Gate Burton Energy Park Environmental Statement

Volume 3, Appendix 3-A: Grid Connection Corridor Appraisal
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Gate Burton Energy Park Limited

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1. Introduction

1.1 Purpose of this Report

1.1.1 This report presents an options appraisal to assist in the identification of a preferred Grid Connection Corridor for the proposed Gate Burton Energy Park, located approximately 6km south of Gainsborough. The appraisal was undertaken during October 2021 to April 2022.

1.1.2 Following the definition of a Search Area (as set out at section 2.1 below) and mapping land, property and environmental constraints, three potential corridors were identified as shown in (Corridor A, B and C). Within Corridor C, two separate corridors were identified – C1 and C2. For all corridors there are two design options that are being considered: an underground cable and an overhead line. These are referred to collectively as the 'Grid Connection'. The 'Solar and Energy Storage Park' refers to the Solar PV site. The Search Area and the Corridors appraised are shown in Annex A.

1.1.3 The objective of this options appraisal is to identify and review the planning, engineering and environmental constraints within each of the corridors in order to identify a preferred Grid Connection Corridor. The preferred corridor will best balance minimising impacts on the environment and the local community with technical and engineering feasibility.

1.1.4 The preferred corridor for each of the installation methods (overhead line or underground cable) will be considered further by Gate Burton Energy Park Ltd (the Applicant) and used to inform the development of detailed design and the associated alignment within the preferred corridor.

2. Methodology

2.1 Step 1 – Definition of Search Area

2.1.1 The corridor Search Area is the primary restriction on the corridor options developed. The search area must therefore be proportionate but at the same time be broad enough to ensure corridor options can be developed that allow the avoidance of key constraints wherever possible.

2.1.2 At the outset of the study, a Search Area was defined which would facilitate the development of alternative Grid Connection Corridors between the Solar and Energy Storage Park and the existing substation at Cottam Power Station (referred to in this Report as the Cottam substation).

2.1.3 The Search Area is shown in Annex A and was defined by taking into consideration:

- The connection start and end points being the Solar and Energy Storage Park's western and southern boundaries and the Cottam substation;

- The location and distribution of statutory designated sites, including landscape, ecological, heritage and hydro-geological designations, ensuring the Search Area was large enough to allow a variety of options to be developed;
- The geographic size, location and distribution of residential property and settlements, ensuring where possible that major settlements could be routed around;
- The location of existing infrastructure that would need to be crossed, in particular rail and road alignments; and
- Physical constraints including topography, major watercourses and areas of flood risk.

2.1.4 The Search Area provides sufficient options for avoidance of key constraints, whilst maintaining a reasonable total distance for the proposed connection.

2.2 Step 2 – Definition of Routing Criteria

2.2.1 There are a number of technical, constructability, environmental and safety factors that need to be considered for the purposes of identifying a preferred Grid Connection Corridor. These factors include (in no order of priority):

- Avoidance, as far as possible, of dense areas of population or close proximity to other buildings or residential dwellings;
- Avoidance, as far as possible, of areas and sites subject to International and National ecological designations such as Ramsar sites, Special Areas of Conservation (SAC), Special Protection Areas (SPA), National Nature Reserves (NNR), Sites of Special Scientific Interest (SSSIs);
- Avoidance as far as possible of areas subject to international and national landscape designations such as National Parks and Areas of Outstanding Natural Beauty (AONB);
- Avoidance, as far as possible, of sites and features subject to cultural heritage designations such as World Heritage Sites, Scheduled Monuments, Registered Parks and Gardens, Registered Battlefields and listed buildings, and significant archaeological sites;
- Minimising the overall effect on agricultural interests as far as possible;
- Potentially difficult construction areas, such as side slopes, solid rock strata, and complex river crossings will be avoided as far as possible;
- Where practicable, steep slopes are traversed directly, because construction on severe side slopes has associated health and safety/engineering implications associated with stability of construction machinery, and may require benching earthworks to create a safe working area;
- Routeing generally seeks to minimise significant changes in elevation;
- All crossing points such as rivers, roads, railways, pipelines and buried apparatus, etc. would be crossed at right angles as far as possible;
- Safe access must be possible for construction traffic;
- Adherence to separation distances where applicable, and any other project specific design constraints; and
- Ease of access (i.e. near to / access from a public road, connecting road network suitable for heavy goods vehicles).

2.3 Step 3 – Open Data Collection

2.3.1 In addition to topographic base mapping showing existing land use, settlement areas and infrastructure, a series of open data sets were obtained including nature conservation, archaeological, heritage, geological, hydro-geological, planning, minerals and tourism information. All data was mapped into a web-based GIS (Web GIS) mapping tool. The data sets (also referred to as 'features') obtained are listed below, noting that not all of the features listed appear within the Search Area.

2.3.2 Open Data Sets Obtained:

- Planning areas;
- Land titles (MoD, Crown Estate and National Trust);
- Existing building footprint;
- Major engineering features:
    - Major roads (including 'A' class and 'B' class roads);
    - Minor roads (including 'C' class and unmade roads);
    - Railway lines (including main line, branch lines and disused);
    - Surface water;
    - Rivers and canals (navigable/non-navigable);
    - High voltage overhead cables;
    - Airfields/ airports (operational/ disused);
- Agriculture (agricultural land classification);
- Source Protection Zones;
- Flood Zones;
- Mineral extraction areas;
- Authorised landfill site;
- Operational quarries;
- Disused quarries;
- Potential quarry expansion areas;
- Mineral safeguard areas;
- Topography;
- Nature Conservation:
    - Statutory designations;
    - Non-statutory sites;
    - Protected Species expected to be encountered in Area of Search;
- Archaeology and Cultural Heritage:
    - Scheduled Ancient Monuments;
    - Listed buildings;
    - Battlefields;
    - Registered Park and Gardens;
    - Conservation Areas;
- Landscape and visual data:
    - Areas of Outstanding Natural Beauty (AONB);
    - National Parks;
    - National Character Areas;

- National Trail;
- Country Park;

- Golf courses

3. Environment

3.1.1 This section of the Report provides a summary of the baseline, survey work undertaken and key issues associated with Corridors A, B and C (refer Annex A) for the environment topics: Ecology, Heritage, Landscape and Visual, Water Environment and Traffic and Transport. Desk-top studies were undertaken for soils, contaminated land, air quality and noise with the results provided in Sections 6 and 7.

3.2 Ecology

Baseline

3.2.1 The habitats within the corridor options are typical of lowland farmland present in Lincolnshire and Nottinghamshire, comprising predominantly arable farmland, grassland, waterbodies (ponds), hedgerows / scrub and each corridor option crosses the River Trent.

3.2.2 These habitats are likely to support, or known to support, populations of species that are protected at an international (European), national, regional or local level. These include:

- Great Crested Newt (*Triturus cristatus*);
- Reptiles;
- Breeding birds;
- Commuting, foraging and roosting bats;
- Badger (*Meles meles*);
- Otter (*Lutra lutra*); and
- Water Vole (*Arvicola amphibius*).

3.2.3 There are no statutorily designated sites of international importance within the route options, or within 10km of the route options.

3.2.4 There are no statutorily designated sites of national importance within the route options, however there is one SSSI (Ashton's Meadow SSSI) which lies 1.5km to the west of the route options.

3.2.5 There are seven non-statutory sites designated for nature conservation within, or immediately adjacent to, the corridor options. These are:

- Littleborough Lagoons Local Wildlife Site (LWS) -within route option A;
- Mother Drain, Upper Ings LWS – within route option A and option B;
- Thornhill Lane Drain Littleborough LWS – within route option A;
- Cow Pasture Lane Drains LWS -within route option A and B;
- Coates Wetland LWS – immediately north of route option C1 and within route option C2;

- 5/2324 LWS – immediately west of route option C2; and
- Torksey Ferry Road Ditch LWS – within route option C2.

Survey

3.2.6 A desk study was undertaken to identify sites designated for their biodiversity value and records of protected and/or notable habitats and species (biodiversity features) and invasive non-native species that are potentially relevant to the Scheme.

3.2.7 The desk study included a search for:

- Sites of international conservation value (Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites) within 10 km of the corridor options as well as any SACs within 30km of the corridor options where bats are noted as the, or one of the, qualifying features;
- Statutorily designated sites of national nature and geological conservation value, e.g. Sites of Special Scientific Interest (SSSIs) and Local Nature Reserves (LNRs) within 2km of the corridor options;
- Non-statutory designated sites of nature and geological conservation value, e.g. Local Wildlife Sites (LWSs) (which includes ancient woodland), within 2km of the corridor options;
- Ancient woodland and other notable habitats within 2km of the corridor options; and
- Records of protected or notable species within 2km of the corridor options.

3.2.8 The requirement for ecological field surveys was determined following a Phase 1 Habitat survey, which followed the standard method 'Handbook for Phase 1 habitat survey: A technique for environmental audit' (Ref 3), which was undertaken in January 2022. In summary, this comprised walking over accessible land within the corridor options and recording the habitat types and boundary features present.

3.2.9 A protected species scoping survey was carried out in conjunction with the Phase 1 Habitat survey, which was used to appraise the habitats for their suitability to support protected or notable species and for the recommendation of further surveys.

3.2.10 Additionally, wintering bird surveys, using a walkover method, and vantage point surveys, to record flight lines of birds using the River Trent, were undertaken along the four corridor options to identify where there are ecological receptors which may influence a corridor's feasibility or constrain a corridor option.

Key Issues

Underground Cable

3.2.11 There are potential impacts of construction of an underground cable within all route corridor options, although ecological constraints can often be avoided through careful and considerate placement of the cabling and through pre-construction management and mitigation.

3.2.12 Where a route corridor option crosses through a LWS or priority habitat, particularly options C1 and C2, then disturbance will need to be minimised (e.g. via routeing to avoid or use of HDD installation methods) to avoid construction-related impacts.

3.2.13 There are no identified operational impacts on ecological receptors.

Overhead Line

3.2.14 There are potential impacts of construction of towers supporting Overhead Power Line (OHL) within all Grid Connection Corridor options, although ecological constraints (including where a route options crosses a LWS or priority habitat) can often be avoided through careful and considerate placement of towers and pre-construction management.

3.2.15 The installation of OHL across the River Trent will increase the risk of collision of birds (such as swans, geese and ducks) using the River Trent corridor.

Limitations

3.2.16 The assessment used to identify the presence of ecological receptors was informed by a combination of site surveys, undertaken between January and March 2022 and from the desk study. Therefore, where a species is not recorded as present, this does not necessarily mean absence and where absence has been recorded from desk study data only, the likely presence of that species (or species group) has been determined through professional judgement and using a precautionary principle, where necessary.

3.3 Heritage

Baseline

3.3.1 The Grid Connection Corridor options have been subject to a rapid assessment of potential heritage constraints. Data from the Lincolnshire and Nottinghamshire Historic Environment Records (HER) and the National Heritage List maintained by Historic England has been considered to support this assessment. A review has been undertaken of the historic mapping available through the EnviroCheck report undertaken as part of the project. A site visit was also used to inform the assessment.

3.3.2 The potential Grid Connection Corridor options lie over and adject to the River Trent. The river is a major arterial river which results in a focus of settlement and development adjacent to the river. The earliest human actively consists of flint nodules dating to the Middle Palaeolithic (70,000-40,000 BC), found within the River Trent close to the proposed crossing locations, and a flint adze, dating from the Upper Palaeolithic (40,000 – 10,000 BC) or Mesolithic period, was found in Torksey. These represent the earliest evidence of human activity in the local area.

3.3.3 The later prehistoric periods, through to the Bronze Age (2500 - 700 BD), is sparsely represented by individual recorded finds. There is significant increase in evidence of the development of the area during the Iron Age (700BC - AD43), particularly in the later phase of the period leading into the transition

into the Roman period (AD43 – AD409). Several areas of cropmarks, across the options, potentially date to the Iron Age and the Roman transition period.

3.3.4 Option B is crossed by Till Bridge Lane, a Roman road linking Ermine Street north of Lincoln to a ford crossing the River Trent at Matron to Segelocum Roman town adjacent to Option A. The Roman town is scheduled and investigation has identified building foundations, pavements, kilns, ovens and multiple small finds. Although the scheduled area lies outside of the option corridors, geophysical survey undertaken on behalf of Historic England shows that the town extends beyond the extent of the scheduled boundary, into Option A (Ref 4). A scheduled Roman fort, south of Littleborough Lane, is also recorded and is visible as cropmarks on aerial photographs within Option B. A study was undertaken in 1997 (Ref 5) into the Romano-British landscape in this area. This work identified a possible Iron Age and definite Romano-British landscape with roadside settlement and evidence of agricultural and manufacturing activities as well as a significant collect of small finds identified through field walking. Evidence of settlement, agricultural practices, and a military presence in the form of a fort at Gate Burton, as well as multiple individual finds, contribute to the understanding of the significance of the Roman presence in this area.

3.3.5 In the winter of AD 872-73 the Viking Great Army made camp at Torksey. Their camp has been identified to the north of Torksey village in the parishes of Brampton and Torksey within Option C. The Universities of Sheffield and York undertook a five year programme of archaeological work to investigate this area between 2011 and 2015: The Viking Torksey Project. Several thousand individuals overwintered in the camp, including warriors, craft workers and merchants.

3.3.6 There is evidence of development of the landscape through the early medieval (AD409 – 1066) and medieval (1066 – 1500) periods including areas of ridge and furrow and trackways. Many of the extant settlements in the areas adjacent to the corridor options, such as Littleborough, Gate Burton, Marton, Torksey and Rampton, have their origins during this time and remnants of these changes are preserved in the landscape. The villages and hamlets of Littlebourough, Marton and Rampton retain their medieval churches, all listed at Grade I, whilst the Church of St Peter at Torskey also has medieval origins and is listed at Grade II*. The former medieval church at Gate Burton was demolished and rebuilt in the post-medieval period. Aside from those located within settlements, a convent church, listed at Grade II*, was also established in the 11th century at Knaith, north of Option A. It was associated with the nearby scheduled monument of a Cistercian nunnery at Heynings Priory to the east. The scheduled medieval moated site at Fleet Plantation lies on the boundary of Option C2. There are numerous features identified from aerial photographs of unknown date across all the options. Several of these features may relate to farming and landscape practices in the early medieval and medieval periods.

3.3.7 The post-medieval period saw the continued development and limited expansion of the medieval settlements already established in the study area, such as at Rampton, Littleborough and Marton, where various buildings dating to the 18th and 19th centuries are now listed at Grade II. The development of

Gate Burton and Torksey, however, differs from this pattern, as at both locations the medieval settlements were lost or destroyed, and stately homes were built in the post-medieval period. The scheduled monument and Grade I listed building of Torksey Castle is an early post-medieval country house built in 1560 by Sir Robert Jermyn, located to the north of the scheduled monument of the former medieval town. It is now ruinous with its west façade and part of the rear wall is all that survives above ground. The west façade overlooks the Trent towards Option C2. At Gate Burton, the parkland associated with Gate Burton Hall extends into Options A and B and contains the deserted medieval settlement of Gate Burton. It is a classic example of population dispersal caused by emparking (the enclosing of land to create parkland) in the 18th century. The Grade II* listed hall was built in 1774-80 for the Hutton family who had recently purchased the estate from the Lords Willoughby of Parham. It had formed part of the Knaith estate, to the north of Option A, until that time. The parkland around the hall was laid out in the 18th century and includes the Grade II* listed Burton Chateau as a garden building with extensive views over the parkland to the south-east into Option B.

3.3.8 The Knaith estate was developed throughout the 15th and 16th centuries around the former medieval convent church. Knaith Hall, to the west of the church, is late medieval or early post-medieval with evidence of development and extension throughout the 17th, 18th and 19th centuries. It is Grade II listed. There is evidence of late 16th to early 17th century garden remains and an 18th century deerpark in the fields to the south of the hall towards Option A.

3.3.9 Outside the settlements and parklands, there is evidence of farming practices and post-medieval flood defences, as well as landscape features such as rabbit warren and quarrying.

3.3.10 The early 19th century toll house at Littleborough Cottage lies on the boundary of Option A. It was built by the Reford and Littleborough Turnpike Trust on the turnpike between Spittle Hill in Reford to a ferry that operated across the Trent at Littleborough. At this point the turnpike loosely follows the line of the former Roman road west of Segelocum Roman town.

3.3.11 The Ordnance Survey map of the assessment area dating from 1885 shows the area as agricultural land subdivided by regular fields. Many of these field boundaries have been removed in the current landscape to create larger fields for modern farming practices. The Manchester – Sheffield - Lincolnshire Railway is also recorded as crossing the route options. The designed landscapes at Gate Burton and Knaith estates are also clearly defined and the boundaries of the historic areas have notably shrunk since these maps were produced in the 19th century.

Survey

3.3.12 A heritage walkover survey was undertaken 11th to 13th January 2022. The survey was undertaken from public right of ways. The purpose of the survey was to view areas of high archaeological potential, consider the setting of known heritage assets and identify any previously unrecorded heritage assets was possible. The results of the survey have been used to verify the desk-

based research and identify key constraints that would significantly constrain the Grid Connection Corridor.

Corridor A

3.3.13 Corridor option A leaves the Solar and Energy Storage Park to the north of the Gate Burton estate and crosses the River Trent to the north of Grade II* listed Burton Chateau and to the south of the Grade II listed Knaith Hall and Grade II* listed Church of St Mary at Knaith. In this area it runs between two parkland gardens; that at Gate Burton and that at Knaith, and the option area therefore forms part of their landscape setting. The option also lies within a key view from the south towards the Grade II* listed Burton Chateau. As the option continues south it passes close to the scheduled Roman town of Segelocum. While no buried features were visible above ground, geophysical survey undertaken in 2016 identified complex archaeological deposits along the line of the Roman road west of Segelocum, crossing the options corridor. The full extent of the archaeological deposits associated with the Roman town and its hinterland is unknown at this stage. The full nature and extent of Roman town, associated assets and the setting of the scheduled monument would require further study should the option be taken forward.

3.3.14 The option passes directly to the east of the Grade II listed early 19th century toll house at Littleborough Cottage, which is an architecturally interesting building where the aesthetic aspects of the building in its setting from part of its significance. The option therefore lies within the asset's setting. From within the option area and its vicinity the church tower of the Grade II* listed Church of St Peter and St Paul in Sturton le Steeple can be also be seen. It is a tall structure in a relatively flat open landscape and it therefore has prominence in the landscape, forming part of its significance. To the east of the option there are listed buildings in Littleborough, including the Grade I listed Church of St Nicholas, but the survey found this area to be relatively enclosed and screened from the option area, so that the option area makes only a limited contribution to their setting and significance.

3.3.15 As corridor option A heads south, it crosses through agricultural land. No previously unrecorded heritage assets were noted during the site visit. However, a number of heritage assets are recorded on the Nottinghamshire HER, including cropmarks of possible enclosures and hut circles of possible Iron Age or Roman date and features relating to agricultural practices in the medieval and post-medieval period.

3.3.16 The option passes to the east of the settlement of Rampton which includes several listed buildings, most listed at Grade II, and the Church of All Saints listed at Grade I. The survey confirmed that the landscape outside the settlement of Rampton is already host to a series of pylon routes and the existing Cottam power station is already a dominant feature of the setting.

3.3.17 At the very southern extent of the corridor the option passes the scheduled medieval moated site at Fleet Plantation. While the scheduled monument itself is outside the extent of the corridor there is potential for associated archaeological deposits to extend into the corridor. The full nature and extent of associated assets and the setting of the scheduled monument would require further study should the option be taken forward.

Corridor B

3.3.18 Corridor option B leaves the Solar and Energy Storage Park on the south-west edge and passes through a field between the Gate Burton estate and the settlement at Marton. It crosses several designed key views at this location. There are key views to and from the Grade II* listed Gate Burton Hall in its parkland garden and with its Grade II listed gates and collection of several listed buildings in front. It also crosses through key views to and from the Grade II* listed Burton Chateau. The placement of the chateau on a rise overlooking the designed parkland landscape to the south-east is a key aspect of its setting and significance.

3.3.19 Between Marton and the River Trent option B passes crosses over the line of the Roman road which is respected by the line of Littleborough Lane. The scheduled Roman fort and the surrounding Romano-British landscape is located within the corridor to the north and south of Littleborough Lane. As well as the scheduled fort there is also records of a second potential non-designated fort within the corridor. No evidence of archaeological deposits were noted during with site visit in most areas. The exception was some potential earthworks noted in one field on the south side of Littleborough Lane close to the River Trent. The full nature and extent of Romano-British landscape and the setting of the scheduled monument would require further study should the option be taken forward.

3.3.20 Ferry House Grade II listed building is located on the western bank of the Trent adjacent to the option area and oriented south-east towards the river and the option corridor, which lies within its setting.

3.3.21 On the west bank of the River Trent option B passes to the south of the scheduled Roman town. While no heritage assets are recorded in this area it is considered that buried deposits relating to the town would extend south into this area. The full nature and extent of Roman town, associated assets and the setting of the scheduled monument would require further study should the option be taken forward.

3.3.22 From this point option B joins with option A to head south towards Rampton and Cottam Power Station.

Corridor C

3.3.23 Corridor option C leaves the Solar and Energy Storage Park on the southern edge, to the immediate south of the parkland garden of the Grade II* listed Gate Burton Hall. The survey found that views between this area and the hall are largely screened by the local topography and mature planting. The corridor passes through the fields to the north and east of Marton. Marton contains several listed buildings, mostly Grade II, but also including the Grade I listed Church of St Margaret of Antioch. The survey found that the historic core of the settlement lies at the base of a slope and that the option area is at the top of the slope, with intervening buildings screening views. To the south-east of this area, the Grade I listed Church of St Mary at Stow is visible as a prominent building in the surrounding landscape and from within the option area.

3.3.24 The Lincolnshire HER records archaeological deposits of potential Roman date, as well and evidence of post-medieval farming practices. As the corridor

heads west into the Trent Valley it crosses sections of post-medieval flood defences recorded on the HER, the remains of which are still visible in some locations. The eastern bank of the River Trent is dominated by the location of the Viking Great Army camp which had been subject to archaeological evaluation and is recorded on the Lincolnshire HER. The known extents of the camp extend to cover most of the corridor width, although there is potential for associated deposits to extend beyond the recorded area. To date the evaluation works have been concentrated to the eastern bank of river. Consideration must also be given to the potential for associated archaeological sites to be located on the western bank of the river. There were no visible remains of the camp noted during the site visit.

3.3.25 On the western bank on the Trent the corridor passed over the post-medieval and modern flood defences, which were visible during the visit to the area, and out of the flood plain. At this point the option divides into option C1 and C2. Option C1 continues to the west and passes through an area identified as a potential Iron Age or Roman settlement from aerial images. From this point the option joins with the southern extent of option A past Rampton and Cottam Power Station.

3.3.26 Option C2 follows the line of the River Trent to the south and then turns west towards Cottam Power Station. The corridor is narrow at this point and runs through the floodplain of the river until it turns to the west. It passes over the line of the Leverton branch of the Manchester – Sheffield - Lincolnshire Railway which is still visible in the landscape as a footpath. The Grade II* Torksey Viaduct over the River Trent at this location formed part of the railway, and its western extent lies partially within the route corridor. To the south of the viaduct the Grade II* listed Church of St Peter and the Grade I listed Torksey Castle (also a scheduled monument) are also visible from the option area. Torksey Castle's principal elevation faces west over the river towards the option area. Its siting next to the church and the river is a key aspect of its significance. Views over the river and towards the asset from the river therefore form an important part of its setting. The survey noted, however, that Cottam Power Station is an existing dominant feature in these views.

3.3.27 As the corridor continues west it passes an area of quarrying where previous archaeological evaluation identified archaeological deposits dating from the prehistoric through to the medieval period. While archaeological deposits within the quarry have been lost there is potential for associated deposits to survive in the wider area. The option also passes the scheduled medieval moated site at Fleet Plantation. While the scheduled monument itself is outside the extent of the corridor there is potential for associated archaeological deposits to extend into the corridor. The full nature and extent of associated assets and the setting of the scheduled monument would require further study should the option be taken forward.

Key Issues

Underground Cable

3.3.28 There is potential for significant previously unrecorded buried archaeological deposits, in addition to those recorded on the HER, across all three of the proposed Grid Connection Corridors. The River Trent forms a key focal point

for human activity and settlement for the earliest periods of human history and an underground cable would include the risk of impacting deposit from all periods. Within all three route options evidence of the hinterland and infrastructure network relating to the Roman town of Segelocum has been recorded. The influence the Roman period had on the landscape was preserved into the later periods and can still be identified, above ground, in some locations. Several areas of Roman archaeology are considered to be of high value (nationally important) and the impact of a buried cable would have a significant effect. The Viking Great Army camp at Torksey is also considered to be nationally important.

3.3.29 In addition, there is also potential of significant archaeological deposits from other periods. Evidence of prehistoric, early medieval, medieval and post-medieval actively is recorded across all route options. The nature, extent and significance of this deposits would need to be evaluated and understood before the significance of the potential effect of an underground cable option.

3.3.30 Should an underground option be taken forward, consideration of effects on preserved palaeoenvironmental deposits within the Trent Valley will also be required. This may include an assessment of the changes in the groundwater levels (de-watering) and what effect these changes have on the preservation levels across the area.

3.3.31 Whilst an underground option would result in temporary impacts to designated heritage assets through change to their settings, the degree of impact and its temporary duration means that in general an underground option is preferred to overground with regard to the setting of designated assets. In option C2 the western extent of the Grade II* listed Torksey Viaduct lies within the corridor and the remains of the railway line to its west side, that form part of its setting also lies within the option area. The underground option would need to be designed to ensure no physical impact upon the Grade II* listed asset.

Overhead Line

3.3.32 The potential physical effect to buried archaeological deposits would be limited to the footprints of the pylons across all options. Archaeological evaluation and careful design of the pylon locations could be used to limit this effect. There is also the potential for effects on the setting of some archaeological assets. It is considered that these effects are unlikely to be significant (on buried archaeological assets alone). However, further work would be required to determine this.

3.3.33 An overhead option will involve permanent significant effects to designated assets through change to their settings. The linear nature of an overhead line and the scale of the proposed pylons, at c.50m, also means that there is limited scope for mitigation of visual impacts.

3.3.34 Impacts to other assets such as the Grade II listed toll house at Littleborough Cottage and Grade II* Church of St Peter and St Paul in Sturton le Steeple (Option A), the Grade II listed Ferry House (Option B) and the Grade I listed Church of St Mary at Stow and Grade II* listed Torksey Viaduct (Options C1 and C2) are also key considerations.

Summary

3.3.35 The following are key considerations across the proposed corridor options:

- Scheduled Roman Town at Segelocum – any deposits outside the boundary of the scheduling form part of the town and its setting and would be considered to be of national importance. Options A and B.
- Scheduled fort south of south of Littleborough Lane - any deposits outside the boundary of the scheduling may be associated with the fort and the Roman town and their setting and would be considered to be of national importance. Option B.
- The scheduled medieval moated site at Fleet Plantation - any deposits outside the boundary of the scheduling form part of the moated site and its setting and would be considered to be of national importance. Option A and C2.
- The Viking Great Army camp at Torksey – The site and any contemporary deposits would be considered of national importance due to their rarity. Option C.
- Potential for significant previously unrecorded buried archaeological deposits. All Options.
- Potential effects on palaeoenvironmental deposits. All Options.
- Gate Burton Hall and parkland – there is no public access available into the parkland around the hall which limits the robustness of an assessment of views and interrelationships between buildings within the park and the Options. Option A and B.
- Knaith Hall and the Church of St Mary at Knaith – there is no public access available into the grounds of the hall and church which limits the robustness of an assessment of views and interrelationships between these buildings and the Options area. Option A and B.
- Torksey Castle – there is no public access to the castle which limits the robustness of an assessment of views and interrelationships between this building and the Options area. Option C.
- More detailed historic research is necessary to properly define the relationship between Heynings Priory, the Knaith estate and the Gate Burton estate to fully understand the setting relationships between these assets and the surrounding landscape and to provide a robust assessment of the likely significant effects of the scheme.

3.4 Landscape and Visual

Baseline

3.4.1 The Grid Connection Corridor options shown in Annex A have been subject to an initial assessment of potential landscape and visual constraints. Data from the Lincolnshire and Nottinghamshire Councils in relation to landscape character and the National Character Area Profiles maintained by Natural England has been considered to support this assessment. A review of aerial photography along with rights of way and designations set by the local authority has been undertaken as part of the project. A site visit has been carried out to inform the assessment.

3.4.2 The potential Grid Connection Corridor options are located over and adjacent to the River Trent. The river is a major arterial river which results in a focus of settlement and development adjacent to the river. The main land use across the study area is agriculture, characterised by large-scale regular arable fields which are generally open in character defined by low, often gappy, neatly trimmed hedgerows. Land to the west of the route corridor is lower than a ridgeline seen in previous assessments east of the River Trent. It forms the flat floodplain of the River Trent, which also forms the boundary between Lincolnshire and Nottinghamshire.

3.4.3 Settlement along the corridor options consists of small hamlets such as Gate Burton and Marton to the north of the study, as well as individual farmsteads interspersed between these settlements. The villages are long-established, and several include historic elements of note such as manor houses, scheduled monuments, and windmills. The influence of the River Trent is strong within the western, eastern, and southern part of the route corridor study area, with the valley containing the prominent power stations at West Burton and Cottam which provide a sense of industrialization in the otherwise rural context. Rampton, to the southwest of the route corridor, is a densely populated village when seen in the context of the surrounding settlements.

3.4.4 Other infrastructure within the search area includes a considerable amount of overhead transmission lines carried by lattice pylons through the Trent valley. The River Trent corridor is well vegetated, being bordered by narrow belts of riverside trees, such that in the southern part of the study area, the main woodland patterns are associated with the River Trent.

3.4.5 Public Rights of Way (PRoW) along the Grid Connection Corridor boundaries are primarily located west of the River Trent, and form a network of recreational value. Lincolnshire County Council's online PRoW mapping, indicates that east of the River Trent PRoW are limited.

3.4.6 None of the Grid Connection Corridor options or immediate surrounding context is covered by any national landscape designations i.e. National Parks or Areas of Outstanding Natural Beauty (AONB). West Lindsey District Council has designated several Areas of Great Landscape Value which are present within the study area. The villages of Rampton, Gate Burton and Marton retain their essential historic character and include listed buildings and conservation areas.

3.4.7 Initial desktop analysis been undertaken across the study area to identify visual receptors whose views may be impacted by the Scheme. A desktop study undertaken during January 2022 indicates that given the nature of the development, the Scheme will be visible during different stages of its development, however, it will not be visible in its entirety due to the variations in landform, the screening provided by intervening vegetation, and due to the overall location of the Order limits.

3.4.8 The northern parts of the Grid Connection Corridor are visible from residential properties adjacent to the A156, Stow Park Road, Littleborough Lane and Littleborough Road due its proximity and position to the Grid Connection Corridor boundaries. These parts of the corridor are also visible for motorists and recreational users along these routes. From elevated locations in the

northern part of the study area, the fields within the Order limits are not visible, due to the combination of distance, landform and intervening vegetation. This area is more sensitive than the southern section of the corridors as the grid connection will bring elements associated with the prominent power stations to the south further north into the view of the receptors located to the north.

3.4.9 Fieldwork was undertaken in February 2022 to review the visibility of the corridor boundary and the visual receptors in winter (i.e. the worst-case).

Survey

3.4.10 The survey area for the landscape and visual impact assessment covers a radius of maximum 1km from the boundary of the proposed corridors depending on their location and the visual extent of the individual development component. The extent of the survey area was based on initial findings of the desktop study and has been verified and refined during the site survey. The survey has been undertaken within and outside of the proposed corridors in areas that are accessible by the general public.

3.4.11 The landscape and visual impact assessment field survey was carried out along publicly accessible routes where close, middle- and long-distance views of the Scheme components will be possible. Cumulative effects in conjunction with the proposed solar farm, have been considered.

3.4.12 Viewpoint from representative locations were identified and photographed during the site visit. These viewpoint locations will be considered for photomontage production depending on the final design of the Grid Connection Corridor.

Key issues

Underground Cable

3.4.13 There is potential for significant effects arising from the construction phases of the underground option of the development. The River Trent forms a key focal point for human activity and a recreational and amenity corridor for residents, an underground cable could risk an impact on the local landscape character temporarily during the construction phase. It will however become imperceptible over time as vegetation regrows and is replanted. Within all three route corridor options, there are a number of residential dwellings and significant historic hamlets. The activity and disturbance during construction would have adverse effects on the visual amenity of these areas. However, any impacts at the construction phase for all three options will be temporary given the nature of the development.

3.4.14 Whilst an underground option would result in potential significant landscape and visual effects on receptors, the degree of impact and its temporary duration is limited to the construction phase and until landscape mitigation measures have established. Potential residual effects would be limited. It is therefore the preferred option.

3.4.15 Underground Option B is the shortest in length to Cottam Power Station and would restrain the construction activities just north of the already industrialized setting of Cottam Power Station. Underground Option B is therefore the

preferred option in this regard as it will limit the extent of landscape and visual impacts created by the construction activity.

Overhead Line

3.4.16 An overhead line option will involve permanent significant effects to the landscape and visual resource of the study area in all route options, given the nature and scale of the development. The linear nature of an overhead line and the associated pylons, would allow for limited scope for mitigation of visual impacts. It is likely that Options A, B, and C could have the potential to create significant effects on the immediate residential and recreational receptors.

3.4.17 The northern section of Option A would particularly result in adverse landscape and visual effects as this area is currently not affected by existing large scale overhead lines and retains therefore a more natural landscape character than other sections of the Grid Connection Corridor options, which is beneficial to views to the north and northeast.

3.4.18 The remaining Grid Connection Corridor options would result in a further intensification of overhead line structures within the visual amenity and reinforce the industrial component of the landscape character, which is defined by Cottam Power Station and associated infrastructure.

3.4.19 Option C (including sub-options) will result in a further industrialisation of the eastern study area in close proximity of the River Trent, potentially resulting in significant adverse visual and landscape effects.

3.4.20 Option B is the shortest in length and will be in-keeping with the already industrialised landscape character due to existing large scale overhead lines within the centre of this Grid Connection Corridor option. While the proposal would further intensify the visual prevalence of overhead lines, it would not be totally out of character and bundle the proposed overhead line with existing ones.

3.4.21 Landscape mitigation measures are limited in order to significantly offset potential landscape and visual effects arising from overhead lines considering the scale and nature of the development.

Limitations

3.4.22 The assessment of landscape and visual effects for the proposed route corridor options has been based on a general understanding of the proposed requirements of the construction and operation of underground cable and overhead line structures. The exact location of these structure options within each corridor has not been known at the time of the assessment so that the impact on specific receptors could not be further detailed.

3.5 Water Environment

Baseline

Topography, Land Use and Rainfall

3.5.1 On the basis of Ordnance Survey mapping, the search area encompassing the Grid Connection Corridor options (Annex A) is rural and largely flat, being generally situated below 10m above ordnance datum (AOD). It constitutes the floodplain of the River Trent which flows south to north through the study area. The area is predominantly agricultural, but interspersed with some areas of improved grassland and deciduous woodland. Cottam Power Station and substation is located to the southwest of the area between the villages of Rampton and Cottam. The A156 (Gainsborough Road) passes through the study area north to south to the east of the River Trent, and passes through the villages of Marton and Gate Burton, while the A1500 connects to Marton from the east within the study area.

3.5.2 The nearest MET Office weather monitoring station is Scampton which is located approximately 12km to the south-east of the Scheme. Based on the available data from this weather station (1981–2010), it is estimated that the study area is likely to receive an average of 613.2mm of rainfall per year, with it raining (greater or equal to 1mm of rain) on approximately 115.6 days per year. This suggests that rainfall in the area is low and can be considered below average for rainfall in the United Kingdom. Rainfall is highest from mid-winter to mid spring and generally peaks in January, with the least rainfall falling in May on average.

Surface Watercourses

3.5.3 The Environment Agency's Catchment Data Explorer website indicates that the study area is located within the Witham Management Catchment within the Anglian River Basin Management Plan (RBMP) and the Lower Trent and Erewash Management Catchment within the Humber RBMP. There are three reportable WFD watercourses within the study area. These are:

- River Trent - Trent from Carlton-on-Trent to Laughton Drain (WFD ID: GB104028058480);
- Marton Drain - Marton Drain Catchment (trib of Trent) (WFD ID: GB104028057840); and
- Seymour Drain - Seymour Drain Catchment (trib of Trent) (WFD ID: GB104028058340).

3.5.4 The Trent from Carlton-on-Trent to Laughton waterbody is designated from the town of Carlton-on-Trent where it flows predominantly north-north east for 58.6 km to Laughton where the waterbody is then designated as the 'Humber Upper' WFD waterbody. It is located to the west of the Solar and Energy Storage Park, but would be crossed by all Grid Connection Corridor options to Cottam substation. The waterbody drains a total area of 126 km^2. It is classified as an artificial waterbody. During the 2019 Cycle 2 its overall classification was Moderate Ecological Potential and its Chemical Status Failing. It is not achieving Good Status due to its physical modifications, sewage discharge pollution, poor soil management and transport drainage. The watercourse is a main river.

3.5.5 The Trent has an extensive floodplain, yet has been constrained to a large, single thread, passively meandering, and morphologically homogenous river, with little lateral connectivity or diversity in flow type or process. As a result, the riparian zone is depleted and of little functional value.

3.5.6 Marton Drain Catchment (trib of Trent) waterbody rises close to the village of Torksey from where it flows generally north for 3.12 km before reaching its confluence with the River Trent. It drains a total area of 5.04 km2. It is classified as a heavily modified waterbody. During the 2019 Cycle 2 its overall classification was Moderate Ecological Potential and it had a Chemical Status of Failing. It is not achieving Good Status due to its physical modifications, sewage discharge pollution and poor livestock management. This watercourse would be crossed by route options C1 and C2.

3.5.7 Seymour Drain Catchment (trib of Trent) rises in an agricultural region, south of the village of Rampton where it flows in a step-like fashion in a north easterly direction for 6.5 km before reaching the confluence with Trent from Carlton-on-Trent to Laughton waterbody (River Trent). It is located west of the River Trent but would be crossed by the Scheme depending on the Grid Connection Corridor. It drains a total catchment area of 19.6 km^2. It is classified as a heavily modified waterbody. During the 2019 Cycle 2 its overall classification was Moderate Ecological Potential and its Chemical Status Failing. It is not achieving Good Status due to its physical modifications, sewage discharge pollution, poor soil management and transport drainage. The watercourse and its tributaries are ordinary watercourses. This watercourse would be crossed by route options C1 and C2.

3.5.8 In addition to the WFD waterbodies described above, there are a number of small, typically unnamed, field drains. These drains, as well as Marton Drain and Seymour Drain, are highly modified in character, with extensive straightened sections, grossly over-deepened, trapezoidal ditches, with little variation. Channel beds are heavily sedimented with silt and fine particles from agricultural fields and are likely heavily polluted due to the use of fertilisers and pesticides in adjacent fields.

Geology and Soils

3.5.9 The BGS Geoindex website indicates that the bedrock geology in the area is predominantly Mercia mudstone, but with a thin corridor of Penarth Group mudstone orientated north-south through Gate Burton and Marton. East of this is Scunthorpe Mudstone Formation. Defra's MAGIC map indicates that the bedrock is Secondary B aquifer (predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering), except for Penarth Group which is Secondary (undifferentiated aquifer). Secondary (undifferentiated) aquifer is where it is not possible to apply either a Secondary A or B definition. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

3.5.10 Superficial geology within the study area is alluvium clay, silt, and sand associated with the River Trent. Further west and east there are river terrace deposits consisting of sand and gravel, and to the east there is also an area

of blown sand. The superficial deposits in the study area are predominantly Secondary A aquifer.

3.5.11 Within the River Trent's immediate floodplain in the study area, soils are loamy and clayey with a naturally high groundwater and moderate fertility. To the east and west of this Grid Connection Corridor, soils have a tendency to be acidic and of very low fertility, although there are some areas of moderate to high fertility, such as in the area between Knaith and Gate Burton. The eastern area of the study is occupied by slowly permeable, seasonally wet, base-rich, loamy and clayey soils, with impeded drainage and moderate fertility.

3.5.12 The study area including all options falls within the Lower Trent Erewash – Secondary Combined groundwater body (GB40402G990300) This waterbody covers a total area of 1924.4 km^2 and during 2019 Cycle 2, was given Good Status, overall, quantitively and chemically.

Water Resources

3.5.13 The study area for all options falls partly within a Drinking Water Protected Area (Surface Water), but not within a Drinking Water Safeguard Zone. Drinking Water Protected Areas (Surface Water) are, within the Water Framework Directive (WFD), where raw water is abstracted from rivers and reservoirs.

3.5.14 The study area is split between three Nitrate Vulnerable Zones (NVZ) which encompass all options. From east to west these are S333 - Marton Drain Catchment (trib of R Trent) NVZ, S347 - R Trent from Carlton-on-Trent to Laughton Drain NVZ and S343 - Seymour Drain Catchment (trib of River Trent) NVZ. Nitrate Vulnerable Zones are areas designated as being at risk from agricultural nitrate pollution.

3.5.15 There are no groundwater source protection zones in the study area.

3.5.16 Information on water quality, pollution incidents, licences and unlicensed water abstractions, and water activity permits (i.e. discharges) have been requested from the Environment Agency and presented in the Environmental Statement.

Nature Conservation Sites

3.5.17 Within the study area, there are no designated protected areas including Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), National Nature Reserves (NNRs) or Local Nature Reserves (LNRs).

Flood Risk

3.5.18 The Grid Connection Corridor options are all predominately located within Flood Zone 3, with minor areas outside of this zone, and will have to cross the River Trent (either beneath or over). There are flood defence embankments running parallel to the River Trent on both banks.

3.5.19 The majority of the area is within the Trent Valley Internal Drainage Board (IDB) area.

3.5.20 There are existing pylons located next to the landward side of the flood defences south of which are intersected by Grid Connection Corridor option B.

Survey

3.5.21 A site walkover was undertaken on 8th February 2022 by a water quality scientist and hydromorphologist. The purpose of the walkover was to understand character and condition of each impacted watercourse, to verify the desk-based study and to therefore further inform the options appraisal.

Key Issues

Underground Cable

3.5.22 Each Grid Connection Corridor option crosses a number of different watercourses:

- Corridor A: River Trent (SK 8259 8362), Mother Drain (SK 8193 8300), and 13 unnamed drainage ditches. Total of 15 crossings (one being WFD designated).
- Corridor B: River Trent (SK 8240 8201), Mother Drain (SK 8216 8168), and seven unnamed drainage ditches. Total of 9 crossings (one being WFD designated).
- Corridor C1: River Trent (SK 8313 8050), Marton Drain (SK 8399 8105), Carr Drain (SK 8271 8051), Seymour Drain (SK 8199 8049), and seven unnamed drainage ditches. Total of 11 crossings (three being WFD designated).
- Corridor C2: River Trent (SK 8313 8050), Marton Drain (SK 8399 8105), Seymour Drain (SK 8166 7856), and four unnamed drainage ditches. Total of 7 crossings (three being WFD designated)

3.5.23 Underground cables have the potential to adversely affect watercourses during their installation depending on the method of installation. Techniques for cable installation that avoid any disturbance of the watercourse bed (e.g. boring or horizontal directional drilling techniques) are preferred from a surface watercourse perspective as they would have no impact on the morphology of the watercourse or its bed, bank and riparian habitats and ecological communities. However, it is acknowledged that there could be issues in the launch/receiving pits related to ecological disturbance at the ground level, as well as issues relating to groundwater ingress and so this would need further assessment and consideration of an appropriate groundwater dewatering strategy.

3.5.24 If open-cut techniques were required across any watercourse, then there would unavoidably be morphological consequences through physical impact to bed, bank and riparian habitats and disturbance of the sediment regime. While this would be a short-term construction impact and the watercourse would be anticipated to be reinstated as found, trenchless approaches are always preferable to minimise impacts to watercourses.

3.5.25 Issues associated with the underground cable are expected to be limited to the construction phase. Once operational, there should be no further impact.

IDB Requirements

3.5.26 The study area south and west of Marton is within the Trent Valley Internal Drainage Board (IDB) area. The IDB's Byelaws prevent the erection of any

building, structure (whether temporary or permanent) within nine metres either side of a Board maintained watercourse.

3.5.27 Consent will be required from the Board to undertake works in, over, under or within nine metres of a Board maintained watercourse.

3.5.28 More specifically the IDB's Bylaw No. 17 (Ref 1) states that no person shall without previous consent of the IDB:

- Place or affix or cause or permit to be placed or affixed any gas or water main or any pipe or appliance whatsoever or any electrical main or cable or wire in, under or over any watercourse or in, over or through any bank of any watercourse;
- Cut, pare, damage or remove or cause or permit to be cut, pared, damaged or removed any turf forming part of any bank of any watercourse, or dig for or remove or cause or permit to be dug for or removed any stone, gravel, clay, earth, timber or other material whatsoever forming part of any bank of any watercourse or do or cause or permit to be done anything in, to or upon such bank or any land adjoining such bank of such a nature as to cause damage to or endanger the stability of the bank;
- Make or cut or cause or permit to be made or cut any excavation or any tunnel or any drain, culvert or other passage for water in, into or out of any watercourse or in or through any bank of any watercourse; and
- Place or fix or cause or permit to be placed or fixed any engine or mechanical contrivance whatsoever in, under or over any watercourse or in, over or on any bank of any watercourse in such a manner or for such length of time as to cause damage to the watercourse or banks thereof or obstruct the flow of water in, into or out of such watercourse.

3.5.29 Subject to the Boards' formal consent, service crossings under the bed of a watercourse may be acceptable if:

- The crossing is installed using directional drilling techniques (or similar);
- The crossing is perpendicular to the watercourse;
- A minimum of 1.5 metres of cover is maintained between hard bed level and the uppermost part of the duct or protective cover. This depth should be maintained 9.0 metres each side of the watercourse; and
- Marker posts indicating the type and depth of crossing along with emergency contact details are installed at the top edge of each bank. Marker posts must be visible at all stages of vegetation growth.

3.5.30 Applications not complying with the above criteria will only be considered in exceptional circumstances. Such applications must be supported by a full written justification statement.

Environment Agency Main Rivers

3.5.31 The River Trent is the only main river in the study area. Work on or near main rivers is regulated by the Environment Agency under environmental permitting (Ref 2).

3.5.32 Permission may need to be applied for to do any of the following regulated flood risk activities:

- Erecting any temporary or permanent structure in, over or under a main river, such as a culvert, outfall, weir, dam, pipe crossing, erosion protection, scaffolding or bridge;
- Altering, repairing or maintaining any temporary or permanent structure in, over or under a main river, where the work could affect the flow of water in the river or affect any drainage work;
- Building or altering any permanent or temporary structure designed to contain or divert flood waters from a main river;
- Quarrying or excavation within 16 metres of any main river, flood defence or culvert;
- Any activity within 8 metres of the bank of a main river, or 16 metres if it is a tidal main river;
- Any activity within 8 metres of any flood defence structure or culvert on a main river, or 16 metres on a tidal main river; and
- Activities carried out on the floodplain of a main river, more than 8 metres from the riverbank, culvert or flood defence structure (or 16 metres if it is a tidal main river), if you do not have planning permission.

Overhead Line

3.5.33 As with the underground cables, overhead lines will have to cross the watercourses described above. Pylons and other infrastructure should not be positioned within 9 metres of an IDB watercourse or 8m of a main river. This buffer reduces potential for any possible bank or riparian habitat disturbance during installation, as well as any longer-term destabilisation of the banks. It should be agreed with the regulators where this buffer distance is measured from, and measuring from the centre line of the watercourse is recommended.

Limitations

3.5.34 It is assumed that the River Trent crossing would be a non-intrusive directional drill. The crossings of the remaining watercourses are assumed for the purposes of the optioneering to be undertaken using an intrusive open-cut approach as a worst case. It is assumed that appropriate buffer distances would be used in keeping with IBD and Environment Agency requirements.

4. Traffic and Transport

Baseline

4.1.1 The following parts of the local highway and transport networks are considered to be potentially impacted by the four cable routes and therefore form the study area for this assessment.

4.1.2 Both the railway line and the River Trent provide physical barriers across the various cable corridor options. The railway line runs from the Cottam Power Station in a south-east-north-west direction between North Leverton and South Leverton. The River Trent runs in a general north-south direction parallel to the A156 between the Cottam Power Station and the Solar and Energy Storage Park.

4.1.3 The A156 is the key strategic vehicle route in the vicinity of the Scheme and provides access to the A631 strategic east-west route and the A159 (route through Gainsborough to the north) and the A57 in the south, which subsequently provides east-west access to Lincoln in the east and Worksop in the west. The A156 runs in a north-south direction and to the west of the Scheme between and including its junctions with the A631/ A159 within Gainsborough to the north and the A57 to the southwest of Saxilby to the south. All four Grid Connection Corridors cross the A156 at various points, which is also a major consideration in transport terms as this is a key north-south strategic highway route.

4.1.4 The A1500 Stow Park Road runs in a generally north-west to south-east direction between Marton and Sturton by Stow; it is a single carriageway road subject to the national speed limit, transitioning to 30mph speed limit on approach to Marton.

4.1.5 Willingham Road/ Marton Road is a narrow single lane road with passing places which runs west to east along the southern border of the Scheme from the A156 before turning north (within the redline boundary) to join the B1421 in the village of Willingham by Stow. This route has signing stating it is unsuitable for HGV use.

4.1.6 Clay Lane, a no-through road single lane track (with passing places) is accessed via the A156 to the southwest of the scheme and passes underneath the railway via a relatively narrow and low underpass.

4.1.7 Cottam Road provides access to the Cottam Power Station and Substation and is a two-way single carriageway road with a national speed limit. Cottam Road runs in an east-west direction from the Power Station towards the residential area of Treswell to the west where it becomes Green Lane, Cottam Lane and Town Street. To the west of the Cottam Road/Rampton Road T-Junction along Green Lane, Cottam Lane and Town Street through Treswell there is a vehicle weight restriction of 18T.

4.1.8 To the east of Cottam Power Station and bridge over the railway line, Cottam Road becomes Town Street which has a 30mph speed limit through the residential area of Cottam. Town Street becomes a relatively narrow two-way carriageway and to the north becomes Headstead Bank which has a national speed limit. Headstead Bank is a narrow two-way carriageway which runs in a north-south direction connecting to Broad Lane to the north.

4.1.9 Broad Lane runs in an east-west direction roughly parallel to Cottom Road, circa 1km to the north. Broad Lane and Cottam Road are connected via Cow Pasture Lane and Westbrecks Lane. Broad Lane is a narrow single carriageway road with limited passing places. A warning sign is located on Broad Lane either side of the railway line stating ‘Drivers of large or slow vehicles must phone and get permission to cross’ where large vehicles are considered over 18.75m long, 2.9m wide or 44 tonnes total weight. Broad Lane continues to the west where it crosses Catchwater Drain via a small bridge where it becomes Cottam Road in South Leverton. To the north of Broad Lane there are various single-track lanes that provide highway links to Coates and Littleborough to the north and North Leverton and South Leverton to the west.

4.1.10 Cow Pasture Lane is a narrow single carriageway track which crosses the railway line circa 750m to the north of Cottam Road. Westbrecks Lane is also a narrow single carriageway road with a weight restriction of 17T and forms a T-Junction with Broad Lane where it means the railway line, circa 1.2km to the north of Cottam Road.

4.1.11 There are no local highway crossings of the River Trent, with the closest highway bridge located circa 10km to the south via the A57 Dunham Road, which is subject to a toll charge and a weight limit of 44 tonnes. To the north, The Flood Road crosses the River Trent circa 16km from the Cottam Power Station which connects to the A631 which runs in an east-west direction between the A1 to the west and A15 to the east.

4.1.12 There are various PRoWs that are within the corridors which are outlined below:

- PRoW Sturton Le Steeple FP8, footway for 1455m along the western bank of River Trent (PRoW_FP8);
- PRoW Sturton Le Steeple BW7, bridleway for 733m along Long Farm Lane to the north of Littleborough Road (PRoW_BW7);
- PRoW Sturton Le Steeple FP6, footway for 351m through the field to the south of Littleborough Road (PRoW_FP6); and
- PRoW North Leverton with Habblesthorpe BOAT14, byway for 559m through the fields along Craikbank Lane (PRoW_BOAT14).
- PRoW Mton 67/1, footway for 361m through the field to the west of Marton;
- PRoW Mton 66/1, footway for 1044m along the eastern bank of River Trent;
- PRoW North Leverton with Habblesthorpe FP9, footway for 1371m along the western bank of River Trent (PRoW_FP9);
- PRoW North Leverton with Habblesthorpe FP20, footway for 103m through the fields from the River Trent banks in the east to PRoW_BW19 in the west (PRoW_FP20);
- PRoW North Leverton with Habblesthorpe BW19, bridleway for 561m through the field to the north of Corner Farm on Coates Road and to the west along March Lane (PRoW_BW19);
- PRoW Cottam BOAT5, byway open to all traffic for 225m along Rimes Lane to the north of Broad Lane (PRoW_BOAT5);
- PRoW North Leverton with Habblesthorpe RB25, restricted byway for 660m along Southbank Lane to the west of Headstead Bank (PRoW_RB25);
- PRoW Cottam RB4, restricted byway for 356m along Okercoal Lane, west of Wells Lane, north of Cottam (PRoW_RB4);
- PRoW Cottam RB6, restricted byway for 110m along Wells Lane to the west of Town Street, north of Cottam (PRoW_RB6);
- PRoW Treswell FP4, footway for 151m to the west of Cottam Power Station (PRoW_FP4);
- PRoW Treswell FP5, footway for 255m to the west of Cottam Power Station (PRoW_FP5);
- PRoW Rampton FP6, footway for 310m to the west of the Cottam Power Station (PRoW_FP6);

- PRoW South Leverton BOAT16, byway for 658m along Cow Pasture Lane, to the north of Outgang Lane (PRoW_BOAT16);
- PRoW Cottam BW7, Bridleway for 171m to the east of the Ash Disposal Site on Town Street (PRoW_BW7);
- PRoW Treswell BW6, bridleway for 177m to the east of the Ash Disposal Site on Town Street (PRoW_BW6);
- PRoW Treswell BW18, bridleway for 733m to the south of the Ash Disposal Site on Town Street (PRoW_BW18);
- PRoW Rampton BOAT13, byway open to all traffic for 1039m to the south of Cottam Power Station (PRoW_BOAT13);
- PRoW Mton 68/1, footway for 453m through the field to the west of A1500 Stow Park Road to A156 High Road(PRoW_Mton/68/1);
- PRoW Mton 66/4, footway for 351m to the fields to the east of the River Trent, west of A156 Gainsborough Road (PRoW_Mton/66/4);
- PRoW Cottam FP1, footway for 567m (PRoW_FP1);
- PRoW Cottam FP3, footway for 661m to the fields to the west of the River Trent, north of Cottam (PRoW_FP3).

Survey

4.1.13 Initially a high-level desktop survey review was undertaken to identify the following:

- The potential local vehicle routes for construction staff vehicles and HGVs to/from the Grid Connection Corridors;
- The potential access locations for construction staff vehicle and HGV to/from the Grid Connection Corridors; and
- The potential disruption and need for traffic management during the construction of the cable corridors, where highways, PRoWs, the rail-line and River Trent need to be crossed by the cable (either as an underground or overhead cable).

4.1.14 The purpose of the site visit walk over of the Grid Connection Corridors was to gain a better understanding of the local highway and transport networks within the vicinity of the cable corridors and to view areas that are not visible on online satellite imagery. In addition, with the site visit would allow further investigation of the above areas to confirm the desktop study.

Key Issues

Underground Cable

4.1.15 The railway line and the River Trent are the key physical barriers impacting the transportation of HGVs and staff along the Grid Connection Corridors and effectively split each cable corridor into three sections. Each of these require vehicle access for delivery of the cable route equipment and for staff access. The A156 is also another key transport consideration which runs through all of four of the Grid Connection Corridors, while the A1500 runs through two of the Grid Connection Corridors. Other key issues regarding the cable route include vehicle (HGVs and staff) routes to the cable corridors, HGV and staff access along the cable corridors themselves and where the cable route crosses highway/ footways or PRoWs. Information provided indicates that

directional drilling will be used to cross the River Trent and it is assumed this technique will be used when crossing the highways, which is likely to require traffic management through the use of two-way traffic signals or temporary road closure with a diversion while the cable is installed underneath the highway. It is also assumed that two-way direction drilling will be used to cross the railway line and PRoWs, with PRoWs either closed for a short period of time or diversions provided.

Overhead Line

4.1.16 The key transport issues identified for the underground cable are assumed to be the same for the overhead cable option. The exception is in relation to potential traffic management when the cable crosses the highway. When the overhead cable crosses the highway, it is assumed that the highway will be required to be temporarily closed so no vehicles can pass underneath during the works. It is assumed this could be undertaken overnight to avoid major disruption with a diversion route in place, whereas the underground cable is likely to require temporary traffic management either through the use of two-way signals or road closures and diversions during installation of the cable under the highway.

Limitations

4.1.17 The assessment of the Grid Connection Corridor options has not considered traffic data for the routes impacted, such as traffic flows, vehicle speeds or collision data for example.

4.1.18 The number of HGVs or staff vehicles required for the cable crossing works are not known at this stage. From an initial assessment, in terms of transport, there would appear to be little difference between the overhead and underground options in terms of impacts, however this could change depending on the number of staff and HGVs required for each of the overhead or underground options.

4.1.19 It is assumed any new site accesses used during the construction phase will also be required during the operational phase for maintenance. It is also assumed for the cable routes that the highway crossing will form the only site accesses on either side of the highway and therefore no other site accesses would be required along the cable routes.

4.1.20 It is assumed that directional drilling will be used where the cable crosses the highway as opposed to cables being run underneath/in-line/parallel with the carriageway. This would prevent longer term traffic management being required, minimising the impact of the temporary works on the operation of the carriageway.

4.1.21 For underground cabling, it is assumed diversions will be provided when individual PRoWs are crossed during the construction of the Grid Connection Corridor.

4.1.22 The conclusions drawn for traffic and transport are based on a desktop and consider the likely number of road, river and rail crossings required for the cable routes for both underground and overground options, the potential number of site accesses required for each of the cable corridors, the likely

vehicle routes for staff and HGVs to access each of the Grid Connection Corridors, the number of PRoWs the cable corridors cross and the potential traffic management requirements during construction.

5. Engineering and Constructability

5.1 Overview

5.1.1 The safety of staff, contractors, residents, and members of the public is paramount to the Applicant and formed a key element of how the cables corridors were assessed. Proximity to existing infrastructure is the primary element of this assessment, most likely to raise concerns over safety and is covered separately below as it the topography and geography of the site.

5.1.2 Key considerations reviewed included distances to property, infrastructure, the need to cross both A and B roads, the River Trent and several existing gas, electricity and water services. Additional considerations during the reviews and surveys included environmental impacts (discussed above), community impacts, the construction methods needed to complete the route, access for construction traffic during the build phase, and continued access to infrastructure post construction.

5.1.3 Three main Grid Connection Corridors (Annex A) were assessed for the connection of the Solar and Energy Storage Park to the National Grid substation at Cottam, with route C split into two potential corridors C1 and C2 for the final route into the connection point.

5.2 Site Safety Appraisal

5.2.1 Surveys confirmed each potential corridor carried similar health and safety considerations. The proximity to individual households and settlements was of key priority. Maintaining reasonable distance to reduce any impact to householders or members of the public aided in refining the suggested corridor routes and dimensions across all three options. Dependant on the construction method, i.e., open trenching or directional drilling, there would also need to be groundworks and trenching for whole sections or at frequent points, so access and construction traffic requirements defined a required width for the corridors.

5.2.2 All three potential corridors involved a crossing of the Trent River and drainage gully's or allocated flood areas. The survey confirmed river crossings would require directional drilling, to maintain the integrity of the riverbanks, as would any drainage or water courses within the corridors. The option of using overhead lines to cross the waterways was immediately discounted given the potential safety concerns and construction requirements of this method.

5.2.3 All three Grid Connection Corridors cross equivalent roads, rail and pathways. Low Carbon's direct staff and all appointed contractors are experienced in the arrangement and delivery of compliant traffic management and road crossing techniques. Early engagement with local authority and national highways

agencies will ensure these works are carried out at minimum impact to road users and will maintain safety as the core priority. As an example, in the event pathways are obstructed alternative footways with full barriers would be provided, and road management inclusive of temporary traffic lights and other traffic management techniques will be implemented should lanes be temporarily affected by works. For busier roads the use of directional drilling has also been considered and will be utilised if required to reduce the impact on road users.

5.2.4 Access to the Grid Connection Corridors for construction traffic has been considered, primarily around existing roads and paths. In all cases some road strengthening would be required at certain intersections to cope with the weight and size of the expected vehicle movements. These improvements have been written into the development plan for the site, any changes will be vetted with the appropriate highways and local authorities before implementation.

5.2.5 While existing infrastructure will be covered in more detail below these were considered from the safety perspective. Operational safety clearances for electricity, gas and water are all known and applied throughout the three corridor areas, as are requirements for specific methods of installation, for example 90 crossing points for laying EHV (Extra High Voltage) electricity cables over existing EHV cables and the requirement for hand excavation near existing cables. The proposal to use underground cable for the entirety of site cable route also reduced the ongoing risk of interference, damage or injury from additional overhead infrastructure in an area where overhead cables are already prolific.

Key Issues

Underground Cable

5.2.6 The areas of prime concern remain the crossing points of geographical features, the river Trent and its drainage areas, and infrastructure such as roads and utilities. The selected Grid Connection Corridor provides an equivalent to slightly reduced exposure to these features and utilities. The Scheme and cable installation techniques are all mature within the industry and reduce the risk of issue.

5.2.7 The River Trent and its drainage gullies, flood zones and supporting landworks present the most significant challenge to all three surveyed corridors. Selected Grid Connection Corridor C1 offers equivalency when compared to the alternative options. The Applicant proposes to use directional drilling to cross the river and its drainage ditches/gullies will maintain the structural integrity of the existing features. This will require land on both sides of the river for entrance and exit pits and the temporary installation of drilling equipment, corridor C1 offers the optimum land availability and placement for these points. More detailed surveys have been undertaken to confirm the ability and effectiveness of these methods inclusive of trial trenching and core surveys, further detail is within this report and the wider submission.

5.2.8 Regards road crossings, it is expected that open cut trenching will be used in most cases, meaning temporary lane closures and appropriate traffic

management allowing each crossing to be completed in two phases, ensuring one lane remains open at all times. Agreements and permits for these crossings will be in place specifically for each location, allowing the works to progress while minimising impacts to road users. Full highways articles governing barriers, temporary walkways should pavements be excavated, traffic management such as temporary traffic lights and advanced warning will be utilised to ensure works are compliant and road users can effectively plan their journeys around the works.

Existing Infrastructure (including river and road crossings)

5.2.9 The electrical infrastructure is significant across all routes, again Corridor C1 offers equivalency when compared to the other considered options. Electrical distribution networks owned by National Grid Electricity Distribution (NGED) formally Western Power Distribution (WPD), and Northern Power Grid (NPG) have been identified along the route. Primarily this network is overhead, as such excavations to install underground cables will experience little difficulty. Safe working clearances and the avoidance of using diggers with high booms/using hand digging where appropriate will be utilised and both network companies have been consulted ahead of the works. These discussions will identify any additional requirements from the existing network owners such as cable sheathing and the potential for diversionary works and will be implemented/adhered to during the work programme.

5.2.10 National Grid Electricity Transmission (NGET) also have existing electrical infrastructure within the Grid Connection Corridor. As above, safe working clearances are known and will be maintained, hand digging will be observed near underground infrastructure and NGET have been consulted with regards the nature and methodology of the required works.

5.2.11 Water mains have been identified within all Grid Connection Corridor options and a high pressure main to the southern end of the route into Cottam substation. Corridor C1 offers equivalency in terms of works near this infrastructure compared to the other assessed routes. Where excavations are required in proximity hand digging will be utilised around the existing infrastructure to reduce the possibility of damage. The owners/operators of the existing infrastructure including Severn Trent water and Uniper have been consulted on the planned works within the selected Grid Connection Corridor.

5.2.12 Gas mains and associated pipework have been identified within all three Grid Connection Corridors, route C1 offers equivalency in terms of works near this infrastructure compared to the other assessed routes. Where excavations are required in proximity hand digging will be utilised around the existing infrastructure to reduce the possibility of damage. The owners/operators of the existing infrastructure have been consulted on the planned works within the selected Grid Connection Corridor.

5.2.13 There is a disused Rail line to the northeast of Cottam Power station, all proposed Grid Connection Corridors required a crossing point for this line. Despite the line no longer being operational the infrastructure remains in place and the route proposes to use directional drilling to provide the crossing. This method will ensure the structural integrity of the line is maintained without the need for a more complex overhead line construction to cross the rail line.

5.2.14 Road crossings have been covered in detail above.

5.2.15 River Trent (and its Drainage ditches/gullies) have been covered in detail above.

Topography and Geography

5.2.16 Proximity to existing buildings was surveyed for all three potential Grid Connection Corridors and selected route C1 offers equivalency when compared with the alternate corridors. The main population centre within proximity of the surveyed cable routes is the village of Marton, with the smaller villages of Littleborough, Gate Burton, Cottam, Brampton and Torksey also within the surveyed area in addition to a number of individual buildings and small hamlets. Route C1 offers a reduction in the number of dwellings within 100m of proposed works when compared to corridors A and B. The route would be designed to adhere to a minimum of 25m distance between proposed works and existing buildings, in most cases this distance is expected to be over 50m. This distance will reduce any impact from works inclusive of noise and vibration.

Key issues

5.2.17 The most likely key issue remains the crossing of the River Trent and attributing drainage works, followed by the road crossings of the A156 and A1500. These locations will all require specific methodology and risk assessments, with Directional Drilling preferred for the Trent crossing and road opening notices, traffic management and pedestrian barriers for the road crossings. The structural integrity of this infrastructure points will be maintained through carefully planned and executed works alongside consultation and planning with the relevant authorities.

5.2.18 Existing electrical, gas and water infrastructure are all within the proximity of the proposed works. Consultation with all organisations and authorities who own and operate this infrastructure will be undertaken alongside requirements for specific working practises, such as hand digging in close proximity or sheathing of overheads lines, already being acknowledged within our development plan.

Summary

5.2.19 To summarise, detailed surveys consider all three Grid Connection Corridors as broadly equivalent in terms of safety, proximity to occupied buildings and infrastructure. Overhead line installation is less preferred primarily due to the prevalence of existing overhead lines in the area, the increased risk of damage and impact of weathering and resultant maintenance required and the complexity of the Trent crossing. Grid Connection Corridor C1 provides the optimum Grid Connection Corridor, delivering the most efficient route and least impactful of the options considered.

6. Route Corridor Options Appraisal – Overhead Power Line

6.1.1 Table 1 provides an appraisal of Grid Connection Corridor Routes A, B and C assuming an overhead line is proposed.

Colour code key

No or a limited number of issues that could be managed via design and mitigation.	A number of issues to overcome that would require mitigation.	A number of significant issues in multiple locations that would require mitigation.

Table 1 Grid Connection Corridor Decision Matrix for Overhead Power Line

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
ENGINEERING AND CONSTRUCTABILITY CONSIDERATIONS						
Total length of route (nominal route within centre of the corridor).	7km	5.97km	7km	6.84km	The shortest route is Corridor B although the differences between the three corridor distances are not significant.	B >C2>A =C1
Safety (proximity of existing and planned residential properties, schools, utilities and other vulnerable uses).					Overhead lines would have minimal impact to safety across all three surveyed corridors however Routes B, C1 and C2 pass closer to the village of Marton.	A>B=C1=C2
Existing infrastructure (including power lines & roads).					Additional overhead lines in this area would cause significant issues to existing overhead	All routes are similar

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
					infrastructure; in a number of locations, may require diversionary works.	
A156 Crossing					Road crossings are common for overhead lines.	All routes are similar
Topography, including elevation changes					Existing overhead line construction can track gradient changes successfully	All routes are similar
Ground conditions, including made ground.					Ground conditions are acceptable for the installation of poles or towers.	All routes are similar
ENVIRONMENTAL CONSIDERATIONS						
Air quality	Sensitive receptors within the corridor are extremely limited comprising a small number of single dwellings.	The northern section of the corridor is adjacent to the village of Gate Burton; however, no adverse air quality impacts are expected due to set back distances from residential properties and the relatively short duration of construction activities.	The northern section of the corridor is adjacent to the village of Marton; however, no adverse air quality impacts are expected due to set back distances from residential properties and the relatively short duration of construction activities.	The northern section of the corridor is adjacent to the village of Marton; however, no adverse air quality impacts are expected due to set back distances from residential properties and the relatively short duration of construction activities.	The boundary of Corridors B, C1 and C2 are adjacent to the village of Gate Burton and Marton, although set back distances from residential properties and the relatively short duration of construction activities at any single location mean that any impacts would be limited.	A = B = C = D

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
Noise and vibration	Sensitive receptors within the corridor are extremely limited comprising a small number of single dwellings.	The northern section of the corridor is in between the villages of Gate Burton and Marton, with a residential property in the middle of the corridor in between the villages. The rest of the corridor is not near any sensitive receptors. Whilst short-term construction activities may result in adverse noise impacts, significant impacts are unlikely the short duration of activities and adoption of best practicable means to minimise adverse levels of noise.	The northern section of the corridor is located to the south of the village of Marton and to the north of a cluster of properties. The rest of the corridor is not near any sensitive receptors. Whilst short-term construction activities may result in adverse noise impacts, significant impacts are unlikely the short duration of activities and adoption of best practicable means to minimise adverse levels of noise.	The northern section of the corridor is located to the south of the village of Marton and to the north of a cluster of properties. The rest of the corridor is not near any sensitive receptors. Whilst short-term construction activities may result in adverse noise impacts, significant impacts are unlikely the short duration of activities and adoption of best practicable means to minimise adverse levels of noise.	The boundary of Corridors B, C1 and C2 are adjacent to the village of Gate Burton and Marton, although set back distances from residential properties and the relatively short duration of construction activities at any single location mean that any impacts would be limited.	A = B = C = D
Ecology	Construction: Four LWS within or immediately adjacent to the corridor, although impacts can be avoided with careful placement of towers. Rivers and wood-pasture and	Construction: Two LWS within or immediately adjacent to the corridor, although impacts can be avoided with careful placement of towers. Rivers, wood-pasture and parkland and	Construction: One LWS immediately adjacent to the corridor, therefore impacts on the LWS can be avoided. Coastal and floodplain grazing marsh, a priority	Construction: Three LWS within or immediately adjacent to the corridor, impacts on habitats likely through towers sited within Cottam Wetland LWS. Coastal and floodplain grazing	Corridors A and B are the least sensitive options and impacts on ecological receptors can be avoided, or minimised, through careful placement of towers supporting overhead power lines. Corridor routes C1 and C2 are routed through a	B > A > C1 > C2

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	parkland, both priority habitats, within and adjacent to the corridor. Coastal and floodplain grazing marsh, a priority habitat, adjacent to the corridor. Route crosses over watercourses, which are likely to support protected species such as Otter and Water Vole although watercourses can be avoided with careful placement of towers. Two waterbodies adjacent to the corridor option, with potential presence of Great Crested Newt although direct impacts will be avoided. European Protected Species Licence may be required during construction of towers if waterbodies support Great Crested Newt.	traditional orchard, all priority habitats, within and/or adjacent to the corridor. Coastal and floodplain grazing marsh, a priority habitat, adjacent to the corridor. Route crosses over watercourses, some of which are known to support protected species such as Otter and Water Vole although watercourses can be avoided with careful placement of towers. Two waterbodies adjacent to the corridor option and one waterbody within the corridor, with potential presence of Great Crested Newt although direct impacts will be avoided with careful placement of towers. European Protected Species Licence may be required during	habitat, within this corridor. Route crosses over watercourses, which are likely to support protected species such as Otter and Water Vole although these can be avoided with careful placement of towers. Two waterbodies adjacent to the corridor option, with potential presence of Great Crested Newt although direct impacts will be avoided with careful placement of towers. European Protected Species Licence may be required during construction of towers if waterbodies support Great Crested Newt. No identified Badger setts within the corridor although likely to be present, although any setts can be avoided with	marsh, a priority habitat, within this corridor. Route crosses over watercourses, which are likely to support protected species such as Otter and Water Vole although these can be avoided with careful placement of towers. Waterbodies adjacent to the corridor option, within Cottam Wetlands LWS are known to support Great Crested Newt, although direct impacts of habitats supporting this species will be avoided with careful placement of towers. A European Protected Species Licence is likely to be required during construction of towers. No identified Badger setts within the corridor although	LWS with the waterbodies also known to support Great Crested Newt. During operation, overhead power lines crossing the River Trent may present a collision risk with birds using the River Trent and mitigation would be required to avoid any such impact.	

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	Known Badger sett within corridor option, with potentially other setts, although these can be avoided with careful placement of towers. Common and widespread species of bat recorded, but no known roosts <u>Operation:</u> Routes over the River Trent with potential collision risk with overhead lines for birds using the river corridor.	construction of towers if waterbodies support Great Crested Newt. Known Badger sett within corridor option, with potentially other setts, although these can be avoided with careful placement of towers. Common and widespread species of bat recorded, but no known roosts <u>Operation:</u> Routes over the River Trent with potential collision risk with overhead lines for birds using the river corridor.	careful placement of towers. Common and widespread species of bat recorded, but no known roosts <u>Operation:</u> Routes over the River Trent with potential collision risk with overhead lines for birds using the river corridor.	likely to be present, although any setts can be avoided with careful placement of towers. Common and widespread species of bat recorded, but no known roosts <u>Operation:</u> Routes over the River Trent, before running adjacent to the River Trent, with potential collision risk with overhead lines for birds using the river corridor.		
Water environment	Corridor A runs southwest from SK 8360 8402, crossing the Trent at SK 8260 8362, as well as 14 small field drains which appear to be heavily modified and expected to be of	Corridor B runs southwest from SK 8415 8244 crossing the Trent at SK 8240 8201, as well as eight small field drains which appear to be heavily modified and expected to be of	Corridor C1 runs from SK 8462 8249 southwest to its crossing of the Trent at SK 8313 8050. Prior to this, it crosses Marton Drain at SK 8399 8105. C1 then runs west to join	Corridor C2 runs from SK 8462 8249 southwest to its crossing of the Trent at SK 8313 8050. Prior to this, it crosses Marton Drain at SK 8399 8105. C2 then runs south along	C2 can be considered the preferred corridor as it would require the least construction works in the vicinity of watercourses, which could have water quality or morphological impacts. This is because it crosses 7	A = B = C1 = C2

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	limited ecological quality (subject to further survey). These drains are predominately on the western floodplain of the Trent. Construction and operation of the overhead powerline within this corridor is likely to have no significant issues, or LSEs provided that appropriate buffers around watercourses are adopted for structures as per IDB byelaws and Environment Agency requirements for main rivers.	limited ecological quality (subject to further survey). These drains are predominantly on the left (western) floodplain of the Trent. Many of the drains crossed by Corridor B are also crossed by Corridor A. Construction and operation of the overhead powerline within this corridor is likely to have no significant issues, or LSEs provided that appropriate buffers around watercourses are adopted for structures as per IDB byelaws and Environment Agency requirements for main rivers.	with corridors A and B at SK 481375, 380475, crossing Seymour Drain (SK 8199 8049) in the process. In total, C1 crosses 11 watercourses, of which three are WFD designated. Construction and operation of the overhead powerline within this corridor is likely to have no significant issues, or LSEs provided that appropriate buffers around watercourses are adopted for structures as per IDB byelaws and Environment Agency requirements for main rivers.	the Trent's left bank, and then west to the south of Cottam Power Station, crossing Seymour Drain at SK 8166 7856. In total, it crosses seven watercourses, of which three are WFD designated. Construction and operation of the overhead powerline within this corridor is likely to have no significant issues, or LSEs provided that appropriate buffers around watercourses are adopted for structures as per IDB byelaws and Environment Agency requirements for main rivers.	watercourses, whereas B, A, and C1 cross 9, 15, and 11, respectively. However, provided that appropriate buffers are provided between watercourses and any required infrastructure (in keeping with Environment Agency and IDB requirements) then no significant effects should occur for any overhead line option.	
Flood risk	Corridor enters FZ3 at the crossing of the River Trent and its floodplain. The remainder of the	Corridor enters FZ3 at the crossing of the River Trent and its floodplain, south of Gate Burton. The	Corridor enters FZ3 south of Marton and remains within it for the rest of the route. South of Marton the	Corridor enters FZ3 south of Marton and remains within it for the rest of the route. South of Marton the	Overhead powerline construction and operation within FZ3 should have no significant impact on floodplain or	A = B > C1 > C2

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	route leading to substation is within FZ3, crossing multiple field drains. On the Western side of the River Trent the corridor route intersects a flood defence embankment. Construction and operation of the overhead powerline within this corridor is likely to have no significant issues, or LSEs.	remainder of the route leading to substation is within FZ3, crossing multiple field drains. On the Western side of the River Trent the corridor intersects a flood defence embankment and existing pylons. Construction and operation of the overhead powerline within this corridor is likely to have no significant issues, or LSEs.	route crosses a flood alleviation channel associated with Marton pumping station, as well as several smaller drains on both side of the River Trent. The corridor intersects the flood defence embankments on the eastern side of the River Trent crossing, and on the western side. On the west bank the overhead power line briefly runs south, parallel to the western flood defence embankment before turning west north of Cottam, crossing this embankment. Construction and operation of the overhead powerline within this corridor is likely to have no significant issues, or LSEs.	route crosses a flood alleviation channel associated with Marton pumping station, as well as several smaller drains on both side of the River Trent. The corridor intersects the flood defence embankment on the eastern side of the River Trent crossing. After crossing the river, the overhead line runs south, parallel to the western flood defence embankment before turning west following the river towards Cottam substation, at which point intersecting and running on top of the flood defence. Construction and operation of the powerline within this corridor has the potential to cause significant issues to	watercourse function for any corridor option. Overhead powerlines crossing flood defence embankments should also have no significant impact on these structures, hence the green colouration for corridor A and B and these options being preferred. Corridor C1 is second preference, as it crosses two flood defences, and briefly runs parallel to the western flood defence which during construction may increase the risk to this structure. Corridor C2 is ranked last due to the corridor and powerline running on top of the west bank flood defence embankment near Cottam power station which could potentially cause significant issues for the structure during construction, and afterwards.	

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
				the flood defence embankment during construction, particularly the approx. 1km stretch running on top of the flood defence. Potential for some LSEs.		
Contaminated land	Corridor is located within two NVZ's: 347 River Trent from Carlton-on-Trent to Laughton Drain and 343 Seymour Drain Catchment, although no adverse impacts are expected.	Corridor is located within two NVZ's: 347 River Trent from Carlton-on-Trent to Laughton Drain and 343 Seymour Drain Catchment, although no adverse impacts are expected.	Corridor is located within two NVZ's: 347 River Trent from Carlton-on-Trent to Laughton Drain and 343 Seymour Drain Catchment, although no adverse impacts are expected.	Corridor is located within two NVZ's: 347 River Trent from Carlton-on-Trent to Laughton Drain and 343 Seymour Drain Catchment, although no adverse impacts are expected.	All routes are similar.	A = B = C1 = C2
Cultural heritage - archaeology	Option A runs adjacent to the Scheduled Roman Town at Segelocum and the medieval moated site at Fleet Plantation. Permanent effects to several assets through physical effects at the pylon locations and change to setting.	Option B runs adjacent to two scheduled monuments, the Roman Town at Segelocum and the Roman fort south of Littleborough Lane. Permanent effects to several assets through physical effects at the pylon locations and change to setting.	Option C1 runs adjacent to one scheduled monument, the medieval moated site at Fleet Plantation. It passes through one site known to be of national value, The Viking Camp at Torksey. Permanent effects to several assets through physical	Option C2 runs adjacent to one scheduled monument, the medieval moated site at Fleet Plantation. It passes through one site known to be of national value, The Viking Camp at Torksey. Permanent effects to several assets through physical	Any ground disturbance works have the potential to significantly effect buried archaeological deposits some of which are of national importance. Archaeological evaluation and careful design of the pylon locations would be used to limit this effect.	A = B = C1 = C2

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	Potential effects across the corridor including to assets of the highest significance.	Potential effects across the corridor including to assets of the highest significance.	effects at the pylon locations and change to setting. Potential effects across the corridor including to assets of the highest significance.	effects at the pylon locations and change to setting. Potential effects across the corridor including to assets of the highest significance.		
Cultural heritage – built environment	Route runs between the parkland garden of Knaith Hall Grade II listed building and the parkland garden of Gate Burton Grade II* listed building, passing close to the north of Burton Chateau Grade II* listed building. Grade II listed building on the west of the route corridor at Littleborough Cottage. Grade II* listed Church of St Peter and St Paul in Sturton le Steeple to the west. Collection of listed buildings in Rampton west of the route,	Route runs to the immediate south of the parkland garden of Gate Burton Hall Grade II* listed building and passes to the south of the Grade II* listed Burton Chateau within a designed view. Collection of listed buildings in Marton, south of the route, including several listed at Grade II and the Church of St Margaret of Antioch listed at Grade I. Grade II listed Ferry House and the Grade I listed Church of St Nicholas on the west of Trent	Route runs south from the southern boundary of the parkland garden of Gate Burton Hall Grade II* listed building. Collection of listed buildings in Marton, west of the route, including several listed at Grade II and the Church of St Margaret of Antioch listed at Grade I. Cluster of Listed Building at Torksey including the Grade I listed Torksey Castle (also a scheduled monument) and the Grade II* listed Torksey Viaduct over the River Trent.	Route runs south from the southern boundary of the parkland garden of Gate Burton Hall Grade II* listed building. Collection of listed buildings in Marton, west of the route, including several listed at Grade II and the Church of St Margaret of Antioch listed at Grade I. Cluster of Listed Building at Torksey including the Grade I listed Torksey Castle (also a scheduled monument) and the Grade II* listed Torksey Viaduct over the River Trent. The route corridor clips	Undergrounding for all options is preferable to an overground option. All options will involve effects to designated assets through change to their settings. It is considered likely that for Options A, B and C2 this could form a barrier to consent due to potential for significant effects to designated assets of the highest significance. For each of these options the overhead line would be visible within designed landscape views which form a key aspect of the setting of assets at Knaith Hall, Gate Burton Hall and Burton Chateau (for Options A and B) and Torksey Castle (for Option C2). Of these	C1>C2>B>A

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	including several listed at Grade II and the Church of All Saints listed at Grade I, although the existing power station is already a dominant part of their setting. Permanent effects to several assets through change to settings, including assets of the highest significance.	Collection of listed buildings in Rampton west of the route, including several listed at Grade II and the Church of All Saints listed at Grade I. Permanent effects to several assets through change to settings including assets of the highest significance.	Collection of listed buildings in Rampton west of the route, including several listed at Grade II and the Church of All Saints listed at Grade I. Grade I listed Church of St Mary (also a scheduled monument) at Stow to the east. Permanent effects to several assets through change to settings including assets of the highest significance.	the western extent of this asset. Permanent effects to several assets through change to settings including assets of the highest significance.	three options, Option C2 is the least impactful, and takes place within a landscape view already compromised by the presence of Cottam Power Station. Nevertheless, the impacts to Torksey Castle Grade I listed building and scheduled monument and Torksey Viaduct Grade II* listed building should not be underestimated. Option B is the least preferable due to impact on key views of and from Gate Burton Hall and Burton Chateau Grade II* listed buildings. Option C1 is considered likely to have a number of significant effects through change to the setting of heritage assets; however, the impacts are considered to be lesser than for the other three options.	
Traffic and transport	River Crossing – vehicle routes and	River Crossing – vehicle routes and	River Crossing – vehicle routes and	River Crossing – vehicle routes and	Route B has less interactions with more significant highways	B>C1>C2>A

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	access required either side. Railway Crossing – vehicle routes and access required either side. Potential for 6 highway crossings (5 minor roads and 1 major road). Potential for 12 site accesses. Vehicle routes through residential areas. Vehicle route likely along Cottam Road, through Cottam via Headstead Road and also along the A156 Gainsborough Road. Potential traffic management in 4 locations on 2 minor roads and 2 major roads which could include temporary road closures including diversions.	access required either side. Railway Crossing – vehicle routes and access required either side Potential for 5 highway crossings and one footway (4 minor roads and 1 major road). Potential for 10 site accesses. Vehicle routes through residential areas. Vehicle likely along Cottam Road, through Cottam via Headstead Road and also along the A156 Gainsborough Road. Potential traffic management in 4 locations on 2 minor roads and 5 major roads which could include temporary road closures including diversions and temporary two-way traffic signals.	access required either side. Carr Drain – vehicle routes and access required either side. Railway Crossing – vehicle routes and access required either side. Potential for 5 highway crossings and one footway (3 minor roads and 2 major roads). Potential for 10 site accesses. Vehicle routes through residential areas. Vehicle routes likely along Cottam Road, Headstead Road through Cottam, A156 Gainsborough Road and A1500 Stow Park Road. Potential traffic management in 5 locations on 2 minor roads and 2 major roads which could include temporary road closures	access required either side. Torksey Viaduct – vehicle routes and access required either side. Potential for 4 highway crossings and one footway (2 minor roads and 2 major roads). Potential for 8 site accesses. Vehicle routes through residential areas. Vehicle routes likely along Cottam Road through Cottam, Headstead Road, A156 Gainsborough Road and A1500 Stow Park Road.Potential traffic management in 4 locations on 2 minor roads and 2 major roads which could include temporary road closures including diversions and temporary two-way traffic signals.	routes as it crosses only the A156 and not the A1500. Route C1 and C2 cross both the A156 and A1500. Route B does not sever Littleborough through crossing Littleborough Road (Route A does). All vehicle routes are likely along Cottam Road and Headstead Bank to access the cable corridor west of the River Trent. Corridor A, B and C1 cross the railway line whereas C2 avoids crossing the railway line. All four corridors cross the River Trent with varying vehicle routes and accesses required.	

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
			including diversions and temporary two-way traffic signals.			

7. Route Corridor Options Appraisal – Underground Cable

7.1.1 Table 2 provides an appraisal of Grid Connection Corridor Routes A, B, and C assuming an underground cable is proposed.

Colour code key:

No or a limited number of issues that could be managed via design and mitigation.	A number of issues to overcome that would require mitigation.	A number of significant issues in multiple locations that would require mitigation.

Table 2 Grid Connection Corridor Decision Matrix for Underground Cable

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
ENGINEERING AND CONSTRUCTABILITY CONSIDERATIONS						
Total length of route (nominal route within centre of the corridor).	7km	5.97km	7km	6.84km	The shortest route is Corridor B. The differences between the three corridor distances are not significant.	B > C2 > A > C1
Safety (proximity of existing and planned residential properties, schools, utilities and other vulnerable uses).					Cable installation works will predominantly be on privately owned land. Where road, pavement or PROW crossings are required the use of traffic or pedestrian	All routes are similar

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
					management methods will be applied.	
Existing infrastructure (including power lines & roads).					There is existing infrastructure across all routes, the use of hand digging and/or Directional Drilling techniques will be applied to avoid impact or damage to this infrastructure.	All routes are similar
A156 Crossing					Techniques for the installation of underground cables across roads are mature, permits will be obtained for any works and full traffic management put in place. The use of directional drilling can be implemented if required for busier roads.	All routes are similar
Topography, including elevation changes					All routes have equivalency in terms of changes to land gradient and elevation. Current cable laying techniques are capable of managing these changes.	All routes are similar

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
Ground conditions, including made ground.					Assessed ground conditions are all suitable for the installation of underground cables.	All routes are similar
ENVIRONMENTAL CONSIDERATIONS						
Air quality	There are no sensitive receptors within the corridor.	The northern section of the corridor is adjacent to the village of Gate Burton; however, no adverse air quality impacts are expected due to set back distances from residential properties and the relatively short duration of construction activities.	The northern section of the corridor is adjacent to the village of Marton; however, no adverse air quality impacts are expected due to set back distances from residential properties and the relatively short duration of construction activities.	The northern section of the corridor is adjacent to the village of Marton; however, no adverse air quality impacts are expected due to set back distances from residential properties and the relatively short duration of construction activities.	Corridor A is the least sensitive. The boundary of Corridors B, C1 and C2 are adjacent to the village of Gate Burton and Marton, although set back distances from residential properties and the relatively short duration of construction activities at any single location mean that any impacts would be limited.	A > B = C = D
Noise and vibration	Sensitive receptors within the corridor are extremely limited comprising a small number of single dwellings.	The northern section of the corridor is in between the villages of Gate Burton and Marton, with a residential property in the middle of the corridor in between the villages. The rest of the corridor is not near any sensitive receptors. Whilst	The northern section of the corridor is located to the south of the village of Marton and to the north of a cluster of properties. The rest of the corridor is not near any sensitive receptors. Whilst short-term construction activities	The northern section of the corridor is located to the south of the village of Marton and to the north of a cluster of properties. The rest of the corridor is not near any sensitive receptors. Whilst short-term construction activities	The boundary of Corridors B, C1 and C2 are adjacent to the village of Gate Burton and Marton, although set back distances from residential properties and the relatively short duration of construction activities at any single location	A = B = C = D

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
		short-term construction activities may result in adverse noise impacts, significant impacts are unlikely the short duration of activities and adoption of best practicable means to minimise adverse levels of noise.	may result in adverse noise impacts, significant impacts are unlikely the short duration of activities and adoption of best practicable means to minimise adverse levels of noise.	may result in adverse noise impacts, significant impacts are unlikely the short duration of activities and adoption of best practicable means to minimise adverse levels of noise.	mean that any impacts would be limited.	
Ecology	Construction: Four LWS within or immediately adjacent to the corridor, although impacts can be avoided using horizontal directional drilling (HDD) construction methods. Rivers and wood-pasture and parkland, both priority habitats, within and adjacent to the corridor. Coastal and floodplain grazing marsh, a priority habitat, adjacent to the corridor. Route crosses over watercourses, which are likely to support	Construction: Two LWS within or immediately adjacent to the corridor, although impacts can be avoided using HDD construction methods. Rivers, wood-pasture and parkland and traditional orchard, all priority habitats, within and/or adjacent to the corridor. Coastal and floodplain grazing marsh, a priority habitat, adjacent to the corridor. Route crosses over watercourses, some of which are known to support protected	Construction: One LWS immediately adjacent to the corridor, although impacts on the LWS can be avoided. Coastal and floodplain grazing marsh, a priority habitat, within this corridor. Route crosses over watercourses, which are likely to support protected species such as Otter and Water Vole although these can be avoided using HDD construction methods and appropriate	Construction: Three LWS within or immediately adjacent to the corridor, impacts on habitats likely through the cable sited within Cottam Wetland LWS. Coastal and floodplain grazing marsh, a priority habitat, within this corridor. Route crosses over watercourses, which are likely to support protected species such as Otter and Water Vole although these can be avoided using HDD construction methods	Corridors A and B are the least sensitive options and impacts on ecological receptors can be avoided or minimised with avoidance or appropriate mitigation. Corridor routes C1 and C2 are routed through a LWS with the waterbodies also known to support Great Crested Newt.	B = A > C1 > C2

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	protected species such as Otter and Water Vole although watercourses can be avoided using HDD construction methods and appropriate setbacks from watercourses. Two waterbodies adjacent to the corridor option, with potential presence of Great Crested Newt although direct impacts will be avoided. European Protected Species Licence may be required if waterbodies support Great Crested Newt. Known Badger sett within corridor option, with potentially other setts, although these can be avoided. Common and widespread species of bat recorded, but no known roosts	species such as Otter and Water Vole although watercourses can be avoided using HDD construction methods and appropriate setbacks from watercourses. Two waterbodies adjacent to the corridor option and one waterbody within the corridor, with potential presence of Great Crested Newt although direct impacts will be avoided with avoidance. European Protected Species Licence may be required if waterbodies support Great Crested Newt. Known Badger sett within corridor option, with potentially other setts, although these can be avoided. Common and widespread species of bat recorded, but no known roosts	setbacks from watercourses. Two waterbodies adjacent to the corridor option, with potential presence of Great Crested Newt although direct impacts will be avoided. European Protected Species Licence may be required if waterbodies support Great Crested Newt. No identified Badger setts within the corridor although likely to be present, although any setts can be avoided. Common and widespread species of bat recorded, but no known roosts	and appropriate setbacks from watercourses. Waterbodies adjacent to the corridor option, within Cottam Wetlands LWS are known to support Great Crested Newt, although direct impacts of habitats supporting this species will be avoided. A European Protected Species Licence is likely to be required during construction. No identified Badger setts within the corridor although likely to be present, although any setts can be avoided. Common and widespread species of bat recorded, but no known roosts		

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
Water environment	Corridor A runs southwest from SK 8360 8402, crossing the Trent at SK 8260 8362, as well as 14 small field drains which appear to be heavily modified and expected to be of limited ecological quality (subject to further survey). These drains are predominately on the western floodplain of the Trent. Construction of the underground cable within this corridor is likely to have temporary adverse impacts on water quality and hydromorphology if installed using intrusive open-cut techniques. It is noted that the River Trent would be crossed using trenchless techniques. If	Corridor B runs southwest from SK 8415 8244 crossing the Trent at SK 8240 8201, as well as eight small field drains which appear to be heavily modified and expected to be of limited ecological quality (subject to further survey). These drains are predominantly on the left (western) floodplain of the Trent. Many of the drains crossed by Corridor B are also crossed by Corridor A. Construction of the underground cable within this corridor is likely to have temporary adverse impacts on water quality and hydromorphology if installed using intrusive open-cut techniques.	Corridor C1 runs from SK 8462 8249 southwest to its crossing of the Trent at SK 8313 8050. Prior to this, it crosses Marton Drain at SK 8399 8105. C1 then runs west to join with corridors A and B at SK 481375, 380475, crossing Seymour Drain (SK 8199 8049) in the process. In total, C1 crosses 11 watercourses, of which three are WFD designated. Construction of the underground cable within this corridor is likely to have temporary adverse impacts on water quality and hydromorphology if installed using intrusive open-cut techniques. It is noted that the River Trent would be	Corridor C2 runs from SK 8462 8249 southwest to its crossing of the Trent at SK 8313 8050. Prior to this, it crosses Marton Drain at SK 8399 8105. C2 then runs south along the Trent's left bank, and then west to the south of Cottam Power Station, crossing Seymour Drain at SK 8166 7856. In total, it crosses seven watercourses, of which three are WFD designated. Construction of the underground cable within this corridor is likely to have temporary adverse impacts on water quality and hydromorphology if installed using intrusive open-cut techniques.	C2 is the preferred corridor as it crosses 7 watercourses, whereas B, A, and C1 cross 9, 15, and 11, respectively. While C2 crosses three WFD classified watercourses it should be noted that WFD principles apply to all watercourses regardless of whether they are designated as 'reportable reaches' and as such the order of preference here has been dictated by the total number of crossings. Notably all of these watercourses (with the exception of the River Trent, which is crossed by all four corridors) are heavily modified agricultural drainage channels including those that are WFD designated. They all drain into the Trent and so any pollutants produced by the Scheme could impact this downstream receptor.	C2 > B > C1 > A

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	trenchless techniques are used for all crossings then no significant issues would be anticipated, subject to appropriate management of any groundwater encountered in launch/receive pits. There would be no significant issues to the water environment during operation of the Scheme.	It is noted that the River Trent would be crossed using trenchless techniques. If trenchless techniques are used for all crossings then no significant issues would be anticipated, subject to appropriate management of any groundwater encountered in launch/receive pits. There would be no significant issues to the water environment during operation of the Scheme.	crossed using trenchless techniques. If trenchless techniques are used for all crossings then no significant issues would be anticipated, subject to appropriate management of any groundwater encountered in launch/receive pits. There would be no significant issues to the water environment during operation of the Scheme.	It is noted that the River Trent would be crossed using trenchless techniques. If trenchless techniques are used for all crossings then no significant issues would be anticipated, subject to appropriate management of any groundwater encountered in launch/receive pits. There would be no significant issues to the water environment during operation of the Scheme.	However, provided non-intrusive techniques are used for the crossings, there should be no significant effects produced by any of the corridors. Until this can be confirmed all options are considered amber as a worst case as there could be temporary significant impacts associated with intrusive crossing installation.	
Flood risk	Corridor enters FZ3 at the crossing of the River Trent and its floodplain. The remainder of the route leading to substation is within FZ3, crossing multiple field drains. On the Western side of the River Trent the corridor route	Corridor enters FZ3 at the crossing of the River Trent floodplain, south of Gate Burton. The remainder of the route leading to substation is within FZ3, crossing multiple field drains. On the Western side of the River Trent the	Corridor enters FZ3 south of Marton and remains within it for the rest of the route. South of Marton the route crosses a flood alleviation channel associated with Marton pumping station, as well as several smaller	Corridor enters FZ3 south of Marton and remains within it for the rest of the route. South of Marton the route crosses a flood alleviation channel associated with Marton pumping station, as well as several smaller drains on both side of	Underground cable construction and operation within FZ3 should have no significant impact on floodplain function for any corridor option. However, digging trenches through flood defence embankments has the potential to cause significant	A = B > C1 = C2

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	intersects a flood defence embankment. Without mitigation, construction of the underground cable within this corridor has the potential to cause significant issues for the flood defence embankment, with the potential for LSEs if the embankment is disturbed. With mitigation including a directional drill that results in no disturbance to the defence embankment, likely significant effects would be mitigated.	corridor intersects a flood defence embankment and existing pylons. Without mitigation, construction of the underground cable within this corridor has the potential to cause significant issues for the flood defence embankment, with the potential for LSEs if the embankment is disturbed. With mitigation including a directional drill that results in no disturbance to the defence embankment, likely significant effects would be mitigated.	drains on both side of the River Trent. The corridor intersects the flood defence embankments on the eastern side of the River Trent crossing, and on the western side. Without mitigation, construction of the underground cable within this corridor has the potential to cause significant issues for the flood defence embankment, with the potential for LSEs if the embankment is disturbed. With mitigation including a directional drill that results in no disturbance to the defence embankment, likely significant effects would be mitigated.	the River Trent. The corridor intersects the flood defence embankment on the eastern side of the River Trent crossing, and on the western side. Without mitigation, construction of the underground cable within this corridor has the potential to cause significant issues for the flood defence embankment, with the potential for LSEs if the embankment is disturbed. With mitigation including a directional drill that results in no disturbance to the defence embankment, likely significant effects would be mitigated.	issues on these structures during construction, hence the amber colouration for these corridor options. Corridor A and B are preferred for the underground cable option as they only intersect one flood defence. Corridor C1 and C2 are second preference as those corridors cross two flood defences.	

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
Contaminated land	Corridor is located within two NVZ's: 347 River Trent from Carlton-on-Trent to Laughton Drain and 343 Seymour Drain Catchment, although no adverse impacts are expected.	Corridor is located within two NVZ's: 347 River Trent from Carlton-on-Trent to Laughton Drain and 343 Seymour Drain Catchment, although no adverse impacts are expected.	Corridor is located within two NVZ's: 347 River Trent from Carlton-on-Trent to Laughton Drain and 343 Seymour Drain Catchment, although no adverse impacts are expected.	Corridor is located within two NVZ's: 347 River Trent from Carlton-on-Trent to Laughton Drain and 343 Seymour Drain Catchment, although no adverse impacts are expected.	All routes are similar.	A = B = C1 = C2
Cultural heritage - archaeology	Option A runs adjacent to the Scheduled Roman Town at Segelocum and the medieval moated site at Fleet Plantation. An underground cable would affect significant known archaeological deposits, some of which are of national importance. An underground cable would affect previously unrecorded archaeological deposits. An underground cable has the potential to effect palaeoenvironmental	Option B runs adjacent to two scheduled monuments, the Roman Town at Segelocum and the Roman fort south of Littleborough Lane. An underground cable would affect significant known archaeological deposits, some of which are of national importance. An underground cable would affect previously unrecorded archaeological deposits. An underground cable has the potential to	Option C1 runs adjacent to one scheduled monument, the medieval moated site at Fleet Plantation. It passes through one site known to be of national value, The Viking Camp at Torksey. An underground cable would affect significant known archaeological deposits, some of which are of national importance. In the location of the Viking camp there is the potential to design the route to avoid the majority of the site by crossing at the very north of	Option C2 runs adjacent to one scheduled monument, the medieval moated site at Fleet Plantation. It passes through one site known to be of national value, The Viking Camp at Torksey. An underground cable would affect significant known archaeological deposits, some of which are of national importance. In the location of the Viking camp there is the potential to design the route to avoid the majority of the site by crossing at the very north of	All four options have the potential to effect significant archaeological deposits, both known and previously unrecorded. Further archaeological evaluation is required to determine the nature, extent and significance of the deposits that would be impacted. Archaeological evaluation and careful design of the specific route and the cable installation design, including directional drill, could be used to limit this effect in corridor option C potentially reducing this to amber.	C2=C1>B=A

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	deposits and preservation of buried deposits.	effect palaeoenvironmental deposits and preservation of buried deposits.	the corridor or by considering directional boring methods. An underground cable would affect previously unrecorded archaeological deposits. An underground cable has the potential to effect palaeoenvironmental deposits and preservation of buried deposits.	the corridor or by considering directional boring methods. An underground cable would affect previously unrecorded archaeological deposits. An underground cable has the potential to effect palaeoenvironmental deposits and preservation of buried deposits.		
Cultural heritage – built environment	Route runs between the parkland garden of Knaith Hall Grade II listed building and the parkland garden of Gate Burton Grade II* listed building, passing close to the north of Burton Chateau Grade II* listed building. Grade II listed building on the west of the route corridor at Littleborough Cottage.	Route runs to the immediate south of the parkland garden of Gate Burton Hall Grade II* listed building and passes to the south of the Grade II* listed Burton Chateau within a designed view. Collection of listed buildings in Marton, south of the route, including several listed at Grade II and the Church of St	Route runs south from the southern boundary of the parkland garden of Gate Burton Hall Grade II* listed building. Collection of listed buildings in Marton, west of the route, including several listed at Grade II and the Church of St Margaret of Antioch listed at Grade I. Cluster of Listed Building at Torksey	Route runs south from the southern boundary of the parkland garden of Gate Burton Hall Grade II* listed building. Collection of listed buildings in Marton, west of the route, including several listed at Grade II and the Church of St Margaret of Antioch listed at Grade I. Cluster of Listed Building at Torksey	Undergrounding for all options is preferable to an overground option. Option C2 is the only option where there is potential for physical impact (intended or accidental) to a listed building, since the western extent of the Grade II* listed Torksey Viaduct is located partially within the route corridor redline boundary. It is	C1=C2>A=B

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
	Collection of listed buildings in Rampton west of the route, including several listed at Grade II and the Church of All Saints listed at Grade I. Temporary effects to several assets during construction through change to settings.	Margaret of Antioch listed at Grade I. Collection of listed buildings in Rampton west of the route, including several listed at Grade II and the Church of All Saints listed at Grade I. Temporary effects to several assets during construction through change to settings.	including the Grade I listed Torksey Castle (also a scheduled monument) and the Grade II* listed Torksey Viaduct over the River Trent. Collection of listed buildings in Rampton west of the route, including several listed at Grade II and the Church of All Saints listed at Grade I. Temporary effects to several assets during construction through change to settings.	including the Grade I listed Torksey Castle (also a scheduled monument) and the Grade II* listed Torksey Viaduct over the River Trent. The route corridor clips the western extent of this asset. Temporary effects to several assets during construction through change to settings. Potential for physical effects (intended or accidental) to the Grade II* listed viaduct located partially within the redline boundary, an removal of part of the remains of the railway line that forms part of its setting.	therefore the least preferable option. All options will involve temporary effects to designated assets through change to their settings. Options A and B take place within parts of, or within the settings of, landscaped gardens associated with key designated assets at Knaith Park, Gate Burton Hall and Burton Chateau. The landscape around these assets formed part of their designed setting and such is more sensitive to change than other areas in the landscape, for instance land within Options C1 and C2. Of Options C1 and C2, Option C1 is preferable as it takes place further away from the cluster of assets at Torksey and does not have the potential for physical	

Topic	Route A	Route B	Route C1	Route C2	Comparative Considerations	Comparison (order of preference)
					impacts to the Grade II* listed Torksey Viaduct.	
Traffic and transport	River Crossing – vehicle routes and access required either side. Railway Crossing – vehicle routes and access required either side. Potential for 6 highway crossings (5 minor roads and 1 major road) Potential for 12 site accesses assumes that highway crossings will form the only site accesses on either side on the highway Vehicle routes will travel through residential areas.	River Crossing – vehicle routes and access required either side. Railway Crossing – vehicle routes and access required either side. Potential for 5 highway crossings and one footway (4 minor roads and 1 major road). Potential for 10 site accesses. Vehicle routes will travel through residential areas.	River Crossing – vehicle routes and access required either side. Carr Drain – vehicle routes and access required either side. Railway Crossing – vehicle routes and access required either side. Potential for 5 highway crossings and one footway (3 minor roads and 2 major roads) Potential for 10 site accesses. Vehicle routes will travel through residential areas.	River Crossing – vehicle routes and access required either side. Torksey Viaduct – vehicle routes and access required either side. Potential for 4 highway crossings and one footway (2 minor roads and 2 major roads). Potential for 8 site accesses. Vehicle routes will travel through residential areas.	Route B has less interactions with more significant highways routes as it crosses only the A156 and not the A1500. Route C1 and C2 cross the A156 and A1500. Route B does not sever Littleborough through crossing Littleborough Road as per Route A. All vehicle routes are likely along Cottam Road and Headstead Bank to access the cable corridor west of the River Trent. Corridor A, B and C1 cross the railway line whereas C2 avoids crossing the railway line. All four corridors cross the River Trent with varying vehicle routes and accesses required.	B>C1=C2>A

8. Conclusion

8.1.1 An options appraisal exercise was undertaken to identify and review the engineering, constructability and environmental constraints within each of the Corridors in order to identify a preferred corridor.

8.1.2 The options appraisal exercise included consideration of both an overhead power line (OHL) and an underground cable.

8.1.3 Key conclusions of the study are:

- Installation of an OHL across the River Trent would potentially give rise to ecological Likely Significant Effects (LSEs) due to increased risk of collision of birds, including swans, geese and ducks using the River Trent corridor;
- The River Trent is a major arterial river which results in a focus of historic settlement and development adjacent to the river. In all corridors, there are significant known archaeological assets. Should an underground option be progressed, further archaeological evaluation would be undertaken to maximise opportunities to avoid impact to archaeological deposits;
- An OHL option in Corridors A, B and C2 would be likely to give rise to significant permanent effects to designated built heritage assets including the parkland garden of Knaith Hall Grade II listed building, Gate Burton Grade II* listed building, the Burton Chateau Grade II* listed building, a Grade II listed building at Littleborough Cottage, the Grade II* listed Church of St Peter and St Paul in Sturton le Steeple, and a cluster of listed buildings at Torksey including the Grade I listed Torksey Castle (also a scheduled monument) and the Grade II* listed Torksey Viaduct over the River Trent;
- In terms of air quality, noise and vibration and traffic and transport, there was relatively little to differentiate the corridors as they all cross the A156 and the River Trent, have a similar number of receptors, and would be likely to utilise similar access routes (being the A156 east of the River Trent and Cottam Road and Northfield Road west of the River Trent), for the purposes of construction; and
- The existing flood defence embankments on the eastern and western sides of the River Trent were identified as a key constraint. Whichever option is adopted would be required to ensure no impact to the structure and integrity of the flood defence embankments

8.1.4 The combination of a preference for an underground cable together with the extent of known beneath ground archaeological assets located in Corridors A & B and the ruling out of Corridor C2 due to constraints east of Cottam power station, resulted in the selection of Corridor C1 as the preferred option. Corridor C1 was identified as providing the best balance of minimising impacts on the environment and the local community whilst meeting the technical and constructability feasibility requirements.

9. References

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Annex A. Figure 1

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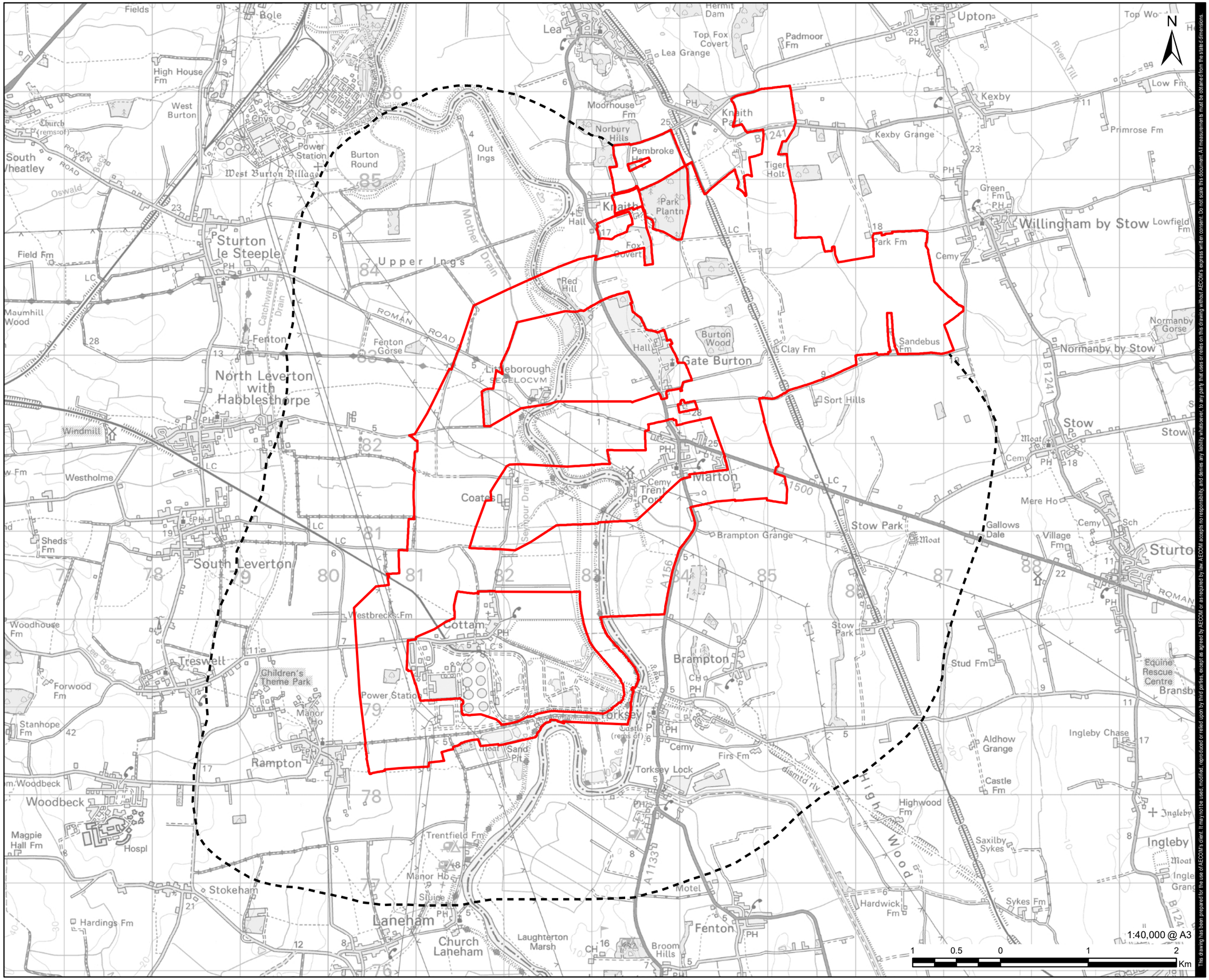
Revision: 01 Drawn: NK Checked: RW Approved: WB Date: 2023-01-25



AECOM

PROJECT

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LEGEND

EIA Scoping Site Boundary

Search Area

NOTES

ISSUE PURPOSE

Environmental Statement

PROJECT NUMBER

60664324

FIGURE TITLE

Search Area

FIGURE NUMBER

Figure 1

Annex B. Figure 2

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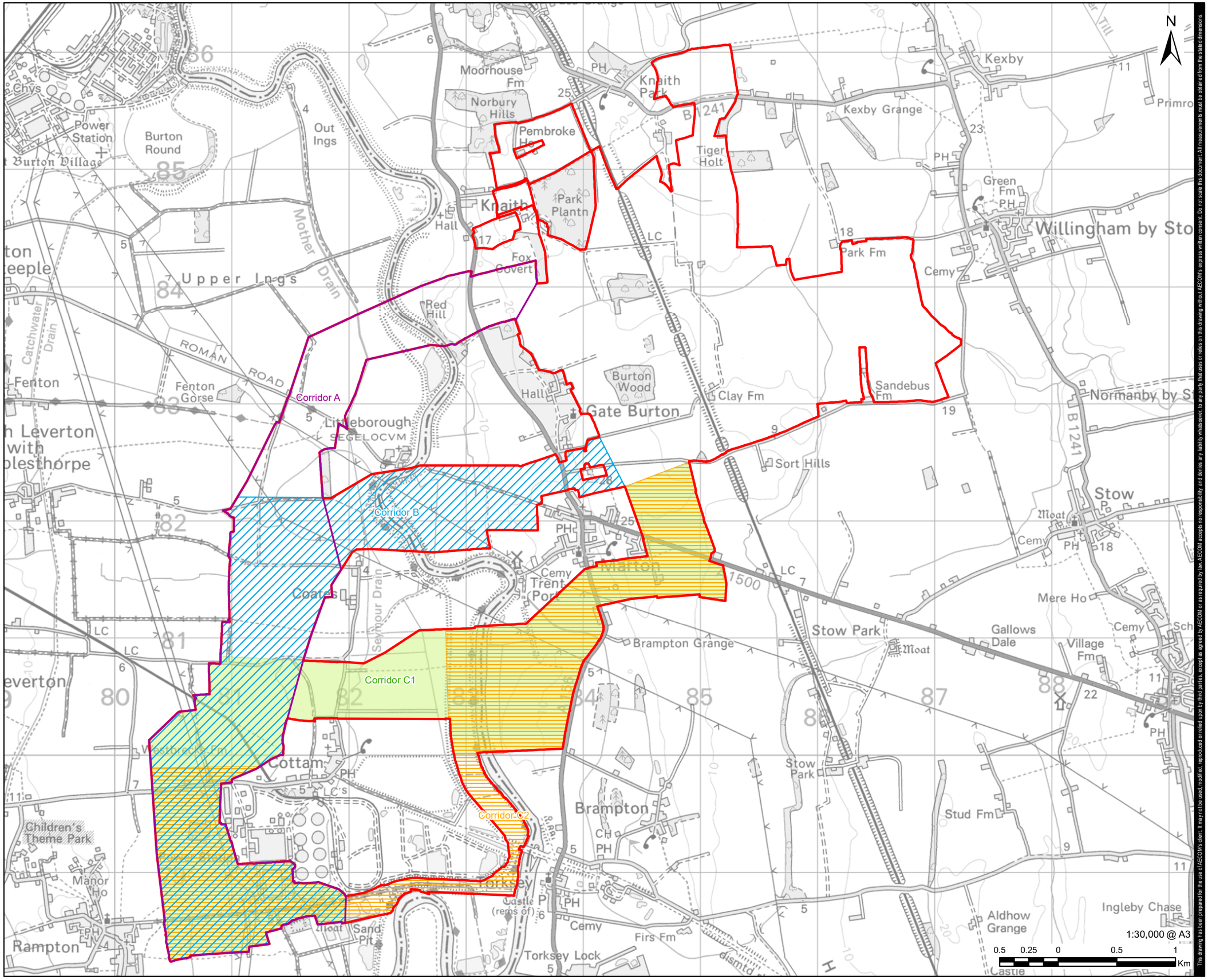
Revision: 01 Drawn: NK Checked: RW Approved: WB Date: 2023-01-20



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LEGEND
- EIA Scoping Site Boundary

Alternative Cable Route
- Corridor A
- Corridor B
- Corridor C1
- Corridor C2

NOTES

ISSUE PURPOSE
Environmental Statement

PROJECT NUMBER
60664324

FIGURE TITLE
Alternative Cable Route Corridors

FIGURE NUMBER
Figure 2