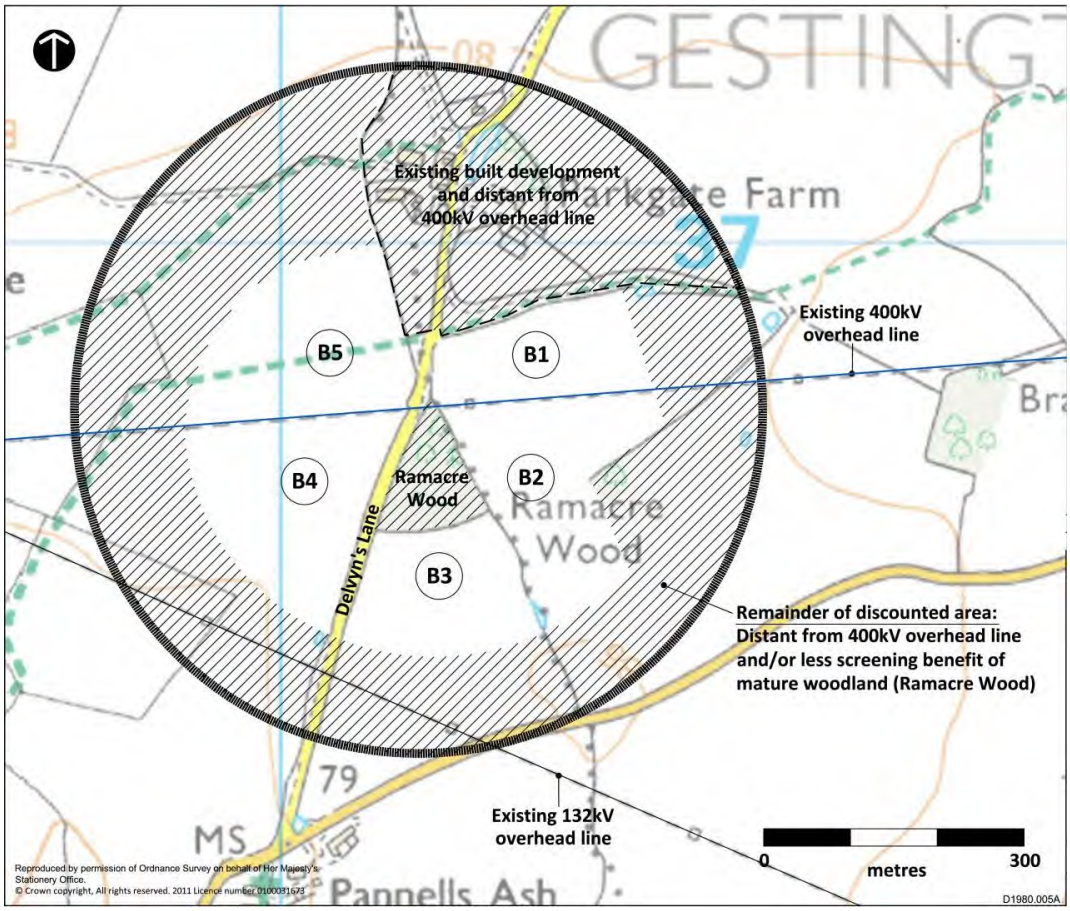


Figure 2. Substation Study Area B – Hatching indicates land discounted

Other options considered but discounted

7.2 Other locations within the study area circle were discounted as they are more distant from the 400kV overhead line, which would therefore result in a greater length of connection between the substation and existing 400kV overhead line with a corresponding increase in cost and environmental effects. These locations would also benefit less from the screening offered by mature woodland at Ramacre Wood. In the north of Study Area B, existing built development at Parkgate Farm is also a constraint.

Technical Assessment

7.3 The table below gives an approximate footprint of the AIS substation for each location:

Table 1. Approximate footprint of AIS substation – Study Area B

Location	B1	B2	B3	B4	B5
AIS m²	14000m²	13000m²	15000m²	16000m²	15000m²

7.4 The schematic layouts of the substations in each location are provided at the end of the report.

7.5 A new "in-line" pylon would have to be built for all options within Study Area B to replace the existing pylon which cannot be adapted for a tee-connection. In order to construct the replacement "in-line" pylon, a series of system outages would be required as well as a temporary overhead line diversion for which one temporary pylon would be required. The purpose of the temporary diversion is to allow the transfer of the high voltage conductors from the existing line in order that the new "in line" pylon can be constructed. On completion of the new pylon, the high voltage conductors would be transferred back from the temporary overhead line diversion to the new pylon. The temporary overhead line diversion would then be removed.

7.6 The new 'in-line' 400kV pylon position 4YL092/3RA allows for a landing gantry to be constructed at the substation location as shown on the layout drawings. The gantry is located to provide the necessary clearances for the 400kV downleads. The substation entrance road would run west of the existing pylon 4YL092 to provide the required site access for heavy vehicles to/from the site.

7.7 For all options other than Location B3, it is proposed that the connection from the substation to the 400kV transmission line would be via a gantry type structure inside the compound with downleads between this gantry and the transmission line tower (pylon) which is located outside the substation compound. Location B3 would be connected from the substation to the 400kV transmission system via downleads from the overhead line tee point to a low height pylon (L2 SFX pylon) which would connect onto a substation lattice gantry.

7.8 The primary factors in setting out the substation plans include location of existing 400kV pylon, existing roadway infrastructure, existing landscaping, location of the existing

400kV overhead line, and orientation requirement for the new 400kV landing gantry and L2 SFX pylon, where applicable.

7.9 With the gantry positioned as shown, the overhead outdoor AIS 400kV substation equipment would be positioned to ensure that the necessary clearances are achieved for operational and maintenance requirements in accordance with approved National Grid design standards. The orientation and layout of the 132kV AIS substation is driven by technical requirements for equipment (clearances, and operational and maintenance requirements), existing landscape features around the proposed site, incoming 132kV busbar from the Super Grid Transformer (SGT) in a 400kV substation, the existing 400kV overhead line, and access road requirements.

Technical Complexities

7.10 The positioning of the temporary transmission line masts may give rise to increased on-site management and precautions, and working methods due to the risks associated by oversailing live transmission lines.

7.11 There are no significant substation technical complexities associated with Locations B1 and B5. These options are therefore considered (for comparison to other options) as "base case" complexity. There are increased complexity issues associated with Locations B2, B3 and B4 as the proposed arrangements form a tee connection to the "Southern" circuit of the 4YL route (Southern Circuit is the Pelham – Braintree – Rayleigh circuit). A temporary non-standard solution is therefore required for these options, which involves the creation of a "four-ended" circuit. This "four-ended" circuit is required to operate for the period of construction works prior to the completion of the new 400kV route.

7.12 The connection to any substation located to the north of the 400kV line would be via downleads from a transmission line pylon located outside the substation compound to a gantry type structure inside the compound.

7.13 Where a substation option is located to the south of the transmission line, it would be possible to effect a connection to the northern circuit via a sealing end compound and underground cables. However, the "four-ended circuit" would be a temporary arrangement, resolved with the completion of the new 400kV route. Given this temporary requirement, National Grid would seek a derogation against the requirements of the NETS SQSS from OFGEM, for the intervening period. This is the most co-ordinated, efficient and economical way to resolve the temporary complexities should a southern Location at B2, B3 and B4 be preferred. This also meets the requirement that derogations should have a period where the non-compliance shall be resolved, as is the

case for this temporary complexity. Any derogation would need to be obtained prior to submitting an application for a Development Consent Order if these locations were chosen.

7.14 Locations B2, B3 and B4 involve additional system access as they would connect from application. They are more technically complex options than Locations B1 and B5 and would need to be factory tested and type registered. This would need to be obtained prior to submitting a Development Consent Order.

Landscape

Baseline Conditions

7.15 There are no landscape designations in or around the substation study area and therefore the landscape is of local value.

7.16 Substation Study Area B is in a predominantly rural and sparsely developed landscape which comprises undulating arable land, interspersed with blocks of woodland. Fields have a mixture of open and hedgerow boundaries with hedgerow trees. Settlements are typically villages and farms and individual residential properties are dispersed throughout the local landscape.

7.17 The character of the western part of the study area and of the surrounding landscape is generally more open than to the east. There are typically fewer field boundary hedges and woodlands in the landscape to the immediate west which gives rise to a more open character. Landform gently falls away to the north-west from the relative high point of the study area which increases the extent of visibility of this part of the site from the surrounding area and the sense of openness. To the south-west, landform rises to a high point at the eastern side of Castle Hedingham and the castle and there is a significant area of mature woodland on the slopes around the castle which limits visibility further in this direction. The eastern part of the study area (east of Delvyn's Lane) has a more enclosed and wooded character. This character is largely as a result of Ramacre Wood, linear tree belts along hedgelines and other smaller groups of trees in the immediate locality.

7.18 The landscape is of local value and has a low to moderate capacity to accommodate a substation. Its rural character is largely intact although it is affected to some extent by the two existing overhead lines. The western part of the study area has a greater degree of openness which could be adversely affected by development and consequently is more sensitive to change than the eastern part of the study area.

Assessment of Effects Prior to Mitigation

7.19 The construction of a substation at any of the substation locations in Study Area B would require a short 400kV temporary diversion with a single tower to the north of the existing 400kV overhead line. In general, temporary overhead line diversions would have temporary negative effects on landscape character. Depending on the exact route there are likely to be some longer-term negative effects due to the cutting back of trees and some tree losses on Delvyn's Lane and to the north of Ramacre Wood to establish clearances beneath the temporary overhead lines. This would contribute to the magnitude of effect (scale of change) on landscape for each location prior to mitigation.

7.20 All substation options would introduce a new and incongruous feature in a predominantly rural setting. However, Locations B1, B2 and B3 are east of Delvyn's Lane and offer greater potential than other options to minimise effects on landscape because a substation could be sited in a relatively enclosed area near to existing woodland.

7.21 Introducing a new substation at Locations B1, B2 or B3 would result in a moderate to high negative magnitude of effect (scale of change) prior to mitigation.

7.22 Introducing a new substation at either of the Locations B4 and B5 in this study area would result in a high negative magnitude of effect (scale of change), prior to mitigation.

Potential for Mitigation

7.23 There is adequate space to carry out supplementary planting at all locations in the study area, although space is more limited to the north of Location B1. Supplementary planting would consist of woodland planting and use of low mounds (approximately 2m high) around the peripheries of the substation sites, which are not already screened by mature vegetation. This would include planting close to the existing overhead line where downleads and gantries are proposed. The screening offered by existing field boundaries would be strengthened with supplementary planting where this would help to reduce negative effects on landscape character. A combination of woodland planting and hedgerow planting would be used to either side of the substation access road so that it would appear similar to a lane or farm track.

7.24 Mitigation measures would be most effective for Locations B1, B2 and B3, east of Delvyn's Lane, where establishing woodland would supplement the enclosure and screening provided by existing woodland and tree lined field boundaries.

Assessment of Effects Following Mitigation

7.25 Following 15 years establishment of woodland planting, the magnitude of effect (scale of change) on landscape character as a result of a substation at Locations B1, B2 and B3 would be reduced to moderate negative, on a landscape with a low to moderate capacity to accommodate a substation. The overall effect on landscape character would be moderate negative with mitigation. Although the overall judgement is the same for Locations B1, B2 and B3, mitigation would be most effective for screening a substation at Location B2.

7.26 With mitigation measures in place, effects on landscape character as a result of a substation at Location B4 or B5 would be higher than other locations due to the more open character. There would be a moderate to high negative magnitude of effect (scale of change) on landscape character. The overall effect on landscape character would be moderate to major negative with mitigation.

Visual Amenity

Baseline Conditions

7.27 The study area is on a low rise in the undulating arable landscape. However Ramacre Wood and tall hedgerows and hedgerow trees limit views, particularly in the eastern half of the study area. The character of the western part of the study area and of the surrounding landscape is more open than to the east, which gives rise to longer distance and unrestricted views to the north-west in particular. To the south-west landform rises to a high point at the eastern side of Castle Hedingham and the castle and there is a significant area of mature woodland on the slopes around the castle which limits visibility further in this direction.

7.28 Existing views of Study Area B are from the B1508 Sudbury Road, Delvyn's Lane, the public right of way network within and in the vicinity of the study area, houses at the southern edge of Gestingthorpe (in Audley End), farmsteads and individual houses at the eastern edge of Castle Hedingham and residential property within or close to the substation study area at Parkgate Farm and two properties at Pannells Ash Farm (one of which is holiday accommodation).

7.29 Given the qualities of the landscape in and surrounding Study Area B and the commonplace nature of the views, views are generally of local importance.

Assessment of Effects Prior to Mitigation

Temporary Overhead Line Diversions During Construction

7.30 The construction of a substation at any of the substation locations in Study Area B would require a short 400kV temporary diversion with a single tower to the north of the existing 400kV overhead line.

7.31 In general, temporary overhead line diversions would have temporary negative effects on views. However, depending on the exact route views experienced from some locations on completion could be influenced by the cutting back of trees and some tree losses on Delvyn's Lane and to the north of Ramacre Wood to establish clearances beneath the temporary overhead lines. Where this is anticipated it has been taken into account in the assessments which follow.

132kV sealing end platform tower – all options

7.32 Options at Locations B1, B2 and B3 would require the replacement of an existing 132kV suspension tower, in arable land within the substation study area, with a 132kV sealing end platform tower in a similar location. There would be views from some nearby properties as well as road and footpath users although these would be largely obscured by existing vegetation. The magnitude of effect (scale of change) for visual receptors would generally be low negative to negligible. A sealing end platform tower at these locations could have cumulative effects on a few visual receptors that could see both the pylon and the substation; however, the low negative to negligible effects mean that the sealing end platform tower would make little contribution to the overall effect on views of a new substation.

7.33 Options at Locations B4 and B5 would require the replacement of an existing 132kV suspension tower, on arable land to the west of Ramacre Wood in the south-western part of the substation study area, with a 132kV sealing end platform tower in a similar location. There would be views from some nearby properties as well as road and footpath users. Given that a sealing end platform tower would replace an existing pylon of a similar height in a similar position, the magnitude of effect (scale of change) for all these visual receptors would be low negative to negligible. A sealing end platform tower at this location would have cumulative effects on a few visual receptors that could see both the pylon and the substation; however the low negative to negligible magnitude of effects (scale of change) mean that the sealing end platform tower would generally make little contribution to the overall effect on views.

Location B1

7.34 Prior to mitigation a moderate to high negative magnitude of effect (scale of change) would be experienced by users of Delvyn's Lane.

7.35 Prior to mitigation a moderate negative magnitude of effect (scale of change) would be experienced by users of the public right of way to the immediate north of Location B1 and residents at Parkgate Farm.

7.36 Prior to mitigation a low negative magnitude of effect (scale of change) would be experienced by users of the B1508 Sudbury Road and residents at Pannells Ash Farm.

7.37 A low negative to negligible magnitude of effect (scale of change) would be experienced prior to mitigation by more distant receptors, which are users of the public right of way network to the south and east, users of the minor road through Audley End and the lane south of the B1508, residents at Audley End to the east and at New Barn and Little Chelmshoe House to the south-east.

Location B2

7.38 Prior to mitigation a moderate negative magnitude of effect (scale of change) would be experienced by users of Delvyn's Lane and residents at Parkgate Farm.

7.39 A low to moderate negative magnitude of effect (scale of change) would be experienced prior to mitigation by users of the public footpath approximately 0.15km north of Location B2 and users of the B1508 Sudbury Road.

7.40 Prior to mitigation a low negative magnitude of effect (scale of change) would be experienced by residents at Pannells Ash Farm, and more distant houses at Audley End to the east and at New Barn and Little Chelmshoe House to the south-east.

7.41 A negligible to low negative magnitude of effect (scale of change) would be experienced prior to mitigation by more distant receptors, which are users of the public right of way network to the south and east and users of the minor road through Audley End and the lane south of the B1508.

Location B3

7.42 Prior to mitigation a moderate to high negative magnitude of effect (scale of change) would be experienced by users of Delvyn's Lane.

7.43 A moderate negative magnitude of effect (scale of change) would be experienced prior to mitigation by users of the B1508 Sudbury Road.

7.44 A low to moderate negative magnitude of effect (scale of change) would be experienced prior to mitigation by users of public footpaths and residents at Pannells Ash Farm.

7.45 A low negative magnitude of effect (scale of change) would be experienced prior to mitigation by residents at Parkgate Farm, the public rights of way to the north, south and east and more distant houses at Audley End to the east and at New Barn and Little Chelmshoe House to the south-east.

7.46 A low negative to negligible magnitude of effect (scale of change) would be experienced prior to mitigation by more distant receptors, which are residents at Lawrence's Farm and Pantile Cottage, users of the public right of way network to the south-west and users of the minor road through Audley End and the lane south of the B1508.

Location B4

7.47 Prior to mitigation a high negative magnitude of effect (scale of change) would be experienced by users of the public footpaths crossing fields immediately west of Delvyn's Lane and users of the B1508 Sudbury Road (0.4km to the south of Location B4).

7.48 Prior to mitigation a moderate to high negative magnitude of effect (scale of change) would be experienced by users of Delvyn's Lane.

7.49 Prior to mitigation a low to moderate negative magnitude of effect (scale of change) would be experienced by residents at Parkgate Farm and Pannells Ash Farm and from the public footpath and section of lane south of the B1508 Sudbury Road and west of Kendallscroft Grove (approximately 0.8 to 1.0km distant).

7.50 A low negative magnitude of effect (scale of change) would be experienced prior to mitigation by residents at more distant dwellings at Great Lodge Farm and Lawrence's Farm (approximately 0.5km to the west), and Pantile Cottage (approximately 0.7km to the south-east) and nearby houses further west on the B1508, and from the public rights of way network further west.

Location B5

7.51 Prior to mitigation a high negative magnitude of effect (scale of change) would be experienced by users of public footpaths crossing fields west of Delvyn's Lane.

7.52 Prior to mitigation a moderate to high negative magnitude of effect (scale of change) would be experienced by users of Delvyn's Lane.

7.53 A moderate negative magnitude of effect (scale of change) would be experienced by users of the B1508 Sudbury Road.

7.54 A low to moderate negative magnitude of effect (scale of change) would be experienced by residents at Parkgate Farm and Pannells Ash Farm.

7.55 A low negative magnitude of effect (scale of change) would be experienced prior to mitigation by residents at more distant dwellings at Great Lodge Farm and Lawrence's Farm (approximately 0.5km to the west), and Pantile Cottage (approximately 0.7km to the south-east) and nearby houses further west on the B1508, from the public footpath and section of lane south of the B1508 Sudbury Road and west of Kendallscroft Grove (approximately 1.0km distant), and from the public right of way network further west.

Potential for mitigation

7.56 There is adequate space to carry out supplementary planting at all locations in the study area, although space is more limited to the north of Location B1. Supplementary planting would consist of woodland planting and use of low mounds (approximately 2m high) around the peripheries of the substation sites, which are not already screened by mature vegetation. This would include planting close to the existing overhead line where downleads and gantries are proposed. The screening offered by existing field boundaries would be strengthened with supplementary planting where this would help to reduce negative effects on landscape character. A combination of woodland planting and hedgerow planting would be used to either side of the substation access road so that it would appear similar to a lane or farm track.

7.57 Mitigation measures would be most effective for Locations B1, B2 and B3, east of Delvyn's Lane, where establishing woodland would supplement the enclosure and screening provided by existing woodland and tree lined field boundaries. Although, there would be less space to plant to the north and north-west of Location B1.

Assessment of Effects Following Mitigation

132kV sealing end platform tower – all options

7.58 Given that off-site planting to mitigate for changes to views as a result of the installation of a 132kV sealing end tower cannot be guaranteed, the negligible to low negative

magnitude of effect (scale of change) anticipated for visual receptors ranging in sensitivity from low to high would result in a neutral to minor negative overall effect on views.

Location B1

7.59 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of the visual receptors, a minor to moderate negative overall effect on views would be experienced by users of the public footpath to the north of substation Location B1 and by residents at Parkgate Farmin the long term.

7.60 A minor negative overall effect on views would be experienced by road users on Delvyn's Lane and the B1508 Sudbury Road.

7.61 Following 15 years' establishment of mitigation, a neutral overall effect on views would be experienced by users of the public right of way network, approximately 1.0km to the south and 0.5 to 1.0km to the east, users of the minor road through Audley End and the lane south of the B1508 (both approximately 1.0km distant), residents at Pannells Ash Farm, houses at Audley End and at New Barn and Little Chelmshoe.

7.62 Following 15 years' establishment of mitigation measures, the overall effect on views of a substation at Location B1 would be minor negative.

Location B2

7.63 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of the visual receptors, a minor negative overall effect on views would be experienced by users of the public footpath approximately 0.15km to the north of Substation Location B2, road users on Delvyn's Lane and the B1508 Sudbury Road, and residents at Parkgate Farm and Pannells Ash Farm.

7.64 Following 15 years' establishment of mitigation, a neutral overall effect on views would be experienced by users of the public right of way network (approximately 0.5 to 1.0km to the east), users of the minor road through Audley End and the lane south of the B1508 (both approximately 1.0km distant), and houses at Audley End and at New Barn and Little Chelmshoe.

7.65 Following 15 years' establishment of mitigation measures, the overall effect on views of a substation at Location B2 would be minor negative.

Location B3

7.66 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of the visual receptors, a minor to moderate negative overall effect on views would be experienced by residents at Pannells Ash Farm and road users on Delvyn's Lane.

7.67 A minor negative overall effect on views would be experienced by users of the public footpath approximately 0.25km to the north of Substation Location B3, users of the public right of way network (approximately 0.5km to the south, 0.8km to the south-west and 0.5 to 1.0km to the east) the B1508 Sudbury Road, and residents at Parkgate Farm.

7.68 Following 15 years' establishment of mitigation, a minor negative to neutral overall effect on views would be experienced by users of the minor road through Audley End and the lane south of the B1508 (both approximately 1.0km distant), and houses at Audley End, New Barn and Little Chelmshoe and Lawrence's Farm and Pantile Cottage.

7.69 Following 15 years' establishment of mitigation measures, the overall effect on views of a substation at Location B3 would be minor negative.

Location B4

7.70 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of the visual receptors, a moderate negative overall effect on views would be experienced by footpath users on the public rights of way which cross the fields immediately west of Delvyn's Lane.

7.71 A minor to moderate negative overall effect on views would be experienced by residents at Parkgate Farm and Pannells Ash Farm.

7.72 A minor negative overall effect on views would be experienced by road users on Delvyn's Lane and the B1508 Sudbury Road and users of the public footpath to the south of the B1508 Sudbury Road (to the west of Kendallscroft Grove).

7.73 Following 15 years establishment of mitigation, the overall effect on views of a substation at Location B4 would be minor to moderate negative.

Location B5

7.74 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of the visual receptors, a moderate

negative overall effect on views would be experienced by footpath users on the public rights of way which cross the fields immediately west of Delvyn's Lane.

7.75 A minor to moderate negative overall effect on views would be experienced by residents at Parkgate Farm and Pannells Ash Farm.

7.76 A minor negative overall effect on views would be experienced by road users on Delvyn's Lane and the B1508 Sudbury Road and users of the public footpath to the south of the B1508 Sudbury Road (to the west of Kendallscroft Grove).

7.77 Following 15 years' establishment of mitigation, a minor negative to neutral overall effect on views would be experienced by visual receptors on the public right of way network further to the west, on the section of lane to the south of the B1508 Sudbury Road (to the west of Kendallscroft Grove), and at houses at Great Lodge Farm, Lawrence's Farm and Pantile Cottage and nearby properties.

7.78 Following 15 years establishment of mitigation measures, the overall effect on views of a substation at Location B5 would be minor to moderate negative.

Historic Environment

Baseline conditions

7.79 There are seven Grade II Listed Buildings within Study Area B, and a buffer of 250m from the Study Area boundary.

7.80 Parkgate Farm includes a group of three Grade II listed buildings; the farmhouse, stables and cart lodges, and outbuildings. The shared setting of this group of buildings includes surrounding agricultural landscape, extending to include the study area.

7.81 Pannells Ash Farm includes a group of three Grade II listed buildings; the farmhouse, barn and outbuildings. The shared setting of this group of buildings includes surrounding agricultural landscape, extending to include the southern part of the study area.

7.82 A Grade II listed milestone on the south verge of the Sudbury Road, to the west of Pannells Ash Farm has a setting that includes the road and verge, but does not include the study area.

7.83 Hedingham Castle is approximately 1.5km from the study area; the Castle is a Scheduled Monument and Grade I listed building with further Grade II* and Grade II listed buildings in the grounds. It has a prominent position and there is intervisibility

between the upper storeys of the keep at Hedingham Castle and Study Area B. The Castle's significance includes its prominent position and the setting includes the wider landscape viewed from the Castle, encompassing Study Area B.

7.84 The cropmark evidence for former field boundaries on land to the north of the Sudbury Road is a heritage asset of negligible sensitivity.

7.85 The historic landscape character comprises enclosure of a pre-18th century character (small, irregular fields). Intact hedgerows within the study area are therefore treated as 'important' in terms of the Hedgerow Regulations.

Assessment of Effects Prior to Mitigation

All options

7.86 Given the distance of separation and intervening vegetation between Study Area B and Castle Hedingham the magnitude of effect for any of the proposed locations, would be negligible on this receptor. The overall scale of effect, for any of the layouts, would be neutral.

Location B1

7.87 A substation at Location B1 would have a negative effect on the setting of three Grade II listed buildings at Parkgate Farm. Given the intervening vegetation, views between these listed buildings and Location B1 would be filtered and the magnitude of effect (scale of change) would be low negative.

7.88 A substation would not affect any known buried archaeology (including the access track, planting area and underground cable connection common to both layouts). There are no strong indicators to suggest that the potential for buried archaeology is high at this location, but also there are no indicators (such as former quarries) to indicate a very low potential; the potential for unknown archaeology is therefore moderate. In relation to buried archaeology, this indicates that the magnitude of negative effect would be low to moderate on assets of low to moderate sensitivity.

7.89 A substation at Location B1 there would be a negligible to very low negative magnitude of effect (scale of change) on historic landscape character through introduction of a new permanent access track which would breach a hedgerow that forms part of a pre-18th century character field pattern, and is therefore treated as if it were 'important' in terms of the Hedgerow Regulations.

7.90 The overall scale of effect at Location B1 with regard to the historic environment would be minor negative.

Location B2

7.91 A substation at Location B2 would have a negative effect on the setting of three listed buildings at Pannells Ash Farm. However, given the separation of the listed buildings from Location B2 by the Sudbury Road, and the intervening vegetation, the magnitude of effect (scale of change) is very low. The substation or associated access track, planting area and underground cable connections would not affect any known buried archaeology. The potential for unknown archaeology is moderate. In relation to buried archaeology, the predicted magnitude of negative effect would be low to moderate on assets of low to moderate sensitivity.

7.92 A substation at Location B2 there would be a low negative magnitude of effect (scale of change) on historic landscape character through introduction of a new permanent access track which breaches a hedgerow that forms part of a pre-18th century character field pattern and is therefore treated as if it were 'important' in terms of the hedgerow regulations.

7.93 The overall scale of effect at Location B2, with regard to the historic environment, would be minor negative.

Location B3

7.94 A substation at Location B3 would have a negative effect on the setting of three listed buildings at Pannells Ash Farm. However, given the separation of the listed buildings from Location B3 by the Sudbury Road, and the intervening vegetation, the magnitude of effect (scale of change) would be low negative. A substation, including associated access track and planting area would not affect any known buried archaeology. The potential for unknown archaeology is moderate. In relation to buried archaeology, the predicted magnitude of negative effect would be low to moderate negative on assets of low to moderate sensitivity.

7.95 The overall scale of effect at Location B3, with regard to the historic environment, would be minor negative.

Location B4

7.96 A substation at Location B4 would have a negative effect on the setting of three listed buildings at Pannells Ash Farm and three listed buildings at Parkgate Farm. However, given the separation of the listed buildings at Pannells Ash Farm from Location B4 by the Sudbury Road, and the intervening vegetation, the magnitude of effect (scale of change) would be low negative. The magnitude of effect (scale of change) would also be low negative with respect to Parkgate Farm, again due to intervening vegetation which limits the views between the listed buildings and substation location. A substation (or associated track or underground cable) would not affect any known buried archaeology. The potential for unknown archaeology is moderate. In relation to buried archaeology, the predicted magnitude of effect (scale of change) would be low to moderate negative on assets of low to moderate sensitivity.

7.97 A substation at Location B4 would have a very low negative magnitude of effect (scale of change) on historic landscape character through the introduction of a new permanent access track.

7.98 The overall scale of effect at Location B4, with regard to the historic environment, would be minor negative.

Location B5

7.99 A substation at Location B5 would have a negative effect on the setting of three listed buildings at Parkgate Farm. There is limited intervening vegetation to obscure views from Parkgate Farm towards Location B5 and the magnitude of effect (scale of change) would therefore be moderate negative.

7.100 The substation or associated access track or underground cable connection, would not affect any known buried archaeology. The potential for unknown archaeology is moderate. In relation to buried archaeology, the predicted magnitude of effect (scale of change) would be low to moderate negative on assets of low to moderate sensitivity.

7.101 A substation at Location B5 would have a very low negative magnitude of effect (scale of change) on historic landscape character through the introduction of a new permanent access track.

7.102 The overall scale of effect at Location B5, with regard to the historic environment, would be moderate negative.

Potential for mitigation

7.103 For any of the locations in Study Area B (including access track, planting and 132kV buried cable connection corridors) a programme of archaeological investigation, mitigation and monitoring would be required to mitigate effects on potential buried archaeology.

Assessment of Effects Following Mitigation

7.104 The planting proposals would reduce the predicted effect on the setting of Parkgate Farm and Pannells Ash Farm, in relation to Locations B1, B2 and B3, from neutral to minor negative.

7.105 The overall scale of effect of Locations B1, B2, B3 and B4 would be minor negative with regard to the historic environment (taking account of potential effects on buried archaeology as well as effects on the setting of designated heritage assets). The overall scale of effect of Location B5 would be moderate negative (in relation to the setting of listed buildings at Parkgate Farm).

7.106 Some of the substation options at Study Area B would require underground cable connections; the length of connection is comparable for each location and is not a distinguishing factor in comparing the effects of different locations. The proposed planting schemes associated with Locations B1, B2 and B3 would require additional land take and therefore increase the probability of encountering previously unrecorded buried archaeology. The planting would, however, lessen the minor negative effects of these options on listed buildings at Parkgate Farm and Pannells Ash Farm, which following mitigation would be neutral.

Ecology

Baseline conditions

7.107 Study Area B is dominated by arable fields with species-rich hedgerow boundaries and two small areas of woodland. The area is divided by Delvyn's Lane which runs north/south through the centre of the site.

7.108 The verges along Delvyn's Lane are designated by Essex County Council as Special Roadside Verges (SRV) and are valued at the county level. The only other wildlife designation within or adjacent to Study Area B is a SRV just south-east of the site along Sudbury Road. This is also valued at the county level.

7.109 There are only two small woodland areas within Study Area B. Ramacre Wood in the centre of the site is predominately a broad-leaved plantation with an area of coniferous planting in the centre. The woodland behind Parkgate Farm is also broadleaved plantation. There are a number of scattered trees within Study Area B, mainly associated with Parkgate Farm and a remnant field boundary in the east. These habitats are likely to support nesting and foraging woodland bird species and may support foraging or roosting bats, although their relatively small size limits the value. They are unlikely to support dormouse and no records for this species are held for the wider area. These habitats are valued at the district level.

7.110 There are numerous mature species-rich hedgerows within Study Area B. They are associated with the plantation woodland, the SRVs and a green lane and as such are likely to have and important connective function within the local landscape and are valued at the district level.

7.111 There are five ponds within or adjacent to Study Area B and there are also a few field ditches which may periodically hold water. There are no records of water vole within 1km of the Area but two of the ponds support a small size class population of great crested newts. The aquatic habitats are valued at the county level.

7.112 The study area is dominated by arable fields. A small area of semi-improved pasture lies south of Parkgate Farm and small areas of unmanaged neutral grassland are situated along the green lane, just north of Ramacre Wood and adjacent to arable fields in the far west. The intrinsic value of these grassland habitats is generally low, although there are records for harvest mouse and badger in the wider area and these species along with farmland birds may use the fields in Study Area B. These habitats are valued at the local level.

Assessment of Effects Prior to Mitigation

7.113 All five location options fall within arable fields and therefore impacts across the options would be similar. All options will require a new pylon (in arable land) on the 400kV line and the 132kV line, (the adjacent existing pylon on each line would be removed). A gantry would be required for Location B3 but this structure will also fall within arable land and does not represent a significant increase in habitat loss compared to options without a gantry. The main differences between options are the route of the access road and the 132kV underground cable connection.

All options

7.114 The construction of a substation at any location within Study Area B would require a short 400kV temporary diversion with a single tower to the north of the existing 400kV overhead line. Depending on the exact route of the diversions there may be some tree losses on Delvyn's Lane and to the north of Ramacre Wood to achieve safety clearances beneath the temporary overhead lines. It is anticipated that this would result in a low negative, permanent magnitude of effect.

7.115 There would be no loss of Special Roadside Verges (SRV), woodland or scattered trees under any of the options, the transport assessment has identified some potential for minor tree pruning adjacent to the B1058 but vehicles will remain within the highway and trailers will only oversail the verges.

7.116 There would be a permanent loss of a section of species-rich hedgerow (south-east of Ramacre Wood) for the access road and 132kV underground cable as a result of Location B1 or B2. This would result in a low negative, permanent magnitude of effect for these options.

7.117 There would be no loss of ponds (or terrestrial habitat within 50m of a great crested newt breeding pond) but there will be a small loss of field ditch (south-east of Ramacre Wood) for the access road and 132kV underground cable under Location B1 or B2. This would result in a low negative, medium-term magnitude of effect for these options.

7.118 There would be a permanent loss of arable land for construction of the substation, the access road and the 400kV and 132kV pylons for all options and a temporary loss of the 132kV underground cable route. This would result in a low negative, permanent magnitude of effect.

7.119 In combination the low magnitude of effects on receptors of local to county value would lead to an overall minor negative effect on ecology as a result of Locations B1, B2, B3, B4 and B5 prior to mitigation.

Potential for mitigation

7.120 The hedgerow removal required for the access to the substation and the 132kV underground cable as a result of Locations B1 or B2 would be compensated by landscaping proposals around the new substation. Impacts to the field ditch as a result of Locations B1 or B2 would be minimised by installing a culvert to prevent fragmentation of habitat at the road crossing.

7.121 For all options in Study Area B, new landscape planting around the substation would reduce impacts on ecology to minor negative to neutral.

7.122 Although all options at Study Area B would have similar impacts on ecology, there is a slight preference for Location B3 which avoids hedgerow loss and has the shortest access route, with the next preference for Locations B4 or B5.

Water Resources

7.123 The Environment Agency has produced Flood Zone maps for much of England and Wales. The latest Flood Zone map shows the substation study area to be located in Flood Zone 1, indicating flood risk from fluvial and tidal sources is low.

7.124 The Environment Agency has recently published flood mapping as a result of potential failure of reservoirs. This map shows the substation study area is not in an area at risk of flooding from this source.

7.125 Given the proposed use, flood risk from groundwater and other sources is considered low.

7.126 It is likely that the development of the substation would include an element of impermeable area. Any impact on the surrounding area as a result of the increased surface water runoff rates and volumes would need to be considered. However, the majority of the site would undergo a process of topsoil stripping and covering with a suitable aggregate to allow access and this would allow natural infiltration to occur in a manner similar to that of the predevelopment situation. The effect for all options would be broadly similar.

Traffic and transport

Baseline conditions

7.127 Delvyn's Lane is a minor road which leaves the B1058 at Pannells Ash. The B1058 runs from the A1017 at Sible Hedingham to the A131 at Bulmer Tye, south of Sudbury. The nearest motorway to the study area is the M11. In terms of the delivery of a 169te transformer, the route highlighted in the Wynns report would take junction 8 from the M11 onto the A120 via Braintree and onto the A131. From the A131, the transformer would travel along the B1058 westbound. An access track from Sudbury Road would then lead to the substation Location.

Assessment of effects

7.128 The B1058 and Delvyn's Lane could accommodate normal construction and operational traffic. Access for AILs is considered further below. Structures on the A131 have been assessed by Essex County Council and assessed as acceptable for the proposed AILs.

7.129 The B1058 has 2 culverts that have not been assessed for load carrying capacity and AIL requirements at OS References TL 832 379 (near Hole Farm) and TL 820 370 (near Mill House). Essex County Council requires that protective measures would be required before the AIL is permitted to cross these culverts. Installing substantial steel plates may be a temporary solution although the exact method would need to be confirmed with Essex County Council before agreement could be secured. Such an operation may be required to take place under a road closure order.

7.130 Use of the A131 requires careful planning especially where full occupation of the road is required in locations such as Halstead. It would be necessary for detailed traffic management plans, possible temporary road closures and street furniture removal to be agreed with Essex County Council and Essex Police prior to movement. The left turn from the A131 to the B1058 has been surveyed and swept path assessments produced which confirm that access is considered to be negotiable within the public highway. There is no requirement to utilise third party land and any modification works can be undertaken within the existing highway. Any remedial works would need to be confirmed as acceptable to Essex County Council. It would be necessary for ground strengthening works to be agreed where the kerb is overrun.

7.131 The B1058 has been surveyed and swept path assessments produced. These confirm that the B1058 can be negotiated with full occupation of the road by the AIL. There would be trailer oversail but this would be over verges within the public highway and no access is required over third party land. There may be a requirement for some minor tree pruning adjacent to the B1058 depending on foliage present at the time of movement. Turn into any new substation access road would need to be designed to accommodate AIL delivery vehicles.

7.132 In terms of construction vehicles, there are narrow road sections and tight bends on the A1017 and the road between Sible Hedingham and Castle Hedingham which would require careful negotiation for HGVs. Sections of this road may also have parked cars which would make passing difficult.

Potential for mitigation

7.133 Engineering solutions would be required to satisfy Essex County Council that the loads are able to cross the two small culverts on the B1058.

7.134 Traffic Management Plans would need to be agreed with Essex County Council and Essex Police in terms of the management of AIL movements on the A131 and B1058 including possible road closures. The site access road would need to be designed to enable the turn to site from the B1058 to accommodate AIL delivery vehicles.

Local Economic Activity

Baseline conditions

7.135 The closest tourism receptor to Study Area B is Hedingham Castle within 2km of the study area. The castle itself is a Grade I listed building and it has gardens and other listed buildings within its grounds. The castle is open to the public for the majority of the year for around 5 days a week. Events take place throughout the year and particularly through the school summer holidays. The castle and grounds are also used as a wedding venue.

7.136 In December 2010, planning permission was granted for the conversion of Pannells Ash Barn to tourism accommodation. This work is currently underway and once operating, will be the closest tourism receptor to all locations within Study Area B.

7.137 There are a number of footpaths in the area and there are published local walking routes around Castle Hedingham to the south-west of the study area and Gestingthorpe to the north-east.

7.138 The study area is located within Grade 2 agricultural land which is defined as the Best and Most Versatile (BMV) agricultural land.

Assessment of effects

7.139 The views from Hedingham Castle would be very limited due to the woodland surrounding the castle as well as Ramacre Wood to the centre of the study area. The impact on local economic activity would be negligible.

7.140 Once the holiday lets at Pannells Ash Barn are operating, Locations B3 and B4 would have the greatest impact in terms of views. Location B1 would be screened by Ramacre

Wood and the impact would therefore be limited. Some views would be possible from Locations B2 and B5 although these would be partially screened by woodland.

7.141 Impacts on other tourist attractions in the area would be negligible given the distances from the study area. Ramacre wood would prevent views of the substation from some vantage points and impacts on the business operations in the area are likely to be limited.

7.142 Views from nearby footpaths are likely to be filtered by trees, although prior to the establishment of mitigation, the impact is likely to be harmful.

7.143 The development would result in the loss of a small area of BMV agricultural land.

Potential for Mitigation

7.144 The potential for mitigation would be as set out in 7.23 and 7.24.

Cost

7.145 The estimated capital costs are set out in the table below:

Table 2. Capital cost estimates for Study Area B.

Location	B1	B2	B3	B4	B5
AIS cost	£22.6m	£24.2m	£24.5m	£24.3m	£22.5m

Summary Study Area B

7.146 Following establishment of mitigation, negative effects on landscape character as a result of a substation at Locations B4 or B5 would be greater than other locations due to their more open character. The overall effect on landscape character would be moderate to major negative. Following establishment of mitigation, the overall effect on landscape character as a result of a substation at Locations B1, B2 and B3 would be moderate negative. Although the overall judgement is the same for these three locations, mitigation would be most effective at Location B2. With mitigation, Locations B4 and B5 would have a minor to moderate negative effect on visual amenity in the long term. Locations B1, B2 and B3 would have a minor negative effect on visual amenity in the long term as these location are better screened by existing mature woodland and tall hedgerows. Although Locations B1, B2 and B3 would each have a minor negative effect

on views, Location B2 would have a slightly lower negative effect than Locations B1 and B3 as it would have greater separation from houses and public footpaths. Of the three locations, Location B3 would have a greater negative effect due to the addition of the 400kV overhead line connection required for this option.

7.147 In relation to effects on the historic environment, Locations B1 – B4 would have a minor negative overall scale of effect. Location B5 would have a moderate negative overall scale of effect, given the potential effects of this location of the setting of a group of listed farm buildings at Parkgate Farm. In Study Area B, Locations B1-B4 would have the fewest negative effects on the historic environment. New landscape planting around the substation would reduce impacts on ecology at all locations to minor negative to neutral. Although all options in Study Area B would have similar impacts on ecology, there is a slight preference for Location B3 which avoids hedgerow loss and has the shortest access route, with the next preference for Locations B4 or B5.

7.148 All options are technically viable although Locations B2, B3 and B4 would involve connections to the southern circuit which would require a period of operation in a bespoke "four-ended" circuit design. This adds to circuit complexity and a requirement for a derogation against the NETS SQSS from OFGEM for the construction period. From a transport point of view, all options would be accessible for the AILs and construction vehicles. Impacts on local economic activity would be greater at Locations B3 and B4 with Location B3 potentially having adverse effects on holiday lets at Pannells Ash Barn. Location B3 would have the highest capital cost of all locations within Study Area B.

7.149 Overall, Location B2 is considered to be the preferred option within Study Area B because it has the least effect on landscape and visual amenity and has more scope for mitigation than Location B1. The effects of Location B2 on other environmental factors would be limited. Prior to mitigation, Location B1 would result in a similar scale of change to the environment as Location B2, and in the event that the technical issues (referred to above) cannot be resolved, consideration could be given to taking forward this option.

8 APPRAISAL – STUDY AREA C

8.1 Study Area C shown in **Figure 3** is located to the west of the A131 with two areas of woodland (Butler's Wood and Waldegrave Wood) within the study area.

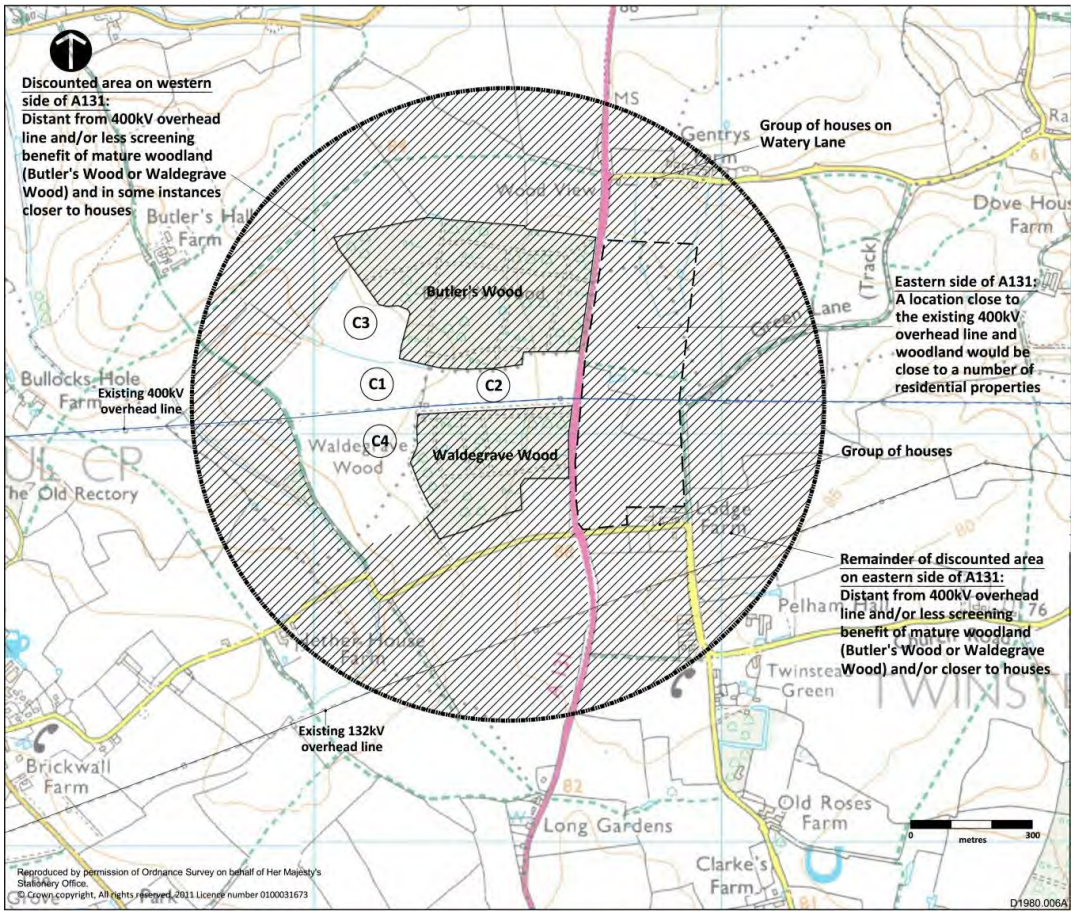


Figure 3. Substation Study Area C – Hatching indicates land discounted

Other sites considered but discounted

8.2 Substation locations to the eastern side of the A131 were discounted as a substation close to the existing 400kV overhead line and mature woodland would also be closer to a number of residential properties, some of which would have open views of the substation.

8.3 Other locations within the circle on the eastern side of the A131, further north, south or east, would benefit much less from the screening effects of mature woodland. A substation location further north or south would also require a greater length of

connection between the substation and existing 400kV overhead line, as well as being closer to houses.

8.4 The remaining land within the substation study area circle and on the western side of the A131 was discounted, as a substation on this land, as well as being closer to houses in some instances, would benefit less from the screening effects of mature woodland and/or would require a greater length of connection between the substation and existing 400kV overhead line.

Discounted Option

8.5 Location C1 is located to the west of the A131, north of Old Road and west of Butler's Wood and Waldegrave Wood, situated between the two woods. This site is immediately adjacent to the existing 400kV overhead line and to the north of it.

8.6 Whilst this location does not fall on land within Study Area C that was initially discounted, in carrying out preliminary assessment and appraisal it became clear that this option offered no benefit compared with Location C2 between Butler's Wood and Waldegrave Wood. Location C1 would still be visible between the woods from some viewpoints in the east, but would be more prominent in views from the western side of the woods. In addition, Location C3 offers an option to the west of the Butler's Wood and north of the existing 400kV overhead line, where a proposed substation would be better accommodated immediately adjacent to Butler's Wood. For these reasons Location C1 was not carried forward to the full options appraisal.

Technical Assessment

8.7 The table below give an approximate footprint of the substations for each site:

Table 3. Approximate footprint of AIS substation – Study Area C.

Location	C2	C3	C4
AIS m^2	10000m^2	11000m^2	11000m^2

8.8 The schematic layouts can be found at the end of the report.

8.9 A new "in-line" pylon would have to be built for Locations C3 and C4 as the existing pylon cannot be adapted for a tee-connection. In order to construct the replacement "in-line" pylon, a series of system outages would be required as well as a temporary

overhead line diversion for which one temporary pylon would be required. The purpose of the temporary diversions is to allow the transfer of the high voltage conductors from the existing line in order that the new "in line" pylon can be constructed. On completion of the new pylon, the high voltage conductors would be transferred back from the temporary overhead line diversion to the new pylon. The temporary overhead line diversions would then be removed. Location C2 would be located directly adjacent to the 400kV overhead line and therefore the existing 400kV pylon (4YL080) can be adapted to create a tee point connection on the "northern" side circuit. This means that there is no requirement for the temporary overhead line diversion arrangements that are applicable to all of the other options.

8.10 For Locations C2 and C4, it is proposed that the connection from the substation to the 400kV transmission line would be via a gantry type structure inside the compound with downleads between this gantry and the transmission line tower (pylon) which is located outside the substation compound. Location C3 would be connected from the substation to the 400kV transmission system via downleads from the overhead line tee point to a low height pylon (L2 SFX pylon) which would connect onto a substation lattice gantry.

8.11 The primary factors in setting out the substation plan include location of existing 400kV pylon 4YL080/1, existing roadway infrastructure, location of the existing 400kV overhead line, and orientation requirement for the new 400kV landing gantry.

8.12 With the gantry positioned as shown, the overhead outdoor AIS 400kV substation equipment is positioned in a linear manner ensuring that the necessary clearances are achieved for operational and maintenance requirements in accordance with approved National Grid design standards. The orientation and layout of the 132kV AIS station is driven by technical requirements for equipment (clearances, and operational and maintenance requirements), existing landscaping around the proposed site, incoming 132kV busbar from the Super Grid Transformer (SGT) in a 400kV substation, the existing 400kV overhead line, and access road requirements.

Technical Complexities

8.13 Increased on-site management at Locations C2 and C4 would be required due to the risks associated with proximity to live transmission lines. Location C2 presents the best option in terms of buildability as no temporary transmission line masts are required; therefore this is an improvement when compared to the "base case" options.

8.14 There are no significant substation technical complexities associated with Location C2. This option is therefore considered (for comparison to other options) as "base case" complexity.

8.15 There is an increased complexity issue associated with Location C4 as the proposed arrangements form a tee connection to the southern (Pelham – Braintree – Rayleigh) circuit of the 4YL route. A temporary non standard solution is therefore required for this option, which involves the creation of a "four-ended" circuit. This "four-ended" circuit is required to operate for the period of construction works, prior to the completion of the new 400kV route.

8.16 During this construction period the "four-ended" circuit would be required to operate as the Pelham – Twinstead – Braintree – Rayleigh circuit. This would require the installation of a bespoke engineering solution for this circuit during this period. Following the completion of the new 400kV construction works, the circuit would be re-designated to the Bramford – Twinstead – Pelham circuit.

8.17 The connection to any substation located to the north of the 400kV line would be via downleads from a transmission line pylon located outside the substation compound to a gantry type structure inside the compound.

8.18 Where a substation option is located to the south of the transmission line, it would be possible to effect a connection to the northern circuit via a sealing end compound and underground cables. However, the "four-ended circuit" would be a temporary arrangement, resolved with the completion of the new 400kV route. Given this temporary requirement, National Grid would seek a derogation against the requirements of the NETS SQSS from OFGEM for the intervening period. This is the most co-ordinated, efficient and economical way to resolve the temporary complexities should Location C4 be preferred. This also meets the requirement that derogations should have a period where the non-compliance shall be resolved as is the case for this temporary complexity.

8.19 Location C4 would involve additional system access as it would connect from the southern circuit. This would need to be obtained prior to submitting a DCO application. Compared with Locations C2 and C3, Location C4 is more technically complex and would need to be factory tested and type registered.

Landscape

Baseline Conditions

8.20 The substation study area is in Braintree District in the county of Essex. Although Old Road and Watery Lane in the study area are designated Protected Lanes in Braintree District Council's Local Plan, there are no other landscape designations in the substation study area and its immediate surroundings and the landscape is considered to be of local value.

8.21 Study Area C is in a predominantly rural and sparsely developed landscape which comprises rolling arable land, interspersed with blocks of broadleaved woodland. Field boundaries are mixed, some having hedgerows with trees and others unmarked and open. The study area is on a low rise in the undulating landscape. Settlements are typically villages and farms and individual residential properties dispersed throughout the local landscape.

8.22 Butler's Wood and Waldegrave Wood are large blocks of woodland that are distinctive features and enclose some areas of land adjacent. The A131 extends through the study area in a southerly direction from Sudbury to Halstead and runs immediately adjacent to these woods. Existing overhead lines are present crossing the landscape in an approximate east to west direction. The existing 400kV overhead line is routed across land in the gap between Butler's Wood and Waldegrave Wood. There is some influence on the landscape character from existing overhead lines and the A131. This does not affect the overall perception of this as a rural landscape; however, it reduces the sensitivity of some areas of land close to them.

8.23 The landscape in and immediately surrounding the study area is of local value and has a low to moderate capacity to accommodate a substation, although the land between the two woods is less sensitive to change and has a greater capacity (moderate capacity) to accommodate a substation. The rural character of this study area is largely intact, although it is affected to some extent by the two existing overhead lines, and overall it is in good condition.

Assessment of Effects Prior to Mitigation

8.24 Location C2 is on land between Butler's Wood and Waldegrave Wood. The existing 400kV overhead line crosses this land affecting the existing character. Effects on landscape character would be largely contained by the woodland. There would be a loss of arable

land between the two woodlands and visibility east and west across the gap between the woods would be restricted by a substation. Prior to mitigation, introducing a new substation at Location C2 would result in a moderate negative magnitude of effect (scale of change) on a landscape with a moderate capacity for a substation.

8.25 Locations C3 and C4 are to the west of Butler's Wood and Waldegrave Wood and the land here has a more open character compared to C2. Changes to the openness as a result of a substation at Location C3 and C4 could be perceived from a relatively wide area to the south and west. Prior to mitigation introducing a new substation at either Locations C3 or C4 would result in a moderate to high negative magnitude of effect (scale of change) on a landscape with a low to moderate capacity for a substation.

8.26 The construction of a substation at Location C2 would not require any temporary overhead line diversions. The construction of a substation at Location C3 or C4 would require a short 400kV temporary diversion with a single tower to the north of the existing 400kV overhead line. The temporary overhead line diversions would have temporary negative effects on landscape character, but it is not anticipated that a temporary diversion at these locations would require any tree lopping or tree losses.

Potential for Mitigation

8.27 There is adequate space to carry out supplementary planting at Locations C2, C3 and C4. There is less space for additional planting around Location C2, but existing mature woodland to the north and south already provides effective screening. There is less space for supplementary planting on the north-western side of the substation at Location C3 (particularly for the AIS option), as this substation location is in a smaller field where space is more limited. Land slopes away to the west from the edge of Butler's Wood and Waldegrave Wood which would influence the effectiveness of woodland planting mitigation measures in relation to Location C4, in particular.

8.28 Supplementary planting would consist of woodland planting around the peripheries of the substation sites which are not already screened by mature vegetation. This would include planting close to the existing overhead line where downleads, gantries and in some instances sealing end compounds are proposed. The screening offered by existing field boundaries would be strengthened with supplementary planting where this would help to reduce negative effects on landscape character. Low mounds (approximately 2m high) will also be used at the peripheries where there is space. Hedgerow planting would

be used to either side of the substation access road so that it would appear similar to a lane or farm track.

8.29 Effects of the 132kV underground cable route crossing the Protected Lane could be minimised through careful routeing through existing gaps in hedgerow and reduction of the working width of the cable swathe at this point. Protected Lanes would be returned to their original condition once construction is complete and this would include replacement hedgerow planting, where required.

8.30 Mitigation measures would be most effective for Location C2, where establishing woodland would enhance the enclosure and screening provided by existing woodland to the immediate north and south.

Assessment of Effects Following Mitigation

8.31 Following 15 years' establishment of mitigation measures, a substation at either Locations C3 or C4 would have a moderate negative magnitude of effect (scale of change) on a landscape with a low to moderate capacity for a substation. The overall effect on landscape character would be moderate negative, although negative effects would be slightly lower at Location C3 because it would occupy lower lying ground.

8.32 For Location C2 the magnitude of effect (scale of change) would be slightly less than other locations because of the enclosure of the site by mature woodland. Following 15 years' establishment of mitigation measures the magnitude of effect (scale of change) would be low to moderate negative on a landscape with a low to moderate capacity for a substation, and the overall effect on landscape character would be minor to moderate negative.

Visual Amenity

Baseline Conditions

8.33 The landscape in and surrounding Study Area C is broadly comprised of undulating arable land, interspersed with broadleaved blocks of woodland. Arable fields have a mixture of open and hedgerow boundaries with hedgerow trees. The study area is on a low rise in the undulating landscape, although nearby Butler's and Waldegrave Woods limit views.

8.34 There are existing views of Study Area C from the A131 which runs in a southerly direction from Sudbury to Halstead and passes to the immediate east of Butler's and

Waldegrave Woods, the minor road network that extends east and west of the A131 and public rights of way to the west and east of Butler's Wood and Waldegrave Wood. There are also views of the study area from houses on the edge of Twinstead Green and on Watery Lane in the eastern part of the study area, and a few individual houses just outside the study area to the west, as well as some more distant properties further west near Wickham St Paul.

8.35 Given the qualities of the landscape in and surrounding Study Area C and the commonplace nature of the views, views are generally of local importance.

Temporary Overhead Line Diversions During Construction

8.36 The construction of a substation at Location C2 would not require any temporary overhead line diversions.

8.37 The construction of a substation at Location C3 or C4 would require a short 400kV temporary diversion with a single pylon to the north of the existing 400kV overhead line. The temporary overhead line diversions would have temporary negative effects on views, but it is not anticipated that a temporary diversion at these locations would require any tree lopping or tree losses which could affect the screening of views in the long-term.

132kV sealing end platform tower – all options

8.38 All options at Study Area C would require the replacement of an existing 132kV suspension tower, which sits on a field boundary in the southern part of the substation study area, with a 132kV sealing end platform tower at a similar location. There would be views from some nearby properties as well as road and footpath users. Given that the 132kV sealing end platform tower would be in a similar location to an existing pylon, the magnitude of effect (scale of change) for visual receptors prior to mitigation would generally be low negative to negligible. A sealing end platform tower at these locations could have cumulative effects on a few visual receptors that could see both the pylon and the substation option. However, the negligible to low negative effects mean that the sealing end platform tower would make little contribution to the overall effect on views of a new substation.

Location C2

8.39 Prior to mitigation a moderate to high negative magnitude of effect (scale of change) on views would be experienced by road users on a short section of the A131 between Butler's and Waldegrave Woods.

8.40 A moderate negative magnitude of effect (scale of change) on views would be experienced prior to mitigation by users of the sections of public footpath to the east and west of the woods.

8.41 A low negative magnitude of effect (scale of change) would be experienced prior to mitigation by users of the scout hut to the east of the woods and residents at the group of houses at Lodge Farm (approximately 0.3km to the south-east), Gentry's Cottage and New House on Watery Lane (approximately 0.5km to the north-east) and Butler's Hall Farm (approximately 0.75km to the north-west).

8.42 A negligible to low negative magnitude of effect (scale of change) would be experienced prior to mitigation by road users on part of Watery Lane, approximately 0.5km to the north-east of Location C2 and the section of lane immediately east of the A131, which runs toward Twinstead Green approximately 0.4km to the south-east of Location C2.

Location C3

8.43 Prior to mitigation, a moderate to high negative magnitude of effect (scale of change) on views would be experienced by footpath users on the public right of way which runs approximately 0.25km to the south-west.

8.44 A low to moderate negative magnitude of effect (scale of change) would be experienced prior to mitigation from a short section of the A131 between the woods and the public footpath to the immediate east of the A131, which would both have views of the 400kV overhead line connection to the substation.

8.45 A moderate negative magnitude of effect (scale of change) would be experienced prior to mitigation by residents at Butler's Hall Farm (approximately 0.3km to the north-west) and Nether House Farm (approximately 0.6km to the south-west).

8.46 A low negative magnitude of effect (scale of change) would be experienced prior to mitigation by users of the public footpath which continues in a northerly direction to Butler's Hall Farm, from the other nearby public footpaths which cross the footpath to

the farm, from the public footpath which runs between Old Road and the A131 (approximately 0.5 to 1.0km to the south) and from the public footpath which runs north-west from Old Road at Nether House Farm (approximately 0.6km distant). A low negative magnitude of effect (scale of change) would also be experienced by road users on Old Road, when travelling between the western edge of Waldegrave Wood and Nether House Farm.

8.47 A negligible to low negative magnitude of effect (scale of change) would be experienced by road users on Church Road and Broad Road and visitors to properties on these sections of road (over 1.0km to the west of Location C3) and from properties on the A131 at Long Gardens (approximately 1.0km to the south).

Location C4

8.48 Prior to mitigation, a moderate to high negative magnitude of effect (scale of change) on views would be experienced by footpath users on the public right of way which runs approximately 0.25km to the south-west.

8.49 A moderate negative magnitude of effect (scale of change) would be experienced prior to mitigation by residents at Butler's Hall Farm (approximately 0.3km to the north-west) and Nether House Farm (approximately 0.6km to the south-west).

8.50 A low to moderate negative magnitude of effect (scale of change) would be experienced by users of the public footpaths which run between Old Road and the A131 (approximately 0.3 to 0.75km to the south), users of the public footpath which runs north-west from Old Road at Nether House Farm (approximately 0.5km distant) and users of Old Road when travelling between the western edge of Waldegrave Wood and Nether House Farm (approximately 0.25km to the south of Location C4).

8.51 A low negative magnitude of effect (scale of change) would be experienced prior to mitigation by users of the public footpath which continues in a northerly direction to Butler's Hall Farm, from the other nearby public footpaths which cross the footpath to the farm and from the public footpath to the immediate east of the A131. A low negative magnitude of effect (scale of change) would also be experienced by road users on the short section of the A131 between the woods and from properties on the A131 at Long Gardens (approximately 1.0km to the south).

8.52 A negligible to low negative magnitude of effect (scale of change) would be experienced, prior to mitigation, by road users on Church Road and Broad Road and visitors to properties on these sections of road, which are over 1.0km to the west of Location C4.

Potential for mitigation

8.53 There is adequate space to carry out supplementary planting at Locations C2, C3 and C4. There is less space for additional planting around Location C2, but existing mature woodland to the north and south already provides effective screening. There is less space for supplementary planting on the north-western side of the substation at Location C3, as this substation location is in a smaller field where space is limited. Land slopes away to the west from the edge of Butler's Wood and Waldegrave Wood which would influence the effectiveness of woodland planting mitigation measures in relation to Location C4. Mitigation measures would be most effective for Location C2.

8.54 Mitigation measures are also described in paragraphs 8.27 – 8.30.

Assessment of Effects Following Mitigation

132kV sealing end platform tower - all options

8.55 For all options, given that off-site planting to mitigate for changes to views as a result of the installation of a 132kV sealing end tower cannot be guaranteed, the low to negligible magnitude of effect (scale of change) experienced by visual receptors ranging in sensitivity from low to high would result in a minor negative to neutral overall effect on views.

Location C2

8.56 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of visual receptors, a minor negative overall effect on views would be experienced from the public footpath approximately 0.5km to the west of Location C2, the public footpaths to the east of the A131 and the section of the A131 between the woods.

8.57 A neutral to minor negative overall effect on views would be experienced by residents at and near Lodge Farm and houses on Watery Lane.

8.58 Following 15 years' establishment of mitigation a broadly neutral overall effect on views would be experienced by road users on part of Watery Lane and from the section of lane immediately east of the A131, users of the scout hut to the east of the woods and residents at Butler's Hall Farm.

8.59 Following 15 years establishment of mitigation measures, the overall effect on views of a substation at Location C2 would be minor negative.

Location C3

8.60 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of visual receptors, a moderate negative overall effect on views would be experienced from the public footpath approximately 0.25km to the south-west of Location C3.

8.61 A minor to moderate negative overall effect on views would be experienced by users of the public right of way network further north toward Butler's Hall Farm and road users of Old Road when travelling to and from the western edge of Waldegrave Wood and Nether House Farm, as well as residents at Butler's Hall Farm and Nether House Farm.

8.62 A minor negative overall effect on views would be experienced by road users on the section of the A131 between the woods, road users on Old Road when travelling to and from the western edge of Waldegrave Wood and Nether House Farm, public footpath users to the immediate east of the A131 and users on the public footpath between Old Road and the A131 and a section of the public footpath which runs northwest from Nether House Farm.

8.63 A neutral to minor negative overall effect on views would be experienced from residential properties on the A131 at Long Gardens and from properties on Broad Road and Church Road.

8.64 Following the 15 years' establishment of mitigation a neutral effect would be experienced by road users on part of Church Road and Broad Road.

8.65 Following 15 years establishment of mitigation, the overall effect on views of a substation at Location C3 would be minor to moderate negative.

Location C4

8.66 Taking into account the magnitude of effect (scale of change) following 15 years' establishment of mitigation and the sensitivity of visual receptors, a moderate negative overall effect on views would be experienced from the public footpath approximately 0.25km to the south-west of Location C4.

8.67 With mitigation a minor to moderate negative overall effect on views would be experienced by residents at Butler's Hall Farm and Nether House Farm.

8.68 A minor negative overall effect on views would be experienced by users of the public right of way network further north toward Butler's Hall Farm, from parts of the public footpath which runs between Old Road and the A131 and from a section of public footpath which runs north-west from Nether House Farm. A minor negative overall effect would also be experienced by road users of Old Road when travelling to and from the western edge of Waldegrave Wood and Nether House Farm.

8.69 A minor negative to neutral overall effect on views would be experienced by users of the public footpath to the immediate east of the A131.

8.70 Following the 15 years' establishment of mitigation a neutral effect would be experienced by road users on the section of the A131 between the woods and road users on part of Church Road and Broad Road. A neutral effect would also be experienced from residential properties on the A131 at Long Gardens and from properties on Broad Road and Church Road.

8.71 Following 15 years establishment of mitigation, the overall effect on views of a substation at Location C4 would be minor to moderate negative.

Historic Environment

Baseline conditions

8.72 There are eight Grade II and one Grade II* Listed Buildings within Study Area C and a buffer of 250m from the study area boundary.

8.73 Gentry's Farm (comprising the Grade II listed buildings of Gentry's Farmhouse, Barn, Cartlodge and Cottage) is separated from the study area by the A131 and Butler's Wood.

The setting of these listed buildings does not include the study area. Grade II listed village pump, Pelham Hall and Sparrow Hall all lie within the settlement of Twinstead Green. Again, they are separated from the study area by the A131 and the setting of these listed buildings does not include the study area.

8.74 Nether House Farmhouse is Grade II listed. Given the association between a farmhouse and the surrounding agricultural landscape, the setting of this listed building does include the study area.

8.75 Butler's Hall Farmhouse is Grade II* listed. Again, because of the relationship between a farmhouse and the agricultural land in which it is sited, the setting of this listed building includes the study area. The house is originally 15th century, and the reason for the designation of the building as a Grade II* listed building rests in the evidential value of its antiquity and architectural interest.

8.76 There are also six non-designated heritage assets within the study area and 250m buffer:

- cropmark evidence for former field boundaries on land at Bulmer and Wickham St Pauls comprises two heritage assets of negligible sensitivity.
- a milestone on the A131 and a house to the north-east of Bulmer Wood are two built heritages asset of low sensitivity.
- a World War II searchlight battery at Twinstead Green is a heritage asset of low sensitivity.
- the find of sherds of Roman pottery to the west of Twinstead Green is a heritage asset of low sensitivity, but could also indicate the presence of buried archaeology from that period within the area.

8.77 The historic landscape character comprises enclosure of a pre-18th century character (small, irregular fields). Intact hedgerows within the study area are therefore treated as 'important' in terms of the Hedgerow Regulations.

Assessment of Effects Prior to Mitigation

8.78 Common to the options at Locations C2 and C4, the underground cable necessary to connect the substation to the existing 132kV overhead line would cross an area of former field boundaries recorded from cropmark evidence. The magnitude of effect would be low. The cable route would also cross a protected lane. The magnitude of effect would be negligible. The potential for buried archaeology within the corridor of the cable

connection is moderate. The predicted magnitude of negative effect on buried archaeology would be low on assets of low to moderate sensitivity.

Location C2

8.79 A substation at Location C2 would not affect the setting of any designated heritage asset.

8.80 There are no known buried archaeology assets at this location. The majority of Location C2 was covered by woodland until the construction of the existing 400kV overhead line (evidenced by Ordnance Survey historic mapping). The management of the wood and tree root damage are likely to have impacted any buried archaeology that was present here. As such Location C2 has a low potential for the presence of previously unrecorded buried archaeology.

8.81 The extent of the woodland has changed a little from that shown on Ordnance Survey mapping from 1876 until the 1970's, when the gap was created to accommodate the 400kV overhead line. The historic landscape character was altered at that point, but no further alteration would be required to accommodate a substation at Location C2.

8.82 The overall scale of effect of a substation at Location C2, including the cable connection would be minor negative in relation to the historic environment.

Location C3

8.83 A substation at Location C3 would have a negative effect on the setting of Butler's Farmhouse Grade II* listed building. There is limited intervening vegetation to obscure views from Butler's Farmhouse towards Location C3 and the magnitude of effect (scale of change) would therefore be moderate negative.

8.84 A substation would not affect any known buried archaeology. The potential for unknown archaeology is moderate. In relation to buried archaeology, the magnitude of effect (scale of change) would be low to high negative on assets of low to high sensitivity.

8.85 A substation at Location C3 would have a neutral effect on historic landscape character.

8.86 The overall scale of effect at Location C3, with regard to the historic environment, is moderate negative.

Location C4

8.87 A substation at Location C4 would have a negative effect on the setting of Butler's Farmhouse and Nether House Farm. However, given the separation of the listed buildings at Nether House Farm from Location C4, and the intervening vegetation, the magnitude of effect (scale of change) would be low negative. Given the distance of separation from Butler's Farmhouse, the magnitude of effect (scale of change) would also be low negative.

8.88 A substation would affect an area where a former field boundary has been recorded. This asset is of very low sensitivity and the magnitude of effect (scale of change) would be negligible. The potential of the location for buried archaeology is moderate. With regard to buried archaeology, the predicted magnitude of effect (scale of change) would be negligible to moderate on assets of negligible to moderate sensitivity.

8.89 A substation at Location C4 would have a low negative magnitude of effect (scale of change) on historic landscape character through introduction of new tracks and infrastructure.

8.90 The overall scale of effect at Location C4, with regard to the historic environment, would be minor negative.

Potential for mitigation

8.91 For any location in Study Area C (including access track, planting and 132kV buried cable connection corridors) a programme of archaeological investigation, mitigation and monitoring would be required to mitigate effects on buried archaeology. The planting proposal for Location C2 is in keeping with the historic landscape character, effectively proposing the replanting of part of the woodland cleared when the 400kV overhead line was constructed.

8.92 Proposed planting would lessen the negative effects on listed buildings, but residual effects on setting would remain.

Assessment of Effects Following Mitigation

Location C2

8.93 Location C2 would have a minor negative overall scale of effect in relation to the historic environment, specifically in relation to the potential for encountering previously unrecorded archaeological remains within the underground cable connection to the 132kV overhead line.

Location C3 and C4

8.94 Location C3 would have a moderate negative overall scale of effect, given the effects on the setting of Grade II* listed Butler's Farmhouse. Location C4 would have a minor negative scale of effect in relation to the historic environment.

Ecology

Baseline conditions

8.95 There are three Local Wildlife Sites (LWS) in the locality, Butler's Wood LWS and Waldegrave Wood LWS are within Study Area C and Twinstead Green LWS is adjacent (south-east) to Study Area C. There are also two Protected Lanes within Study Area C (in the south-west and north-east). All these sites are valued at the county level.

8.96 There are two woodland areas within Study Area C. Butler's Wood and Waldegrave wood are on the ancient woodland inventory and listed on Essex County Council's Tree Preservation Order (TPO) records. The value of these woods is considered under their LWS designation. There are two further areas of trees within the site; a small plantation block in the south-west and along a green track (which runs north-east from Lodge Farm). There are a number of scattered trees within Study Area C, mainly associated with field boundaries. These habitats are likely to support nesting and foraging woodland bird species and may support foraging or roosting bats; however, their relatively small size limits the value. These habitats (outside of the LWSs) are valued at the local level.

8.97 There are numerous mature species-rich hedgerows within Study Area C. They are associated with the woodland habitats, the ponds, field ditches and a green lane (which runs north-west off Old Road) and as such are likely to have and important connective function within the local landscape and are valued at the district level.

8.98 There are numerous ponds across Study Area C (mainly associated with hedgerows) and a few field ditches which may periodically hold water. There are no records of water vole within 1km of the Study Area but surveys have recorded a medium size class population of great crested newts in ponds adjacent to the south-east edge of Study Area C. In combination the aquatic habitats are valued at the district level although the value of individual features will vary depending on the species they support.

8.99 Study Area C is dominated by arable fields. The intrinsic value of these habitats is generally low, although there are records for badger and brown hare in the wider area and these species along with farmland birds may use the fields in Study Area C. These habitats are valued at the local level.

Assessment of Effects Prior to Mitigation

8.100 All three locations fall within arable fields and therefore impacts across the options would be similar. All options would require a new pylon (in arable land) on the 400kV line and the 132kV line, (the adjacent existing pylon on each line would be removed), except option C2 which only requires a modification of the existing pylon on the 400kV. A gantry would be required for Location C3 but this structure would also fall within arable land and would not result in a significant increase in habitat loss compared to other options. The main differences between options are the length and route of the access road and the 132kV underground cable connection.

8.101 There would be no loss of Local Wildlife Sites or Protected Lanes under any of the options.

8.102 It is anticipated that there would be no loss of woodland or scattered trees with any of the options as a result of temporary works during construction or in the long term. There may be a fragmentation effect of constructing the substation or the access road between the two woodland blocks. This effect could be increased by artificial lighting of the substation but this would be restricted to normal office hours except in an emergency. Both impacts are likely to result in a low negative, long-term magnitude of effect (scale of change) for all options.

8.103 There would be a permanent loss of a section of the hedgerow (at the crossing of Old Road/Protected Lane) for the 132kV underground cable under all options. This would result in a low negative, permanent magnitude of effect.

8.104 There would be no loss of ponds (or terrestrial habitat within 50m of a great crested newt breeding pond) but there would be a small loss of field ditches for the access road and/or the 132kV underground cable under all options. This would result in a low negative, medium-term magnitude of effect for these options.

8.105 There will be a permanent loss of arable land for construction of the substation, the access road and the 400kV and 132kV pylons and gantries and a temporary loss of the 132kV underground cable route. This would result in a low negative, permanent magnitude of effect for all options.

8.106 In combination, the low magnitude of effect on receptors of local to district value would lead to an overall minor negative effect on ecology as a result of Locations C2, C3 and C4 prior to mitigation.

Potential for mitigation

8.107 Potential fragmentation impacts from constructing and lighting a new substation and/or access road between Butler's and Waldegrave Woods (Location C2) can be compensated by landscaping proposals which would include a mix of woodland planting around the new substation (and hedgerow planting under the 400kV overhead line) as well as hedgerow planting along the verges of the access road. This assessment does not consider new hedgerow planting along the A131 as this would be outside any permanent easement and landowner consent could not be guaranteed.

8.108 The very small area of hedgerow removal required for the 132kV underground cable crossing of Old Road under all options could be mitigated by planting a new stretch of hedgerow along the field boundary west of the crossing (where there is currently no hedgerow) up to the green lane. Impacts to field ditches would be minimised by installing a culvert to prevent fragmentation of habitat at the road crossing.

Assessment of Effects Following Mitigation

8.109 New landscape planting around the substation and access road would reduce impacts on ecology as a result of Locations C2, C3 and C4 to minor negative to neutral.

8.110 Within this there is a slight preference for Location C2 which avoids impacts on ditches and has the shortest access route and against Location C3 (as the access road would cross two field ditches and a species-rich hedgerow).

Traffic and transport

Baseline conditions

8.111 Study Area C straddles the A131 which runs between Halstead and Sudbury. The nearest motorway to the study area is the M11. In terms of the delivery of a 169te transformer, the route suggested by Wynns would take junction 8 from the M11 onto the A120 via Braintree and onto the A131.

8.112 The proposed access is directly off the A131 and would require a new access point (suitable for abnormal loads) to be constructed from this road. From that point a new 5m wide access road to the substation is required.

Assessment of effects

8.113 The A131 would provide a good standard of access for construction and operational traffic movements. Further consideration is given to access by AILs below. Structures on the A131 have been assessed by Essex County Council as acceptable for the proposed AILs.

8.114 The route to Butler's Wood is negotiable by AILs, although the final approaches on the A131 will require careful planning especially where full occupation of the road is required in locations such as Halstead. It would be necessary for detailed traffic management plans, possible temporary road closures and street furniture removal to be agreed with Essex County Council and Essex Police prior to movement. The turn into any new substation access road from the A131 would need to be designed to accommodate AIL delivery vehicles.

8.115 In terms of construction traffic, there is a series of roundabouts to negotiate as well as sharp bends in the road where vehicles are advised to slow. There is a 30mph speed limit through Halstead and parts of the highway have parked vehicles which would also have to be negotiated.

Potential for mitigation

8.116 Traffic Management Plans would need to be agreed with Essex County Council and Essex Police in terms of the management of AIL movements on the A131.

Local Economic Activity

Baseline conditions

8.117 This study area is located approximately equal distances between Castle Hedingham to the west, Sudbury to the north-east and Halstead to the south-west. Both Sudbury and Halstead are centres for local business services and tourism. The A131 is a main route into both Sudbury and Halstead as well as the smaller settlements of Bulmer Tye and Ballingdon.

8.118 There are a number of footpaths in the area and there are arranged local walks around Castle Hedingham to the west of the study area. There is a footpath to the west of the study area which runs north-west to south-east. The Stour Valley path and St. Edmunds Way are located approximately 2km to the east of the study area.

8.119 The study area is located within Grade 2 agricultural land which is defined as the Best and Most Versatile (BMV) agricultural land.

Assessment of effects

8.120 Given the separation between the study area and nearby settlement areas such as Bulmer Tye, Castle Hedingham, Sudbury and Halstead, there would be no views of the study area, particularly Location C2 between the two sections of woodland.

8.121 Impacts on other areas likely to attract tourists would be negligible given the distances from the study area. The two areas of woodland would prevent views of the substation from most vantage points and impacts on the business operations in the area are likely to be limited.

8.122 Views from nearby footpaths are likely to be filtered by vegetation in places with a small area between the woods being visible from both the footpath to the west of the study area and the A131 to the east of the study area.

8.123 The development would result in a small loss of BMV agricultural land.

Potential for mitigation

8.124 With mitigation, the change to views experienced by visual receptors on the public footpath to the west of this study area would be further filtered by woodland planting. This would reduce the impact in the long term, although there would be short term impacts during construction and until vegetation is established. The overhead line would also preclude a large amount of planting to this side of the substation in Location C2.

8.125 Some mitigation measures could be put in place to prevent views from the main road such as an angled access with woodland planting.

Cost

8.126 The estimated capital costs are set out in the table below:

Table 4. Capital cost estimates for Study Area C.

Location	C2	C3	C4
AIS	£21.1m	£23.9m	£25.8m

Summary Study Area C

8.127 Following establishment of mitigation, a substation at either Locations C3 or C4 would have a moderate negative overall effect on the landscape, although negative effects would be slightly lower at Location C3 because it would occupy lower lying ground, even though this option would require a 400kV overhead connection. Location C2 would have least effect on the landscape with mitigation in place (a minor to moderate negative effect). With mitigation, Locations C3 and C4 would have a minor to moderate negative effect on visual amenity in the long-term. Due to the greater degree of existing screening surrounding Location C2, this option would have a minor negative effect on visual amenity with mitigation and in the long-term.

8.128 In relation to effects on the historic environment in Study Area C, Locations C2 and C4 would have a minor negative overall effect while Location C3 would have a moderate negative effect. New landscape planting around the substation and access road would reduce impacts on ecology for all locations but overall a minor negative to neutral effect would remain. There would be a slight preference for Location C2 which avoids impacts on ditches and has the shortest access route.

8.129 All options are technically viable, although Location C4 would be connected to the southern circuit which would require a period of operation in a bespoke "four-ended" circuit design. This adds to circuit complexity and a requirement for a derogation against the NETS SQSS from OFGEM for the construction period.

8.130 From a transport point of view, all options would be accessible for the AILs and construction vehicles. Impacts on local economic activity would be greater at Location C3 and C4 due to the more open aspect from these locations. Location C2 would have the lowest capital cost of all locations.

9 CONCLUSIONS AND NEXT STEPS

Technical

9.1 All options are technically feasible, although there would be some temporary technical complexity associated with those to the south of the Pelham – Braintree – Rayleigh circuits. Location C2 complies with the NETS SQSS throughout the construction period. Locations B2, B3, B4 and C4 would be connected to the southern circuit which would require a period of operation in a bespoke "four-ended" circuit design. This adds to circuit complexity and a requirement for a derogation against the NETS SQSS from OFGEM for the construction period.

9.2 From an access and traffic management perspective, Study Area C would be the preferred option. Study Area A would be the least preferred option because of the difficulty of routeing AILs to the site.

Environment

9.3 All the substation location options would have a negative effect on visual amenity. With mitigation, a substation at Location B2 or Location C2 would have only a minor negative effect on visual amenity. This reflects the degree of existing screening offered at these locations, as well as distance from sensitive visual receptors and opportunities for additional planting. Although both Locations B2 and C2 would have a minor negative effect overall in the long term, there would be a preference for Location C2 as it would benefit from a greater degree of screening by existing mature woodland. Location A1 would have a minor to moderate negative effect on visual amenity as it would be more difficult to mitigate the effect on local views.

9.4 There would be negative effects on landscape character as a consequence of building a substation in any of the study areas. There are feasible mitigation measures at each of the potential substation locations that could be used to reduce overall effects on the landscape. Locations A1 and C2 would have the least negative overall effect on landscape character of all the location options as they would have a minor to moderate negative overall effect on landscape character. The overall judgement of minor to moderate negative reflects the existing landscape character at Location A1 and the degree of existing woodland enclosure offered by Location C2. Although both Locations A1 and C2 would have a minor to moderate negative effect there would be a preference

for Location C2 as there is greater scope at this location for mitigation to supplement existing mature woodland screening.

9.5 Locations A1, B5 and C3 would all have moderate negative effects in relation to the historic environment. The remaining locations would all have minor negative effects in relation to the historic environment. In the case of Location C2, this relates solely to the 132kV cable route. Given this distinction, Location C2 is considered to have the least negative effect in terms of the historic environment.

9.6 Across all the options, impacts to habitats and the species they support can be minimised through use of wildlife-friendly working practices including minimising working areas, planning works to avoid sensitive seasons and pollution control methods, resulting in only low impacts on ecology for all locations.

9.7 Following mitigation, impacts on ecology for all substation options have been assessed as minor negative to neutral apart from Location A1 which has been assessed as minor negative. There is a slight preference for Location C2 as this option would have access directly off a main road and would not require construction of a long access road. In addition, the landscaping proposals which would be associated with Location C2 have the potential to improve current habitat linkages between the two ancient woodland wildlife sites. However, any of the options would be acceptable on ecological grounds and for each of the locations there could be some long term positive effects on ecology as associated woodland and hedgerow planting becomes established.

Local economic activity

9.8 Study Area A would require significant engineering solutions involving large costs in order to provide satisfactory access to the site for the large vehicles carrying the transformer. Study Areas B and C are more accessible for the AILs with major roads within close proximity of the study areas.

9.9 In terms of impact on the local economy, Location A1 is directly adjacent to a visitor attraction as well as being open to views from local footpaths. The southern options within Study Area B are more likely to impact upon holiday lets at Pannells Ash. All options are likely to have some impact on local footpaths as well as the agricultural nature of the land. Whilst the loss of agricultural land cannot be mitigated, there is potential for mitigation against loss of views.

9.10 In terms of impact on views from tourism receptors, options in Study Area C would have the least impact and those in Study Area A the most.

Cost

Table 5. Capital cost estimates for all options

Location	A1	B1	B2	B3	B4	B5	C2	C3	C4
AIS	£21.9m	£22.6m	£24.2m	£24.5m	£24.3m	£22.5m	£21.1m	£23.9m	£25.8m

9.11 Location C4 would have the highest cost of all options. Location C2 would have the lowest cost of all the options as the substation is directly adjacent to the 400kV line, therefore not requiring additional overhead line to be constructed.

Overall Conclusions

9.12 After having reviewed all ten of the above options within the three study areas, it is concluded that the option which is the least environmentally constrained is Location C2. This is because overall it would have the least impact on the landscape character of the area, visual amenity, ecology and the historic environment. This option would also be the least constrained from a technical perspective and have the shortest access road. In terms of local economic activity, there is a slight preference for Location C2 over the other options within Study Area C and the capital cost, as shown in the table above, is the lowest of all options. This is subject to further consultation as set out below.

9.13 Location B2 is considered to be the preferred option within Study Area B because it has the least effect on landscape and visual amenity and has more scope for mitigation than Location B1. The effects of Location B2 on other environmental factors would be limited. Location B1 would result in a similar effect on the environment and these two options will be presented in more detail for the purposes of consultation.

9.14 Location A1 would be the most complex of all options from a transport point of view with significant and costly engineering solutions likely to be required to facilitate transformer movements. There would also be impacts on local economic activity surrounding and in close proximity to the study area, notably the Colne Valley Railway tourist attraction. For these reasons, National Grid considers that Location A1 should not be taken forward.

Next steps

9.15 In February 2013, in accordance with the SOCC, public events will be held to consult with local residents and other interested parties. The information contained in the Distribution System Options Report and in this Options Appraisal Report will be made available to inform the consultation. Feedback will be sought on the strategic options discussed in the Distribution System Options Report, the three potential substation study areas and on all the various options in each study area as set out in this report.

9.16 All feedback received will be taken into account in the assessment of the options. A consultation feedback report will be produced which will identify the relevant issues raised during the consultations and the responses to these issues.

9.17 After that feedback has been considered, National Grid will confirm which option is to be taken forward as part of its proposed application for development consent. National Grid will continue to work with UKPN on the technical and operational requirements for, and the detailed siting and design of, the new substation.

9.18 Outputs from the consultation will help to inform the development of a detailed design for the substation, which will also be influenced by technical considerations, further environmental surveys, geo-technical surveys and discussions with affected landowners and occupiers.

9.19 During Stage 3 of the process, the detailed connection design, including the proposed substation, will be subject to environmental impact assessment (EIA) and further public consultation.

9.20 The project is subject to a continuous process of backcheck and review in the pre-application stages to ensure that when new information comes forward (be it related to policy, technological developments, environmental or other factors), this is communicated to the project team and its effect on the robustness of decision making evaluated.

9.21 It is anticipated that as part of the Stage 3 Consultation in accordance with the SOCC, National Grid's public consultation on the proposed application including the detailed connection design will be undertaken in Summer 2013. The proposal will then be finalised in the light of the consultation responses and it is anticipated that an application will be made to the Planning Inspectorate in Winter 2013/14, seeking consent for the connection and associated development. Timescales and activities may be subject to alteration as the project progresses.

ABBREVIATIONS

AC	Alternating Current
AONB	Area of Outstanding Natural Beauty
CPRE	Council for the Protection of Rural England
CWS	County Wildlife Site
DCO	Development Consent Order
DPD	Development Plan Document
EIA	Environmental Impact Assessment
ERM	Environment Resources Management
GCN	Great Crested Newt
GIL	Gas Insulated Line
Ha	Hectare
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HVDC	High Voltage Direct Current
ICNIRP	International Commission on Non-Ionising Radiation Protection
IET	Institution of Engineering and Technology
IPC	Infrastructure Planning Commission
Km	Kilometre
kV	Kilovolt
LDF	Local Development Framework
LIDAR	Light Detection and Ranging
LNR	Local Nature Reserve
LWS	Local Wildlife Site
m	metre/million
MVA	Mega Volt Ampere
NCR	National Cycle Route
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OHL	Overhead Line
PILs	Persons with an Interest in Land
PINS	Planning Inspectorate
PROW	Public Right of Way
RSPB	Royal Society for the Protection of Birds
SLA	Special Landscape Area
SSSI	Site of Special Scientific Interest
TEP	The Environment Partnership
TPO	Tree Preservation Order
UKPN	United Kingdom Power Networks

APPENDICES

APPENDIX A

A1 PLANNING POLICY BACKGROUND

National Policy Statements

A1.1 The context for an appraisal of options relating to energy infrastructure is provided by the Overarching National Policy Statement for Energy (EN-1). This states that in considering any proposed development, and in particular when weighing its adverse impacts against its benefits, the IPC[23] should take into account:

- its potential benefits including its contribution to meeting the need for energy infrastructure, job creation and any long term or wider benefits; and
- its potential adverse impacts, including any long term and cumulative adverse impacts, as well as any measures to avoid, reduce or compensate for any adverse impacts.

A1.2 It goes on to note that, in this context, the IPC should take into account environmental, social and economic benefits and adverse impacts, at national, regional and local levels. The NPS provides guidance on assessment on a topic basis relevant to all energy projects which is supplemented by guidance specific to the project type. In the case of the Bramford to Twinstead Tee Connection, the relevant guidance is to be found in the National Policy Statement for Electricity Networks Infrastructure (EN-5).

A1.3 EN-5 makes reference to associated infrastructure of the electricity network including substations. The NPS states that there will usually be some flexibility around the location of associated substations and applicants should give consideration as to how they are placed in the local landscape, taking account of such things as local topography and the possibility of screening.

A1.4 The NPS recognises that new substations, sealing end compounds and other above ground installations can give rise to landscape and visual impacts as well as affecting biodiversity and noise levels.

[23] The functions of the IPC were transferred to the Planning Inspectorate in April 2012

National Planning Policy Framework

A1.5 The National Planning Policy Framework [24] (NPPF) may be considered as an "important and relevant"[25] matter to be considered in decision making for Nationally Significant Infrastructure Projects (NSIPs). Paragraph 6 of the NPPF states that "*the purpose of the planning system is to contribute to the achievement of sustainable development*". It goes on to note that planning has a key role to play in "*supporting the delivery of renewable and low carbon energy and associated infrastructure*". The Bramford to Twinstead Tee Connection is intended to provide additional transmission capacity to permit the connection of wind and nuclear powered generation and thereby assist the UK to meet its renewable energy targets. While the NPPF does not include policies specifically related to electricity transmission infrastructure, it does include policies for conserving and enhancing the natural and historic environment which have been taken into account in planning and assessing indicative alignments for the route corridor and any associated infrastructure.

A1.6 Paragraph 118 calls on local planning authorities to aim to conserve and enhance biodiversity in determining planning applications by protecting nationally and internationally designated sites from development which would have an adverse effect upon them and, in all locations, by refusing development which could result in significant harm to biodiversity and which cannot be avoided or adequately mitigated or compensated. Specific mention is made of the need to protect irreplaceable habitats, including ancient woodland and veteran trees. The potential effects on biodiversity, including woodland, hedgerows and trees are considered in Chapters 6-11.

A1.7 Paragraph 128 states that in determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. Paragraph 132 states that "*when considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting*." Subsequent paragraphs provide for weighing the harm to heritage assets against the public benefits which would be achieved through the proposed development.

[24] Department for Communities and Local Government : National Planning Policy Framework : March 2012
[25] National Planning Policy Framework paragraph 3

Development Plans

A1.8 The Essex and Southend-on-Sea Structure Plan ceased to form part of the Development Plan for the route corridor in September 2007, with the exception of a small number of policies saved by a direction from the Secretary of State. None of the saved policies are of relevance to the current proposal.

A1.9 The Braintree Core Strategy[26] aims to "*make sure the landscape character of the countryside, biodiversity, wildlife habitats (including those of European importance outside the District), agricultural land, historic towns, villages and buildings are protected and enhanced for future generations*."

A1.10 Policy CS8 states that "*all development proposals will take account of the potential impacts of climate change and ensure the protection and enhancement of the natural environment, habitats and biodiversity and geo-diversity of the District*". This encompasses protection of :

- the best and most versatile agricultural land;
- the natural environment of the District, and in particular designated sites of national importance and locally designated sites identified on the Proposal Map;
- development from the risk of flooding.

A1.11 It states that development must have regard to the character of the landscape and its sensitivity to change and where development is permitted it will need to enhance the locally distinctive character of the landscape in accordance with the Landscape Character Assessment.

A1.12 Policy CS9 includes measures to promote and secure the protection and enhancement of the historic environment in order to respect and respond to the local context, especially in the District's historic villages, where development affects the setting of historic or important buildings, conservation areas and areas of highest archaeological and landscape sensitivity.

A1.13 The Core Strategy replaces some of the policies in the Local Plan[27], including Policy RLP78 (The Countryside) and RLP79 (Special Landscape Areas). Other policies, such as RLP80, which require assessments to be made of the effects of development on particular environmental assets, are retained until other elements of the Local Development Framework are in place.

[26] Braintree District Council : Local Development Framework Core Strategy : September 2011
[27] Braintree District Council : Braintree District Local Plan Review: July 2005

A1.14 Policy RLP 161 states that "*proposals for development required for the operational needs of utilities serving the public will be supported and approved where applicable, subject to their acceptability on environmental and amenity grounds in terms of the other policies in this Plan. In considering proposals the Council will take into account existing levels of infrastructure, technical and operational requirements and opportunities for the sharing of sites, facilities and installations*".

A1.15 The Core Strategy replaces some of the policies in the Local Plan[28], including Policy RLP78 (The Countryside) and RLP79 (Special Landscape Areas). Other policies, such as RLP80, which require assessments to be made of the effects of development on particular environmental assets, are retained until other elements of the Local Development Framework are in place.

A1.16 Policy RLP 161 states that "proposals for development required for the operational needs of utilities serving the public will be supported and approved where applicable, subject to their acceptability on environmental and amenity grounds in terms of the other policies in this Plan. In considering proposals the Council will take into account existing levels of infrastructure, technical and operational requirements and opportunities for the sharing of sites, facilities and installations".

A2 HORLOCK RULES

A2.1 The Horlock Rules set out National Grid's approach to substation siting and design in the context of the company's duties under Schedule 9 of the Electricity Act. The Rules are used by National Grid Staff, their consultants and contractors in the siting and design of new substations and extensions to substations and are used to assist in achieving the most appropriate siting and design. The Guidelines are as set out below:

- Guideline 1 – In development of system options including new substations, consideration must be given to environmental issues at the earliest stage to balance the technical benefits and capital cost requirements for new development against the consequential environmental effects in order to keep adverse effects to a reasonably practicable minimum.
- Guideline 2 - The siting of new National Grid Company plc. (NGC) substations, sealing end compounds and line entries should as far as reasonably practicable seek to avoid altogether internationally and nationally designated areas of the

[28] Braintree District Council : Braintree District Local Plan Review: July 2005

highest amenity, cultural or scientific value by the overall planning of the system connections.

- Guideline 3 - Areas of local amenity value, important existing habitats and landscape features, including ancient woodland, historic hedgerows, surface and ground water sources and nature conservation areas should be protected as far as reasonably practicable.
- Guideline 4 – The siting of substations, extensions and associated proposals should take advantage of the screening provided by land form and existing features and the potential use of site layout and levels to keep intrusion into surrounding areas to a reasonably practicable minimum.
- Guideline 5 – The proposals should keep the visual, noise and other environmental effects to a reasonably practicable minimum.
- Guideline 6 – The land use effects of the proposal should be considered when planning the siting of substations or extensions.
- Guideline 7 – In the design of new substations or line entries, early consideration should be given to the options available for terminal towers, equipment, buildings and ancillary development appropriate to individual locations, seeking to keep effects to a reasonably practicable minimum.
- Guideline 8 – Space should be used efficiently to limit the area required for the development consistent with appropriate mitigation measures and to minimise the adverse effects on existing land use and rights of way, whilst also having regard to future extension of the substation.
- Guideline 9 – The design of access roads, perimeter fencing, earthshaping, planting and ancillary development should form an integral part of the site layout and be designed to fit in with the surroundings.
- Guideline 10 – In open landscape especially, high voltage line entries should be kept, as far as possible, visually separate from low voltage lines and other overhead lines so as to avoid a confusing appearance.
- Guideline 11 – The inter-relationship between towers and substation structures and background and foreground features should be studied to reduce the prominence of structures from main viewpoints. Where practicable the exposure of terminal towers on prominent ridges should be minimised by siting towers against a background of trees rather than open skylines.

APPENDIX B

B1 Method for Appraisal of Potential Effects on Landscape Character and Visual Amenity

B1.1 This appraisal of options and potential effects on landscape character and visual amenity included:

- review of existing information contained in the previous study 'Bramford to Twinstead Connection: Substation Siting Study' October 2009 (Draft);
- desk top review of existing landscape designations and county and district level landscape character assessments; and
- field study.

B1.2 The information gathered from initial desk top review and field study were presented to the Landscape and Views Thematic Group at a meeting in December 2011 for comment.

B1.3 The assessment of **landscape character** involved undertaking a review of existing landscape designations and county and district level landscape character assessments. The landscape appraisal considers the baseline conditions of the landscape within each study area and option site with reference to the relative value that is attached to the landscape. The previous study identified that there are no highly valued landscapes with national level designations and therefore that the landscapes in each of the study areas is of local value and importance.

B1.4 Government guidance advocates an approach to landscape protection and enhancement which avoids designation at the local planning authority level and favours an approach where local landscape character assessments identify value. Aspects of local planning policy and character assessments are referred to in the appraisal where relevant.

B1.5 The appraisal includes a description of baseline conditions and makes reference to landscape condition or quality, which in turn assists in making judgements about landscape sensitivity and capacity (see paragraph B1.7 below). A factual description is provided of the physical state of the landscape and how intact it is based on appearance.

B1.6 Sensitivity and capacity is also considered in baseline conditions. This refers to the degree to which a landscape can accommodate change without suffering detrimental effects on its character. This varies depending on factors including existing land use,

pattern, scale of the landscape, visual enclosure or openness and landscape value. The capacity of a landscape to accommodate change is dependent on the characteristics of the receiving landscape and the type and nature of the proposed development. For example, a large scale landscape with blocks of woodland may be more able to accommodate a large building without detrimentally affecting its overall character, compared to a smaller scale or more intimate landscape, such as a narrow river valley where effects could be more significant. A judgement on the capacity of the landscape to accommodate a substation development within each study area is provided with the description of landscape baseline conditions.

B1.7 The assessment of effects on landscape considers effects prior to mitigation. The scope for mitigation is a consideration in appraising landscape capacity. Where appropriate to include mitigation measures these could minimise effects on landscape character and increase capacity.

B1.8 Within the assessment of landscape effects, reference is made to magnitude of effect (scale of change) which is a judgement of the scale of change that would arise through the proposed development compared to the baseline landscape. A scale of change rating is judged to be high, moderate, low or negligible. Considerations in making this judgement about scale of change includes:

- how great a change would arise as a consequence of a development compared to the baseline conditions;
- the nature of the change (positive or negative); and
- the duration of effect, whether temporary, short, medium or long term.

B1.9 In the assessment of landscape effects a judgement is made on the likely overall effect of the option on the landscape. This is not an absolute scale but is a judgement based on the magnitude of the anticipated effect (or scale of change), the value and condition of the landscape and the sensitivity or capacity of the landscape to accommodate the particular development. These considerations result in an overall judgement of neutral, minor, moderate or major effect, and effects can be negative or positive.

B1.10 The assessment of effects on landscape for each substation location considers these effects prior to mitigation. Specific mitigation measures are then described and the effects are reassessed in the summary taking mitigation into account.

B1.11 The appraisal of **visual amenity** considers the nature of baseline views from field survey work. That is the extent and nature of existing views within each study area. This has been carried out from publicly accessible locations such as roads and footpaths.

B1.12 The baseline and assessment of visual effects also makes reference to the sensitivity of visual receptors and the general importance of views. The sensitivity of visual receptors depends upon the location of the viewpoint, the activity of the receptor and expectations of the view. For example a walker using a public footpath for the purposes of recreation and the enjoyment of the countryside is likely to be of higher sensitivity than a worker in their workplace where the key focus is on work rather than views out from the workplace. The land use planning system considers that public views are of greater importance than private views from private property. In this assessment, users of public rights of way, and particularly long distance footpath routes, and public open spaces are considered to be of high sensitivity. Private residents are also considered to be of high sensitivity. Workers, motorists, rail passengers and people playing outdoor sports are generally considered to be of lower sensitivity.

B1.13 The appraisal includes judgements about the importance of views. The importance of views is considered in the context of the value placed on it, the alternatives available and relative scenic quality of the view. Reference to a view in a guidebook or in a tourist map indicates a view of greater importance which can be experienced by many people visiting a place specifically to enjoy the view.

B1.14 As for appraisal of effects on landscape character the assessment of potential effects on visual amenity has included making judgements about the magnitude of effect (scale of change, which is a judgement of the scale of change that would arise through the proposed development compared to the baseline views. A scale of change rating is judged to be high, moderate, low or negligible. This is not an absolute scale but is based on a number of interrelating factors. Considerations in making this judgement about scale of change include:

- how great a change would arise as a consequence of a development compared to the baseline conditions (high, moderate, low or negligible);
- the nature of the change (positive or negative);
- the duration of effect, whether temporary, short, medium or long term;
- factors such as distance, angle of the view, proportion of view affected, filtering effects, back-grounding effects.

B1.15 In the assessment of visual effects a judgement is made on the likely overall effect of the option on each visual receptor and on visual amenity in general. This is not an absolute scale but is a judgement based on the magnitude of the anticipated effect (or scale of change), the sensitivity of visual receptors and the importance of views. These considerations result in an overall judgement of neutral, minor, moderate or major effect, and effects can be negative or positive. The assessment of effects on visual amenity for each substation location considers these effects prior to mitigation. Mitigation measures are then described and the effects are reassessed in the summary taking mitigation into account.

B1.16 Woodlands, trees and hedgerows can form an important part of views as they add screening and filtering effects. Where reference is made to trees and hedges in views, these are considered to be relatively long-standing features in the landscape which will continue to perform a similar function for the majority of the lifetime of the proposed substation. It is assumed that hedges and trees of value would be protected by relevant legislation such as Hedgerow Regulations and Tree Preservation Orders.

Assumptions

B1.17 Some of the options require the relocation of the existing 400kV pylon. The magnitude of effect (scale of change) of relocating a pylon would be negligible for all the options where this occurs, although there would be temporary effects on landscape and views during construction. The effects of downleads and pylon modifications are noted in the assessment of landscape and views.

B1.18 Each of the substation location options would involve the installation of a section of 132kV underground cabling between the substation and the existing 132kV overhead line. During construction and reestablishment periods the underground cable route would have a temporary negative effect on views through the loss of farmland and hedgerows, and there is potential for the permanent loss of trees within the cable route, although this would largely be avoided through careful routeing. However, in the long-term and with mitigation measures employed to minimise effects and re-establish hedgerows, the underground cable route would have a broadly neutral effect on landscape and views.

B1.19 The following assessment therefore does not refer to effects on landscape and views as a result of underground cabling, but is focused on the effects of above ground infrastructure.

B1.20 The occasional requirement for lighting the substation during office hours in winter months and for emergency repairs out of hours is common to all options. Lighting of the substation would result in a negative effect on landscape and views. All three substation study areas are devoid of street lighting, with private properties and vehicles on the A131 and A1017 the only light sources in the area. However, the negative effects of lighting will be occasional and for short periods of time and mitigation measures through the design of a lighting scheme and establishment of screen planting would help to minimise effects.

B1.21 Temporary negative effects during construction would be common to all options presented and these temporary effects are likely to be greater compared to the long-term effects as a result of construction traffic, temporary overhead line diversion pylons and lighting during construction. These effects would be temporary and the landscape and visual assessment within the options appraisal primarily focuses on the long-term landscape and visual effects of a substation and associated above-ground elements at each of the location options. The potential effects of temporary overhead line diversions for each location are also considered within the assessment.

B1.22 The difference between 132kV Air Insulated Switchgear (AIS) and Gas Insulated Switchgear (GIS) options is not so great as to vary the judgements on the magnitude of landscape and visual effect or the overall effect judged for each of the substation locations. Where an AIS or GIS option would offer a slightly less negative effect on landscape or views in a particular location this is discussed in the concluding part of each option's summary.

Mitigation measures common to all options

B1.23 Negative effects on views would be minimised by avoiding the removal of existing hedgerows and trees at the field boundaries, wherever possible. Where the removal of sections of hedgerow to construct the underground cable connection is unavoidable, hedgerows would be replanted on completion.

B1.24 For the substation options it would be feasible to minimise negative effects on views through the acquisition of a substation site that includes space to carry out additional tree and hedgerow planting and earth mounding. Opportunities for mitigation are limited in some areas where a permanent clear easement is required, such as under the existing overhead lines and downleads and over the underground cable swathes and for

security reasons there is a requirement for a 5m clearance between the substation fence and any tree planting. A description of the mitigation proposed at each substation location is provided in the landscape and visual amenity assessments.

B1.25 The GIS building which forms part of the 132kV GIS option would be clad in a recessive colour appropriate to the location to assist in minimising effects on views. In addition, other elements within the substation such as substation fencing and ancillary buildings would also be finished in a recessive colour.

B1.26 The summary section for each location option considers the overall scale of effect on landscape character and on views following 15 years establishment of planting mitigation measures.

B1.27 Further mitigation by way of additional hedgerow and woodland planting off-site could assist in lessening potential effects on views further. However, this would be subject to the agreement of landowners and would need to be carefully managed and monitored to ensure successful establishment. Given the lack of certainty that such measures will be feasible in every instance, the assessment of effects on views in the summary section has been judged without these off-site mitigation measures in place.

B2 Method for Appraisal of Potential Effects on the Historic Environment and Ecology

B2.1 The **historic environment** appraisal has obtained information from all of the relevant Historic Environment Records, the National Monuments Record, English Heritage and local authority records. In addition selected historic mapping was consulted. Site survey work was undertaken from publically accessible vantage points. The archaeology and history criteria for determining 'important' hedgerows (Schedule 1, Part II of the Hedgerow Regulations 1997) were also used to provisionally quantify the likely occurrence of 'important' hedgerows within the substation locations.

B2.2 The known heritage assets have been classified as those which are 'designated' and those which are not. Designated heritage assets in this case are listed buildings, conservation areas and scheduled monuments, as no registered battlefields, registered parks and gardens, world heritage sites, or protected wrecks or military remains are recorded within or adjacent to the substation locations.

B2.3 National Planning Policy Statement for Energy (EN-1) acknowledges that "*the more significant the designated heritage asset, the greater the presumption in favour of its conservation should be"*. All listed buildings are of national importance, but in line with guidance and policy, the assessment of effects treats Grade I and II* listed buildings as having greater significance than Grade II listed buildings.

B2.4 Non-designated heritage assets are, in this case, primarily archaeological and historic landscape remains or features included in the local or national monuments record. The non-designated heritage assets within the substation locations are currently determined to be of local or regional importance. In the case of buried archaeological remains, any rating of importance is very provisional, given the difficulties in characterising such assets, common to any assessment of this type. Also, the assessment of effects has taken into account the probability of encountering previously unrecorded buried archaeology. Non-designated heritage assets of demonstrably equivalent significance to a designated heritage asset are subject to the same considerations.

B2.5 In order to determine the likely and relative effects of the connection options on heritage assets, and in line with the above, the relative significance of the various heritage assets has been categorised as follows:

- Very high sensitivity: Grade I and II* listed buildings;

- High sensitivity: Grade II listed buildings, conservation areas and scheduled monuments; potentially some of the known non-designated heritage assets; and

- Moderate, low, negligible sensitivity: Non-designated heritage assets and landscape features.

B2.6 It is Government policy that decision makers (EN-1) should "*seek to preserve those elements of the setting of a designated heritage asset that make a positive contribution to, or better reveal the significance of, the asset*". In the case of listed buildings this is a statutory requirement under Section 66 of the Planning (Listed Buildings and Conservation Areas) Act 1990.

B2.7 The effects of a substation on historic environment receptors will be either direct or indirect. Direct effects are any physical change to any archaeological or cultural heritage site. Indirect effects are any change or effect on the setting of, or important views to or from, a designated heritage asset.

B2.8 In either case, the magnitude of effect can be high (likely to result in the total loss or substantial harm to the heritage asset), moderate (likely to result in less than substantial harm to the heritage asset) or low (likely to result in harm to the heritage asset).

B2.9 The substation proposals could have a direct negative effect on buried archaeology. The effect would occur during construction, and would be within the footprint of the substation, access tracks (permanent or temporary), the footprint of any associated pylons, and within the footprint of any other temporary and ancillary works including proposed underground cable connections. The extent of adverse effect on non-designated buried archaeology will be commensurate with the area of disturbance (i.e. the larger the area disturbed the greater the likelihood for encountering buried archaeological remains).

B2.10 Buried archaeological remains are a non-renewable resource and sustaining their significance is best achieved through avoidance. Where this is not possible, mitigation can be achieved through a programme of archaeological recording. Similarly, avoidance

is the preferred option for mitigating indirect effects on designated heritage assets. Where this is not possible, reducing the indirect effects may be achieved by landscape planting.

B2.11 The overall scale of effect of each of the substation options has been assessed by comparing the relative significance of the heritage assets against the magnitude of effect. The effects on heritage assets are described as major, moderate or minor negative, minor negative to neutral and neutral..

B2.12 The **ecological** appraisal of the connection options has been carried out using desktop records including wildlife site designations, TPO data, species records and habitat inventory data, in combination with Phase 1 habitat survey data gathered in the field and supplemented with mapping data and satellite imagery. This method, and the information gathered, was presented to the Biodiversity Thematic Group at meetings from October 2011 to September 2012 for comment. Ecological information provided by consultees at the Biodiversity Thematic Group meetings, Community Forums, public events and discussions with landowners has been added to the baseline data used to inform this assessment.

B2.13 The ecology appraisal in starts by considering the baseline conditions within each study area with reference to the relative value attributed to ecological receptors. A receptor can refer to a habitat type, a species, a wildlife site or can be a combination of these. The value of certain receptors can be determined by associated legislation or policy. For example Sites of Special Scientific Interest (SSSI) are designated nationally and are valued at the national level, whereas Local Wildlife Sites (LWS) are designated by the County Council and are valued at the county level. However, this is not always the case, for example while badgers are protected under national legislation, they are relatively abundant in many areas and a badger sett would not be valued at the national level. Similarly while great crested newts are a European protected species, a population within a Substation Area is not automatically of European importance. Its value takes account of factors such as status, rarity, uniqueness, quality and abundance, and considers these factors in relation to local, district, county, regional, national and international conditions. Relevant published evaluation criteria form an important basis for determining value for sites, species and habitats. Value can be intrinsic but can also be linked to the function of a receptor. For example, a species-poor hedgerow may have a high value due to its role in connecting two important dormouse woodlands or providing a commuting route between a rare bat roost and bat foraging grounds. The

ecological appraisal takes a broad and precautionary approach to considering the value of receptors.

B2.14 Within the assessment of ecology effects, reference is made to magnitude of effect. This considers the scale of the change that would arise through the proposed development compared to the baseline (i.e. whether low, moderate or high), its nature (negative or positive) and its duration (temporary, short, medium or long term). This information on magnitude is combined with the value of receptor to determine the overall impact on the receptor. Impacts upon receptors of higher value are given greater weight than impacts upon receptors with a lower value. These considerations result in an overall judgement of either minor, moderate or major scale of effect on ecology for each connection option within each study area. The assessment of effects on ecology considers these effects prior to mitigation. Mitigation measures are then described and the effects are reassessed taking mitigation into account.

Assumptions

B2.15 General construction stage effects such as noise and lighting disturbance are likely to only have a low temporary impact on ecology and are common to all options. As such these impacts have not been described in the impacts assessment for each option. Construction of a substation at some of the potential locations would result in the need for temporary overhead diversions, which could result in long-term effects. These are considered in the impacts assessment for each option.

B2.16 There is a difference in the footprint of Air Insulated Switchgear (AIS) and Gas Insulated Switchgear (GIS) but as all the main substation footprint is located wholly within arable fields (avoiding habitats such as woodland, hedgerows and ponds) for all options, this difference in size is not considered significant when assessing effects on ecology.

Mitigation measures common to all options

B2.17 During the construction period a number of standard best-practice approaches would be used to avoid and minimise effects on ecology. These include:

B2.18 Root protection fencing will be installed to avoid compaction of tree roots (by construction vehicles and materials stores) along woodland edges and hedgerows.

B2.19 Pollution control methods such as bunding around sensitive features, using trip trays when refuelling vehicles and machines or running generators and temporary drainage systems will be used to prevent contamination of watercourses, field ditches and ponds.

B2.20 Vegetation clearance including sections of hedgerow will be undertaken outside the bird breeding season to prevent damage to nests or young.

B2.21 As there is certainty that these working methods will be undertaken and that they are common to all options, assessment of ecological effects is considered after the application of these methods.

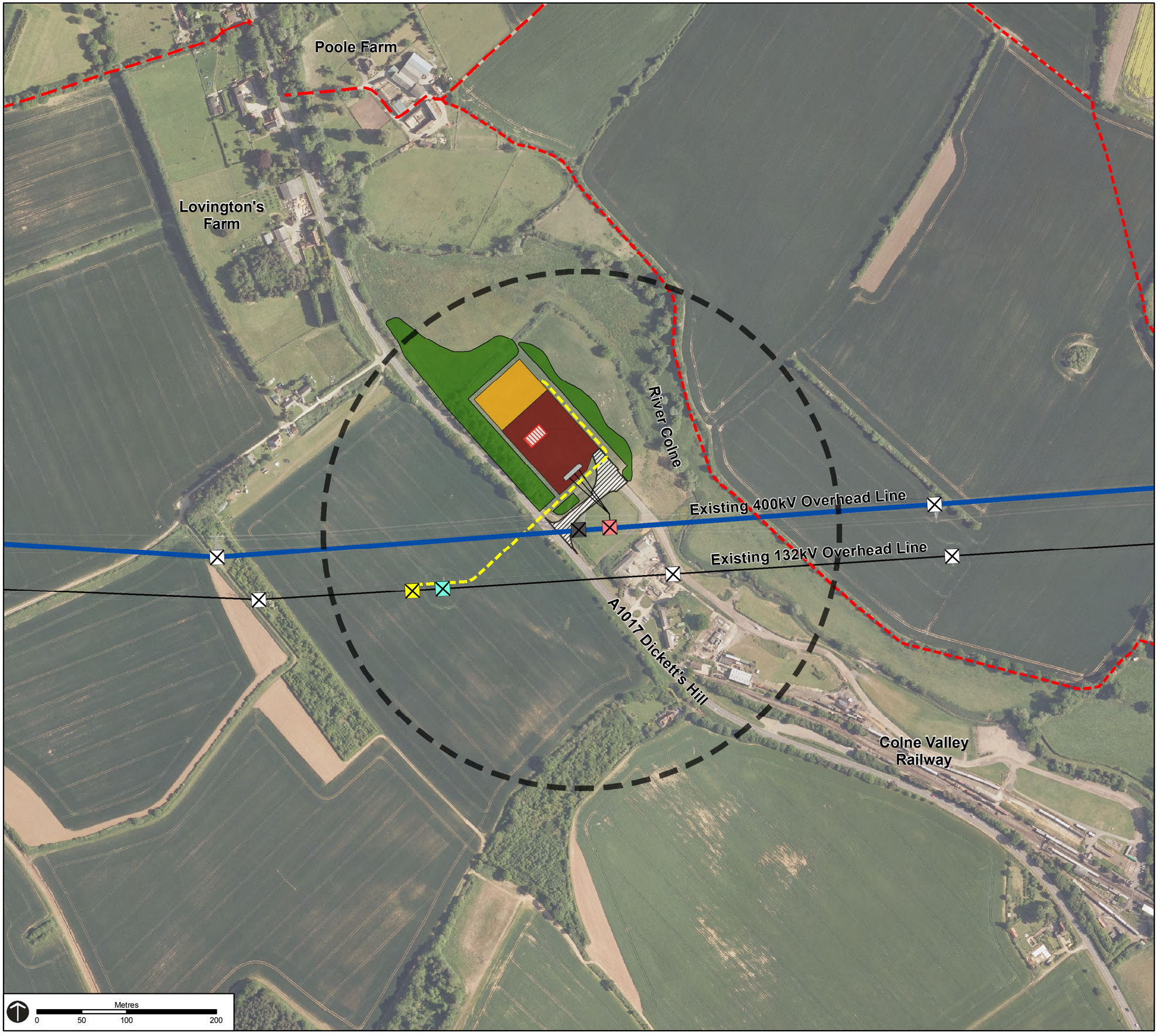
B2.22 Where detailed surveys identify the presence of protected species appropriate licences will be sought from Natural England to allow works to commence. Any such licence application will be supported by a detailed method statement and construction works will proceed in adherence with any licence method statement. Based on current information such licensed mitigation approaches are likely to include:

B2.23 Installation of amphibian exclusion fencing and terrestrial clearance of great crested newts from ranging habitats within the construction area.

B2.24 Supervised removal of small hedgerow sections to ensure dormouse nests are not disturbed, to avoid dormouse hibernation periods and to minimise fragmentation effects.

B2.25 Where potential impacts on protected species have been identified they have been described in the assessment chapters.

B2.26 For each of the location options a substation site would be acquired that includes space to carry out some additional woodland and hedgerow planting. Opportunities for mitigation are restricted in some areas where a permanent clear easement is required, such as under the existing overhead lines and downleads and over the underground cable swathes. A specific description of the mitigation proposed at each substation location is provided in the landscape and visual amenity assessments. For all options in the long term there is the potential for positive effects on ecology as a result of the establishment of additional woodland and hedgerow planting.



Key

Substation Study Area

Existing Infrastructure

- Existing 400kV overhead line
- Existing 132kV overhead line
- Existing electricity pylon

Proposed Infrastructure

- 400kV Air Insulated Switchgear (AIS) compound
- 132kV AIS compound
- Landscape buffer incorporating low mounds, woodland and hedgerow planting
  Approximate maximum height of woodland planting after 15 years is 10m
- New 400kV pylon with downleads to gantry
- Gantry (approximately 12.5m high)
- Location of Super Grid Transformer (SGT) (approximately 10.5m high)
- Existing 400kV pylon to be removed
- Existing 132kV pylon to be removed
- New 132kV pylon with sealing end platform
- 132kV underground cables route
- Substation access road

Public Right of Way

- Footpath
- Bridleway
- Byway

NOTE:

Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

This map includes data from the following sources:
- National Grid
- Ordnance Survey

nationalgrid

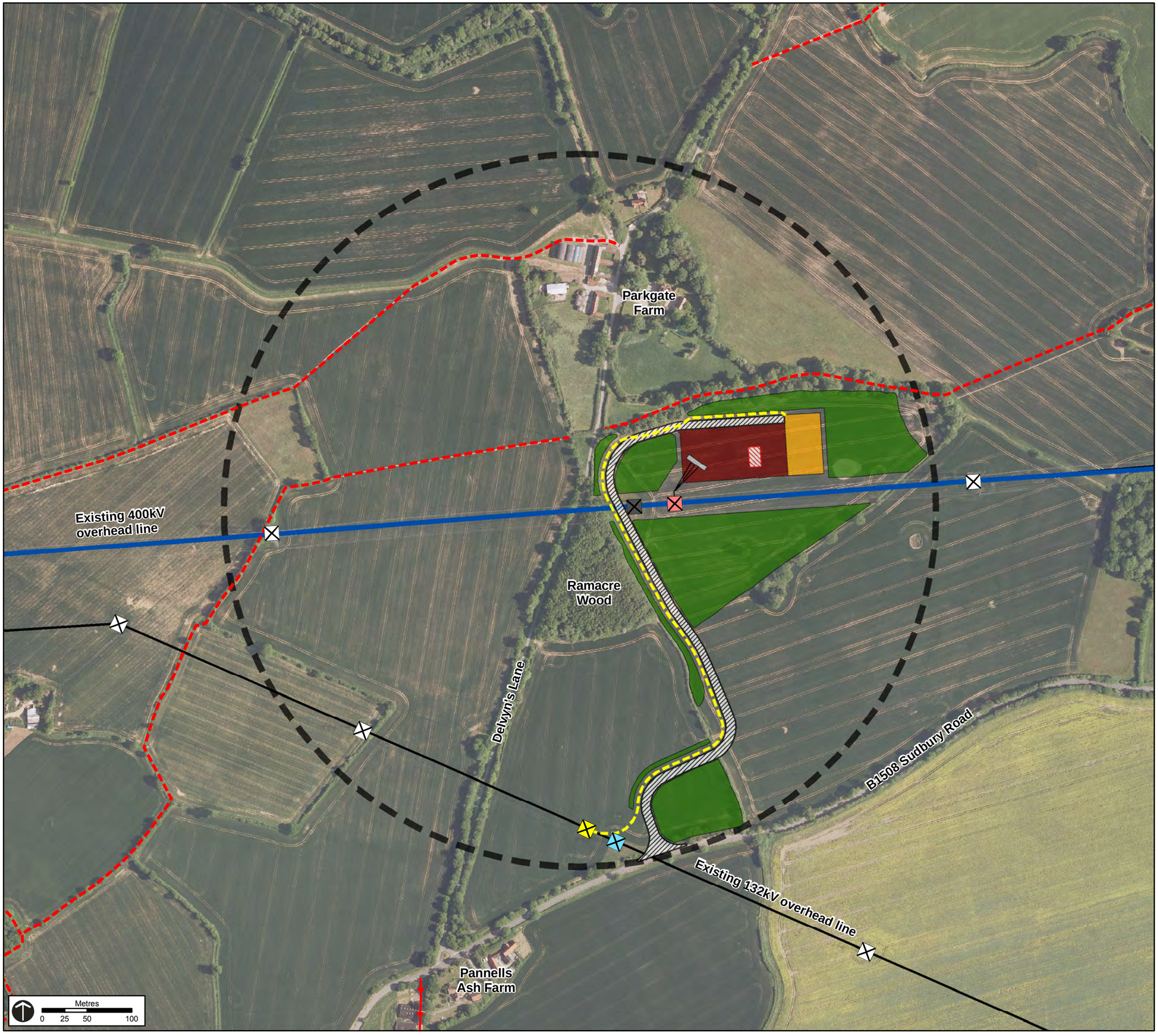
Project: **Bramford to Twinstead Tee Connection**

Title: **Location A1 Schematic Layout AIS Option**

Drawing No: G1980.995e

Date:	TEP Ref No:
04-02-2013	G1980.995e

Drawn:	Checked:	Approved:
CB	CH	CH



Key

Substation study area

Existing Infrastructure

Existing 400kV overhead line

Existing 132kV overhead line

Existing electricity pylon

Proposed Infrastructure

400kV Air Insulated Switchgear (AIS) compound

132kV AIS compound

Landscape buffer incorporating low mounds, woodland and hedgerow planting

Approximate maximum height of woodland planting after 15 years is 10m

New 400kV pylon with downleads to gantry

Gantry (approximately 12.5m high)

Existing 400kV pylon to be removed

Location of Super Grid Transformer (SGT) (approximately 10.5m high)

Existing 132kV pylon to be removed

New 132kV pylon with sealing end platform

132kV underground cable route

Substation access road

Public Right of Way

Footpath

Byway

NOTE:

Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

This map includes data from the following sources:
- National Grid
- Ordnance Survey

nationalgrid

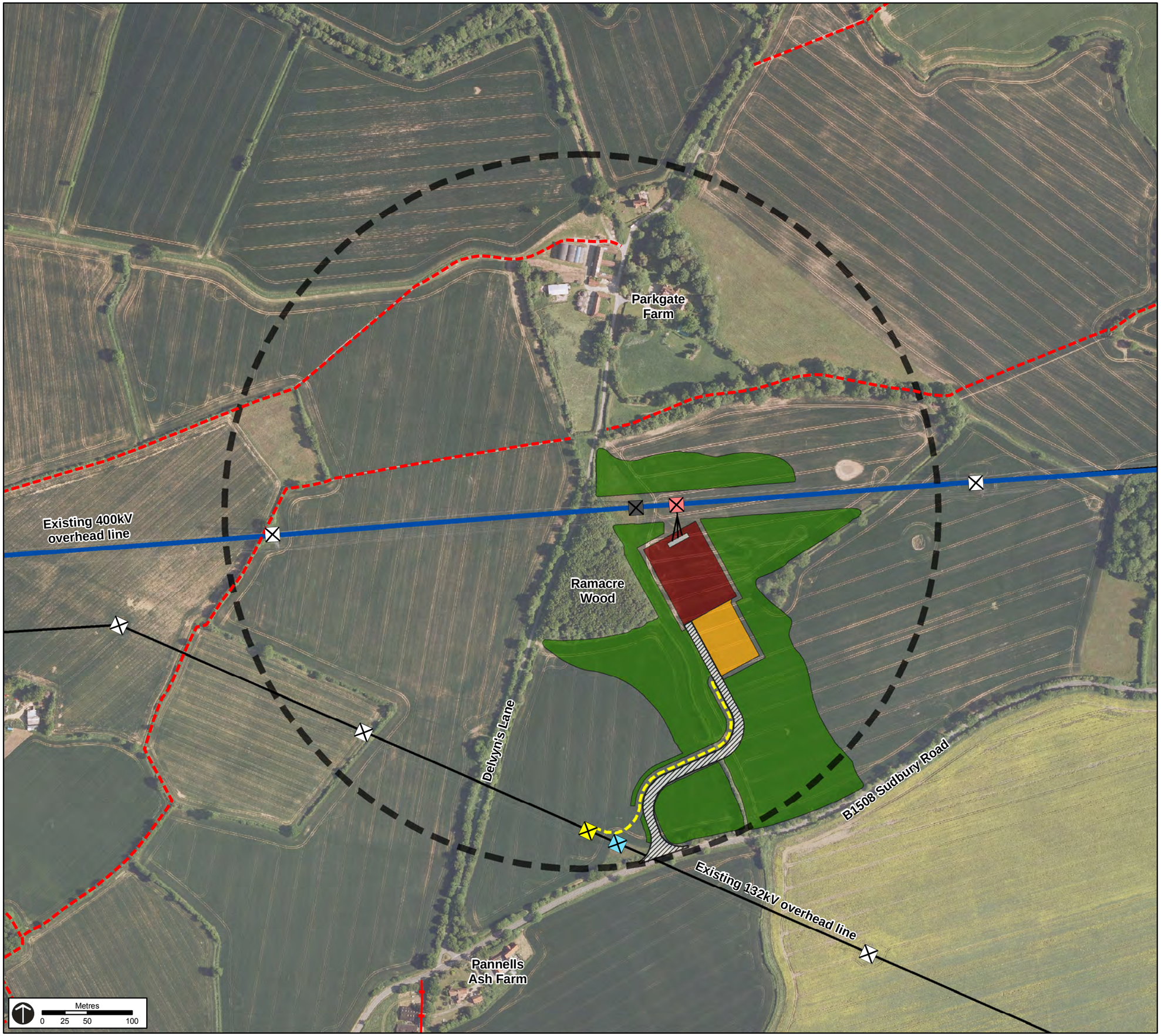
Project:
Bramford to Twinstead Tee Connection

Title:
Location B1 Schematic Layout AIS Option

Drawing No:
G1980.964c

Date:	TEP Ref No:
26-01-2013	G1980.964c

Drawn:	Checked:	Approved:
DH	CH	CH



Key

Substation study area

Existing Infrastructure

- Existing 400kV overhead line
- Existing 132kV overhead line
- Existing electricity pylon

Proposed Infrastructure

- 400kV Air Insulated Switchgear (AIS) compound
- 132kV AIS compound
- Landscape buffer incorporating low mounds, woodland and hedgerow planting
  Approximate maximum height of woodland planting after 15 years is 10m
- New 400kV pylon with downleads to gantry
- Gantry (approximately 12.5m high)
- Location of Super Grid Transformer (SGT) (approximately 10.5m high)
- Existing 400kV pylon to be removed
- Existing132kV pylon to be removed
- New 132kV pylon with sealing end platform
- 132kV underground cable route
- Substation access road

Public Right of Way

- Footpath
- Byway

NOTE:

Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

This map includes data from the following sources:
- Ordnance Survey
- National Grid

nationalgrid

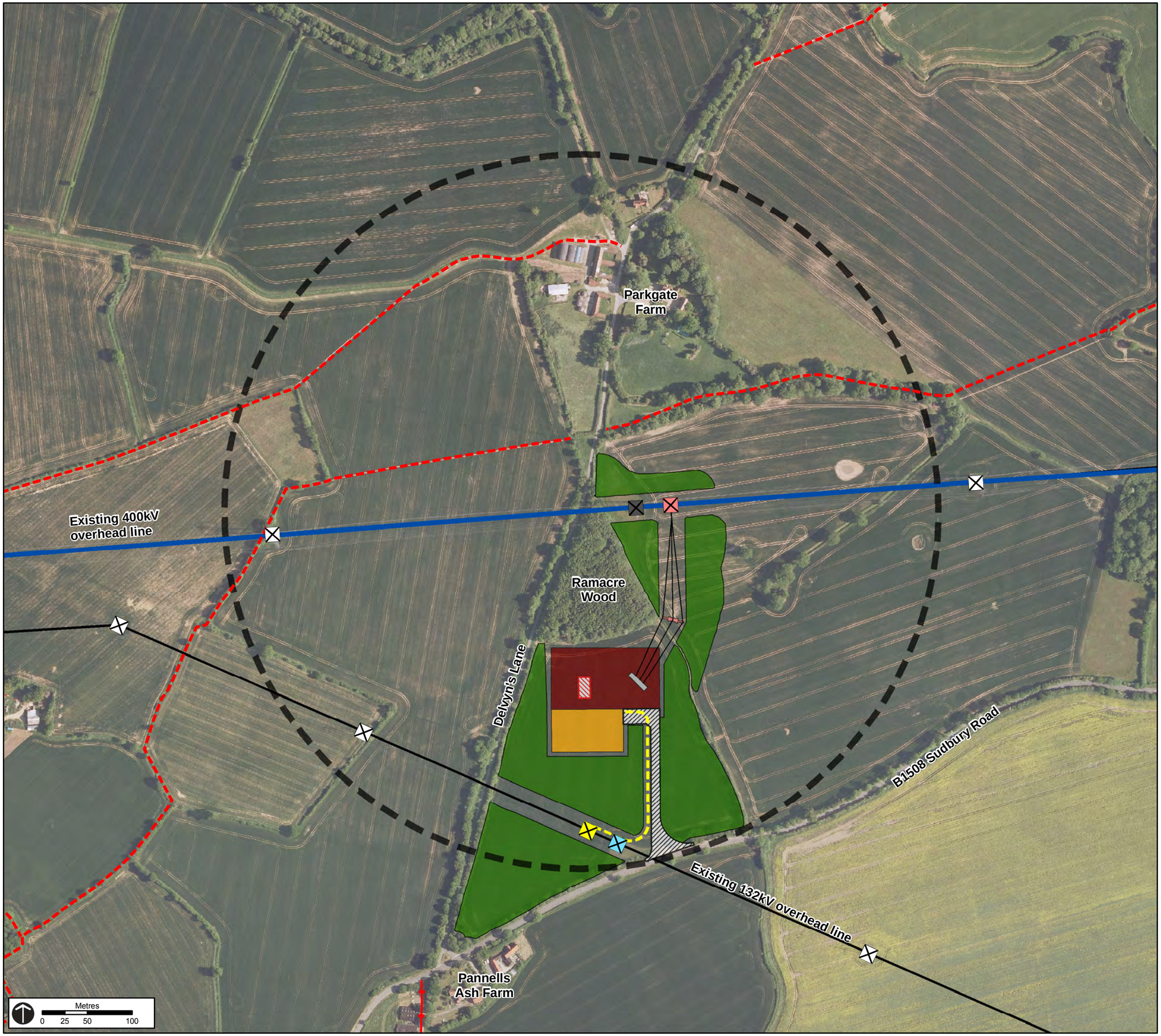
Project: **Bramford to Twinstead Tee Connection**

Title: **Location B2 Schematic Layout AIS Option**

Drawing No: G1980.996b

Date:	TEP Ref No:
26-01-2013	G1980.996b

Drawn:	Checked:	Approved:
CB	CH	CH



Key

Substation study area

Existing Infrastructure

Existing 400kV overhead line

Existing 132kV overhead line

Existing electricity pylon

Proposed Infrastructure

400kV Air Insulated Switchgear (AIS) compound

132kV AIS compound

Landscape buffer incorporating low mounds, woodland and hedgerow planting
Approximate maximum height of woodland planting after 15 years is 10m

New 400kV pylon with downleads to a smaller pylon (approximately 16.5m high) before connection with gantry

Gantry (approximately 12.5m high)

Location of Super Grid Transformer (SGT) (approximately 10.5m high)

Existing 400kV pylon to be removed

Existing132kV pylon to be removed

New 132kV pylon with sealing end platform

132kV underground cable route

Substation access road

Public Right of Way

Footpath

Byway

NOTE:

Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

This map includes data from the following sources:
- Ordnance Survey
- National Grid

nationalgrid

Project:
Bramford to Twinstead Tee Connection

Title:
Location B3 Schematic Layout AIS Option

Drawing No:
G1980.997b

Date:	TEP Ref No:
26-01-2013	G1980.997b

Drawn:	Checked:	Approved:
CB	CH	CH

Key

Substation study area

Existing Infrastructure

- Existing 400kV overhead line
- Existing 132kV overhead line
- Existing electricity pylon

Proposed Infrastructure

- 400kV Air Insulated Switchgear (AIS) compound
- 132kV AIS compound
- Landscape buffer incorporating low mounds, woodland and hedgerow planting
  Approximate maximum height of woodland planting after 15 years is 10m
- New 400kV pylon with downleads to gantry
- Gantry (approximately 12.5m high)
- Location of Super Grid Transformer (SGT) (approximately 10.5m high)
- Existing 400kV pylon to be removed
- Existing132kV pylon to be removed
- New 132kV pylon with sealing end platform
- 132kV underground cable route
- Substation access road

Public Right of Way

- Footpath
- Byway

NOTE:

Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

This map includes data from the following sources:
- Ordnance Survey
- National Grid

nationalgrid

Project: **Bramford to Twinstead Tee Connection**

Title: **Location B4 Schematic Layout AIS Option**

Drawing No: G1980.998b

Date:	TEP Ref No:
26-01-2013	G1980.998b

Drawn:	Checked:	Approved:
CB	CH	CH

Key

Substation study area

Existing Infrastructure

- Existing 400kV overhead line
- Existing 132kV overhead line
- Existing electricity pylon

Proposed Infrastructure

- 400kV Air Insulated Switchgear (AIS) compound
- 132kV AIS compound
- Landscape buffer incorporating low mounds, woodland and hedgerow planting
  Approximate maximum height of woodland planting after 15 years is 10m
- New 400kV pylon with downleads to gantry
- Gantry (approximately 12.5m high)
- Location of Super Grid Transformer (SGT) (approximately 10.5m high)
- Existing 400kV pylon to be removed
- Existing132kV pylon to be removed
- New 132kV pylon with sealing end platform
- 132kV underground cable route
- Substation access road

Public Right of Way

- Footpath
- Byway

NOTE:

Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

This map includes data from the following sources:
- Ordnance Survey
- National Grid

nationalgrid

Project: **Bramford to Twinstead Tee Connection**

Title: **Location B5 Schematic Layout AIS Option**

Drawing No: G1980.999b

Date:	TEP Ref No:
17-01-2013	G1980.999b

Drawn:	Checked:	Approved:
CB	CH	CH

Butler's Wood

A131

Existing 400kV overhead line

Waldegrave Wood

Old Road

Existing 132kV overhead line

Nether House Farm

Metres
0 50 100 200

Key

Substation study area

Existing Infrastructure

Existing 400kV overhead line

Existing 132kV overhead line

Existing electricity pylon

Proposed Infrastructure

400kV Air Insulated Switchgear (AIS) compound

132kV AIS compound

Landscape buffer incorporating low mounds, woodland and hedgerow planting

Approximate maximum height of woodland planting after 15 years is 10m

Existing 400kV pylon with downleads to gantry

Gantry (approximately 12.5m high)

Location of Super Grid Transformer (SGT) (approximately 10.5m high)

Existing 400kV pylon to be removed

Existing132kV pylon to be removed

New 132kV pylon with sealing end platform

132kV underground cables route

Substation access road

Public Right of Way

Footpath

Bridleway

NOTE:
Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

nationalgrid

Project: **Bramford to Twinstead Tee Connection**

Title: **Location C2 Schematic Layout AIS Option**

Drawing No: G1980.1000d

Date: 07-02-2013

TEP Ref No: G1980.1000d

Drawn:	Checked:	Approved:
CB	CH	CH

Butler's Wood

A131

Existing 400kV overhead line

Waldegrave Wood

Old Road

Existing 132kV overhead line

Nether House Farm

Metres
0 50 100 200

Key

Substation study area

Existing Infrastructure

Existing 400kV overhead line

Existing 132kV overhead line

Existing electricity pylon

Proposed Infrastructure

400kV Air Insulated Switchgear (AIS) compound

132kV AIS compound

Landscape buffer incorporating low mounds, woodland and hedgerow planting
Approximate maximum height of woodland planting after 15 years is 10m

New 400kV pylon with downleads to a smaller pylon (approximately 16.5m high) before connection with gantry

Gantry (approximately 12.5m high)

Location of Super Grid Transformer (SGT) (approximately 10.5m high)

Existing 400kV pylon to be removed

Existing132kV pylon to be removed

New 132kV pylon with sealing end platform

132kV underground cable route

Substation access road

Public Right of Way

Footpath

Bridleway

NOTE:

Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

nationalgrid

Project: **Bramford to Twinstead Tee Connection**

Title: **Location C3 Schematic Layout AIS Option**

Drawing No: G1980.1001b

Date:	TEP Ref No:
26-01-2013	G1980.1001b

Drawn:	Checked:	Approved:
CB	CH	CH

Butler's Wood

A131

Waldegrave Wood

Old Road

Existing 132kV overhead line

Nether House Farm

Metres
0 50 100 200

Key

Substation study area

Existing Infrastructure

Existing 400kV overhead line

Existing 132kV overhead line

Existing electricity pylon

Proposed Infrastructure

400kV Air Insulated Switchgear (AIS) compound

132kV AIS compound

Landscape buffer incorporating low mounds, woodland and hedgerow planting

Approximate maximum height of woodland planting after 15 years is 10m

New 400kV pylon with downleads to gantry

Gantry (approximately 12.5m high)

Location of Super Grid Transformer (SGT) (approximately 10.5m high)

Existing 400kV pylon to be removed

Existing132kV pylon to be removed

New 132kV pylon with sealing end platform

132kV underground cable route

Substation access road

Public Right of Way

Footpath

Bridleway

NOTE:

Layout is indicative and for the purpose of options appraisals only

Pylon footprints not to scale & diagrammatic only

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Project: **Bramford to Twinstead Tee Connection**

Title: **Location C4 Schematic Layout AIS Option**

Drawing No: G1980.1002b

Date:	TEP Ref No:
26-01-2013	G1980.1002b

Drawn:	Checked:	Approved:
CB	CH	CH

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