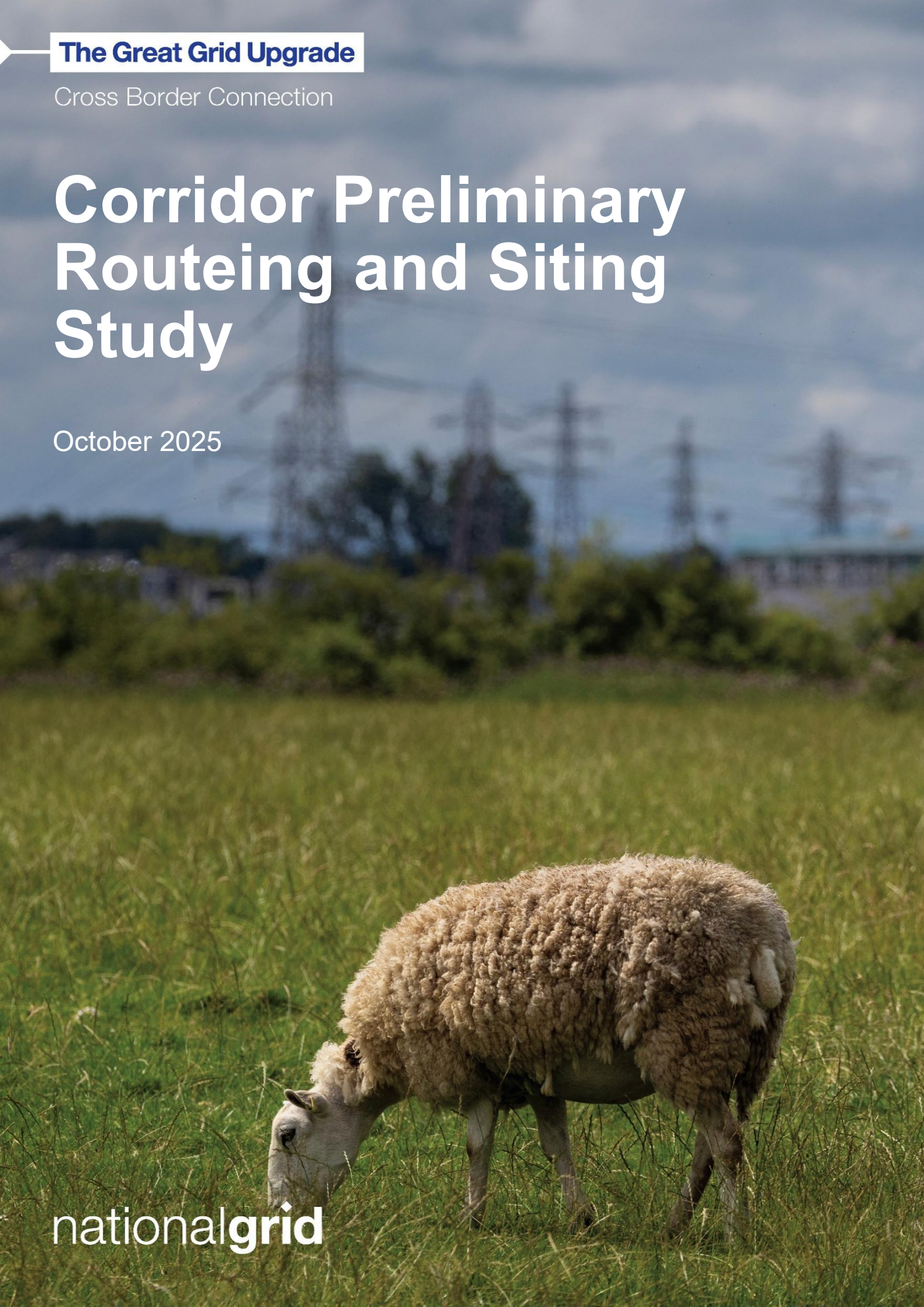
The Great Grid Upgrade

Cross Border Connection

Corridor Preliminary Routeing and Siting Study

October 2025



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Appendix A – Hadrian's Wall World Heritage Site Capacity Assessment
Appendix B – Graduated Swathe Drawings

Table 1-1 – Abbreviations

Abbreviations	Definition
AC	Alternating Current
AIL	Abnormal Indivisible Load
AIS	Air Insulated Switchgear
ALC	Agricultural Land Classification
AQMA	Air Quality Management Area
BESS	Battery Energy Storage System
BMV	Best and Most Versatile
CNP	Critical National Priority
CPRSS	Corridor Preliminary Routeing and Siting Study
CSNP	Centralised Strategic Network Plan
DC	Direct Current
DCO	Development Consent Order
Defra	Department for Environment Food and Rural Affairs
DNO	Distribution Network Operators
EIA	Environmental Impact Assessment
EISD	Earliest in-service date
NESO	National Energy System Operator
FEED	Front-End Engineering Design
FES	Future Energy Scenarios
FRA	Flood Risk Assessment
GIS	Geographical Information Systems (or Gas Insulated Switchgear dependent upon context)

Abbreviations	Definition
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HND	Holistic Network Design
LCA	Landscape Character Area
LNR	Local Nature Reserve
MoD	Ministry of Defence
NCA	National Character Area
NCN	National Cycle Network
NETS	National Grid Electricity Transmission System
NGED	National Grid Electricity Distribution Plc
NGET	National Grid Electricity Transmission Plc
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OfGEM	Office of Gas and Electricity Markets
OHL	Overhead Line
OS	Ordnance Survey
PROW	Public Right of Way
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SEC	Sealing End Compound
SF_6	Sulphur Hexafluoride
SINC	Site of Importance for Nature Conservation
SOR	Strategic Options Report
SPA	Special Protection Area

Abbreviations	Definition
SPEN	Scottish Power Energy Networks
SPT	Scottish Power Transmission plc
SPZ	Source Protection Zone
SQSS	Security and Quality of Supply Standard
SSSI	Site of Special Scientific Interest
WFD	Water Framework Directive

Table 1-2 – Glossary of Terms

Term	Definition
Air Insulated Switchgear (AIS)	An air insulated switchgear composing electrical disconnect switches or circuit breakers used to control, protect and isolate electrical equipment.
Alternating Current (AC)	A type of electrical current, in which the direction of the flow of electrons switches back and forth at regular intervals or cycles. Current flowing in transmission lines and normal household electricity that comes from a wall outlet is alternating current.
Boundaries	A boundary splits the system into two parts, crossing critical circuit paths that carry power between areas and where power flow limitations may be encountered. Boundaries help identify regions where reinforcement is most needed by enabling analysis of power transfers between separated areas. They can be local boundaries, which are small areas of the Transmission System with a high concentration of generation, or wider boundaries, which are large areas containing significant amounts of both generation and demand.
Corridor	A broad preliminary area, which National Grid seeks to identify within the study area where new transmission infrastructure for the Proposed Development (overhead lines and underground cables) could be routed.

Term	Definition
Corridor Preliminary Routeing and Siting Study	The Corridor Preliminary Routeing and Siting Study (CPRSS) reports the process undertaken as part of the Options Identification and Selection Stage (Stage 2) to identify an emerging preferred corridor, Siting Zones and Siting Areas within which the required infrastructure for the Proposed Development may be located.
Cross Border Connection (the Project)	Proposed network reinforcement that is being developed jointly by National Grid and SPT. The Project, that is located between Gala North in Scotland to the Carlisle area in England, is required to help deliver the UK Government's Net Zero targets. It forms part of a major programme of reinforcement of the electricity transmission system to accommodate substantial increases in north-south power flows between Scotland and England, helping take power generated from low-carbon sources (especially from offshore wind) to areas of consumer demand.
Direct Current (DC)	Direct current (DC) is electrical current which flows consistently in one direction. The current that flows in a torch or another appliance running on batteries is direct current.
Distribution Network Operator (DNO)	A Distribution Network Operator is the company that owns and operates the overhead power lines and infrastructure that connects the National Grid electricity transmission system to properties and businesses.

Term	Definition
	The DNOs in proximity to the Project are SP Transmission plc)), SP Electricity North West , and National Grid Electricity Distribution (NGED).
Electricity Transmission System	In England and Wales, the electricity transmission system is made up largely of 400 kV and 275 kV assets connecting separately owned generators, interconnectors, large demands fed directly from the transmission system, and distribution systems. The electricity transmission system is designed to make sure there is sufficient transmission capacity to ensure that the system can be operated in an economic and efficient way by the NESO, ensuring power can be moved from where it is generated to demand centres across Great Britain. The planning and development of the electricity transmission system is governed by the Security and Quality of Supply Standard (SQSS) which ensures that the network is developed and operated securely and is resilient to any foreseeable network faults and disruption.
Emerging Preferred Corridor	An area within which the transmission infrastructure for the Proposed Development may be located, based on the findings of the Options Identification and Selection Stage (Stage 2).
Emerging Preferred Siting Area	An area within a Siting Zone, within which the substation or SEC infrastructure for the Proposed Development may be

Term	Definition
	located, based on the findings of the Options Identification and Selection Stage (Stage 2).
Emerging Preferred Siting Zone	An area within which the Emerging Preferred Siting Area may be located, based on the findings of the Options Identification and Selection Stage (Stage 2).
Future Energy Scenarios (FES)	Published annually by the NESO to indicate possible future power requirements and where future connections may occur across the network.
Gas Insulated Switchgear (GIS)	Gas insulated switchgear (usually Sulphur hexafluoride (SF_6) – see below) composing electrical disconnect switches or circuit breakers used to control, protect and isolate electrical equipment.
Graduated Swathe	Shaded areas within the emerging preferred corridor, Siting Zone and Siting Areas within which Proposed Development infrastructure is considered more or less likely to be located, shown by the varying levels of shading. Darker shaded areas represent where infrastructure is likely to be better located, in National Grid's emerging view at this stage, within the corridor, Siting Zone and Siting Areas.
Holford Rules	A series of guidelines/rules for the routeing and design of new overhead lines or overhead line extensions. The guidelines were initially developed in 1959 and have been reviewed on a number of occasions by National Grid and by the other

Term	Definition
	UK transmission licence holders. The guidelines provide a set of design criteria that have stood the test of time and became accepted industry best practice in overhead line routeing. The guidelines now form an important part of national planning policy relating to the development of electricity networks, as set out in National Policy Statement EN-5[1].
Horizontal directional drilling (HDD)	A trenchless method of installing underground pipes, conduits, or cables along a predetermined path by drilling a curved borehole. It is commonly used for crossing obstacles like roads, rivers, or buildings without digging open trenches.
Horlock Rules	A series of guidelines/rules for the siting and design of new substations, or substation extensions, including consideration of line entries and sealing end compound (SECs). The guidelines were initially developed in 2003 and have been reviewed on a number of occasions by National Grid, with a revised version issued in 2009. The Horlock Rules provide a set of principles which avoid, or reduce the environmental impacts associated with the development of new substation infrastructure.
National Energy System Operator (NESO)	The National Energy System Operator plans and operates the transmission system in Great Britain but does not own the transmission assets such

[1] National Policy Statement for Electricity Networks Infrastructure (EN-5).

Term	Definition
	as the overhead lines and substations. These are developed, owned and maintained by National Grid Electricity Transmission and other 'Transmission Owner' companies. Generation and interconnector customers apply to National Grid NESO when they wish to connect to the network. The NESO is a wholly independent company within the wider National Grid Group.
National Grid	The wider National Grid Group comprises several businesses, including National Grid Ventures and National Grid Electricity Distribution. These businesses are not licenced Transmission Owners and do not develop the national transmission system.
National Grid Electricity Distribution Plc (NGED)	In June 2021 Western Power Distribution was acquired by National Grid Group. It remains a separate company from NGET, operating within the wider National Grid Group and was recently rebranded as National Grid Electricity Distribution. NGED is a DNO operating in proximity to the Project.
National Grid Electricity Transmission Plc (NGET)	National Grid Transmission Plc (NGET) operate the national electricity transmission network across Great Britain and own and maintain the network in England and Wales, providing electricity supplies from generating stations to local distribution companies. National Grid does not distribute electricity to individual premises, but its role in the

Term	Definition
	wholesale market is vital to ensuring a reliable, secure, and quality supply to all.
National Policy Statement (NPS)	Government planning policy relating to the development of Nationally Significant Infrastructure Projects (NSIPs) is set out in the relevant National Policy Statement (NPS). NSIPs should be developed in accordance with the relevant NPS. In the case of new transmission routes, the relevant energy-related NPS are EN-1; Overarching NPS for Energy[2] and EN-5; Electricity Networks Infrastructure[1].
Options Appraisal	A robust and transparent process used to compare options and to assess the potential impacts they may have across a wide range of criteria including environmental, socio-economic, technical and cost factors.
Options Identification and Selection	Work undertaken to determine the emerging preferred corridor and preliminary routeing options for the Proposed Development. It is intended to demonstrate how National Grid's statutory duties, licence obligations, policy considerations, environmental, socio-economic, technical, cost, and programme issues have been considered and to provide information on the approach to the identification and appraisal of corridors.
Overhead Line	An above ground electricity line that safely and securely

[2] Overarching National Policy Statement for Energy (EN-1).

Term	Definition
	transmits electricity through a series of conductors (wires). An overhead line comprises a series of components including supporting structures, such as pylons; line fittings, such as electrical insulators and conductor spacers; an earthwire (to protect the line from electrical faults and carry control data); and the conductors themselves.
Project Need Case	Sets out the reasons why the Project is required.
Proposed Development	Section of the Project located in England, developed by National Grid, extending from the Carlisle area in North England to the England-Scotland border.
Pylon	Overhead line structure used to carry overhead electrical conductors, insulators and fittings.
Ramsar Site	An area of land designated under the Ramsar Convention to conserve wetlands, especially those providing waterfowl habitat.
Scottish Power Transmission Plc (SP Transmission plc)	Scottish Power Transmission Plc (SPT) is a wholly owned subsidiary of Scottish Power Energy Networks, and is responsible for the transmission of electricity in central and southern Scotland.
Sealing End Compound (SEC)	A secure compound within which the transition between underground cables and overhead lines is made. Buried cables are brought to the surface and directed vertically through insulated post

Term	Definition
	structures before connecting onto overhead line conductors (wires) secured (via insulators) to anchor blocks or gantry structures.
Security and Quality of Supply Standard (SQSS)	The SQSS sets out a coordinated set of criteria and methodologies for planning, constructing and operating the National Grid Electricity Transmission System (NETS).
Site of Special Scientific Interest (SSSI)	An area of land designated by Natural England as of special interest by reason of its flora, fauna or geological or physiographical features.
Siting Area	An area of land within a study area, within which a substation or cable sealing end compound (SEC) could be sited.
Siting Zone	An area of land within a study area, within which multiple Siting Areas could be located.
Special Area of Conservation (SAC)	An area of land designated under the under Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora to protect one or more special habitats and/or species.
Special Protection Area (SPA)	An area of land designated under the Directive 2009/147/EC on the Conservation of Wild Birds to protect the habitats of migratory birds and certain particularly threatened birds.
Stage 1 Consultation	An engagement process which will be undertaken to capture public, stakeholder and landowner feedback on the

Term	Definition
	emerging preferred corridor, Siting Zone and Siting Areas, and the graduated swathe. The feedback received will inform the further development of the Proposed Development.
Strategic Proposal	The outcome of the strategic options appraisal process; the Strategic Proposal is taken forward to the Options Identification and Selection Stage (Stage 2).
Substation	A secure node on the electricity system where: switching may be undertaken to direct power flows; operating voltages may be altered through the use of electricity transformers and; sources of electricity import, generation and/or demand can be connected, substations may be located either outdoors or within a building but will always be enclosed by a secure perimeter fence.
Sulphur hexafluoride (SF_6)	Sulphur hexafluoride is a highly effective electrical insulator used in high-voltage electrical applications. It's a greenhouse gas that has a global warming impact of 22,800 times that of carbon dioxide.
Underground Cable	An insulated conductor carrying electric current designed for underground installation.
Wirescape	Caused by multiple overhead lines running in different angles or the proximity of multiple overhead lines.
World Heritage Site	A natural or man-made site, area, or structure recognised as being of outstanding

Term	Definition
	international importance and therefore as deserving special protection. Sites are nominated to and designated by the World Heritage Convention (an organisation of UNESCO).

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Executive summary

National Grid Electricity Transmission Plc ('NGET') (referred to in this report as 'National Grid') own, build and maintain the high-voltage electricity transmission network in England and Wales. National Grid is responsible for making sure electricity is transported safely and efficiently from where it is produced to where it is needed.

The Cross Border Connection Project (the 'Project') is a proposed network reinforcement that is being developed jointly by National Grid and Scottish Power ('SP') Energy Networks ('SP Energy Networks'). The Project is required to help deliver the UK Government's Net Zero targets. It forms part of a major programme of reinforcement of the electricity transmission system to provide additional north-south power flows between Scotland and England, helping take power generated from low-carbon sources to areas of consumer demand. As part of The Great Grid Upgrade, the Project will help the country meet future energy demands.

SP Energy Networks is developing the section of the Project located in Scotland, which extends from the proposed Gala North Substation to the Scotland-England border. The Scottish section of the Project was subject to a separate routeing and siting study undertaken by SP Energy Networks, and will be delivered under a separate consent for development. At the time of writing this report, SP Energy Networks has identified a proposed route for the Scottish section of the Project up to the Scotland-England border, which was subject to public consultation in Autumn 2024 and in Spring 2025.

National Grid is developing the section of the Project located in England (referred to in this report as the 'Proposed Development'), which extends from the Carlisle area in North England to the England-Scotland border. The indicative location for the English section of the Project was identified through a strategic appraisal reported in a Strategic Options Report ('SOR')[3] undertaken at the Strategic Proposal Stage (Stage 1)[4]. This considered several strategic options from a common point at Teviot in Scotland, one of which was to connect in the Carlisle area in North West of England to meet the need to reinforce the network in the region. There were a further four options set out in the SOR. All five options were appraised taking into consideration environmental, socio-economic, technical and cost considerations. The SOR identified a preferred strategic option, which represents the shortest route (approximately 58km) from Teviot to the Carlisle area, which performed more favourably against the above considerations.

This report describes the independent **Corridor Preliminary Routeing and Siting Study (CPRSS)** undertaken by National Grid for the Proposed Development. It details the work undertaken at the Options Identification and Selection Stage (Stage 2). This includes development and refinement of preliminary corridor options, preliminary Siting Zones and preliminary Siting Areas and the comparative assessment of these options to identify National Grid's emerging preferred corridor, Siting Zones and Siting Areas. It identifies the broad location of new infrastructure required for the Proposed Development to meet the overall Project need.

[3] National Grid. Cross Border Connection / Carlisle to Newcastle. Strategic Options Report. September 2025

[4] National Grid's Approach to Consenting outlines the project development process, divided into six stages, for major infrastructure projects; Strategic Proposal, Options Identification & Selection, Defined Proposal & Statutory Consultation, Assessment & Land Rights, Application, Examination & Decision and Construction, with Strategic Proposal being Stage 1 and Construction being Stage 6. National Grid's Approach to Consenting is detailed in Chapter 3 of this report.

Due to its extent and location, the Hadrian's Wall component of the UNESCO Frontiers of the Roman Empire World Heritage Site ('WHS') (referred to in this report as the 'Hadrian's Wall WHS') and its buffer zone represents a significant constraint to the routeing of the Proposed Development and of other reinforcement projects in the cross-border and North West region that are required to provide additional north-south power flows between Scotland and England. As far as practicable, a co-ordinated approach has been adopted in this CPRSS, where the identification and assessment of route and site options for the Proposed Development considered potential implications for other reinforcement projects and the impact on the WHS, while also accounting for the relative differences in design maturity of each project.

This report considers the routeing of new electricity transmission infrastructure and the siting of the new substation for the Proposed Development. In summary, the component parts of the Proposed Development are as follows:

- A new 400 kV substation in the Carlisle area ('new Carlisle substation');
- A new double circuit 400 kV overhead line between the new Carlisle substation and the England-Scotland border; and
- A connection from the new Carlisle substation to the existing network.

The new Carlisle substation will facilitate connection of the Proposed Development and of regional reinforcement projects in the cross-border and North West region. As set out in the SOR, at this early stage it can already be predicted that the Harker Substation cannot be used for the intended connection to Teviot as part of this Project, due to lack of resilience within the network in this region. In the event of unavailability of Harker Substation, the network would experience loss of connection to the whole East of Scotland and loss of transfers on the East Coast of England. On that basis in this scenario, Harker substation would be a single point of connection and system constraint, and hence this solution is less resilient and results in the need for a new substation in the Carlisle Area.

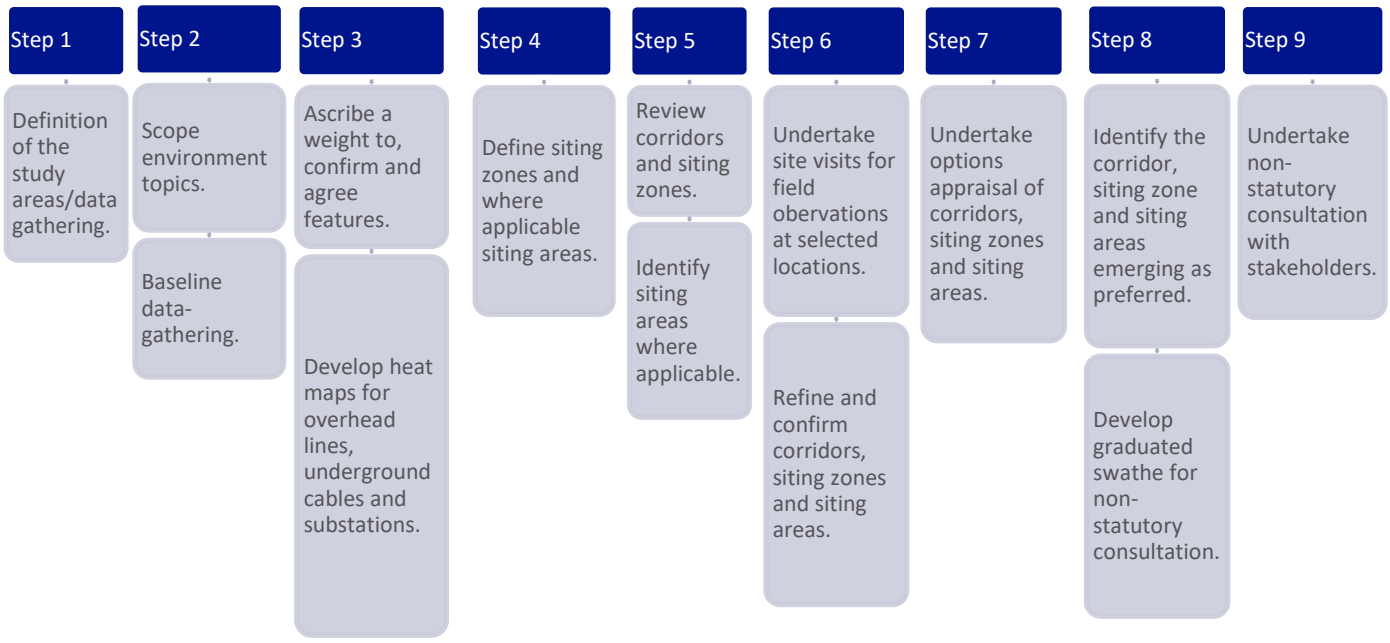
Additionally, a new Carlisle substation will facilitate a connection point to future regional reinforcement projects as identified in NESO Beyond 2030 report. The new substation is critical in resolving the regional need to deliver a number of network improvements through regional projects whilst recognising these projects are at different stages of maturity. The Proposed Development, as the first of the regional projects to come forward, will deliver the substation and provide the connection point to future projects representing a coordinated approach to the development of projects in the region.

The strategy at this early stage of development, was to identify two emerging preferred options for each component of the Proposed Development for the purpose of the Stage 1 consultation, as follows:

- one substation site option and one route corridor option north of Carlisle and a connection to the existing Harker substation (Option A); and
- one substation site option and one route corridor option south of Carlisle and a connection to the existing transmission network via the 400 kV Harker-Hutton overhead line (Option B).

This approach will maintain future flexibility for the Proposed Development, as part of a network of projects to achieve the required reinforcement of the electricity transmission system in the cross-border and North West region.

The methodology used to identify, appraise and select the emerging preferred options consists of nine steps as illustrated below. This CPRSS report details the work undertaken as part of Step 1 to Step 8.



A summary description of, and reasons for selecting, the emerging preferred options for each key component of the Proposed Development is provided below.

New 400 kV Carlisle substation

A total of nine Siting Zone options for the new Carlisle substation, comprising 19 Siting Areas, were identified.

Four of the Siting Zones (comprising 11 of the Siting Areas) were options which could provide a new substation to the north of Carlisle. From these options, substation Siting Area CSZ4.C within Siting Zone CSZ4 was selected as the emerging preferred option to the north of Carlisle (Option A). This Siting Area would be to the north of Carlisle, approximately 1.7km to the east of the existing Harker substation, and to the east of the A7. CSZ4.C performed favourably across the broadest range of the environmental, socio-economic, and engineering aspects, in particular for landscape and visual, historic environment, transport and geotechnical considerations. The landscape context with existing energy infrastructure and the better accessibility via the A7 resulted in this Siting Area being identified as a more preferable option. Specifically, the northern part of CSZ4.C was identified as the preferred location within the Siting Area, as this part of the site had fewer constraints and a lower potential for impacts.

Five of the Siting Zones for the new Carlisle substation (comprising eight Siting Areas) were options which could provide a new substation to the south of Carlisle. From these options, substation Siting Area CSZ9.A within Siting Zone CSZ9 was identified as the emerging preferred option to the south of Carlisle (Option B). This Siting Area would be south-east of Carlisle and adjacent to the A6. This Siting Area is bisected by the 400 kV Harker-Hutton overhead line. CSZ9.A provided fewer constraints than the other Siting Areas. There would be limited landscape and visual impacts, and fewer historic environment and ecology constraints. There would be better accessibility, via the A6, than the other options and better opportunities for civil engineering and technical considerations to locate the substation within the Siting Area. Whilst the potential for geotechnical constraints on a precautionary basis were identified, these were not considered to outweigh the other environmental and engineering benefits of CSZ9.A.

Emerging preferred options for the overhead line between the new 400 kV Carlisle substation and the England-Scotland border

Five potential route corridors to the north of Carlisle were identified. These are referred to as 'Core Route Corridors'. This is because the emerging preferred corridor selected to the north of Carlisle would also be used by the emerging preferred corridor to the south of Carlisle to reach the England-Scotland border and connect with the Scottish section of the Project.

Core Route Corridor 4 using segment 4a at its northernmost extent was selected as the emerging preferred option to the north of Carlisle (Option A). Segment 4a falls within Scotland, and therefore any overhead line infrastructure in that segment would not be delivered as part of the Proposed Development, instead it would be delivered as part of the Scottish section of the Project. From north to south, the emerging preferred route corridor of the Proposed Development in England would start from the England-Scotland border and pass through Kershope Forest, following predominantly a north-east to south-west alignment. It would then pass through areas of rolling countryside transitioning into a more open rural landscape. It would cross the A6071 and pass in proximity to the Hayburn Wind farm and Woodlands Industrial Park. The route would cross the River Lyne and the existing 132 kV Harker Spadeadam overhead line before terminating at the emerging preferred Siting Area for the new Carlisle substation north of Carlisle in CSZ4.C.

Core Route Corridor 4 using segment 4a was considered the preferred environmental and technical option, with landscape and ecology constraints being particular determining factors in the selection. Core Route Corridor 4 would be within a sparsely settled landscape, which could better accommodate overhead lines, and it would be further from ecological designated sites. It was also identified as the option with fewest technical constraints in terms of overhead lines, particularly in the northern part of the corridor. Although it would provide a more expensive option based on the indicative cost of providing the overhead line due to increased length, when compared to some of the other options, this option was identified to perform better in environmental and socio-economics terms and is also considered less technically complex.

The emerging preferred route corridor to the south of Carlisle (Option B) comprises the corridor identified as Option A and additional segments that cross the WHS and its buffer zone and extend to the south-east of Carlisle. The southern corridor and the additional segments comprise Core Route Corridor 4 plus segments 5a, 5c and 5d. Continuing from the southern extent of the Core Route Corridor 4, the emerging preferred route corridor to the south of Carlisle (Option B) would then cross the Hadrian's Wall WHS and buffer. This is an area where the Hadrian's Wall World Heritage Site Capacity Assessment (WHSCA) concluded that the monument is potentially least sensitive to change through the introduction of a new OHL, as described in the WHS Capacity Assessment Technical Note included in **Appendix A**. The route would terminate at the emerging preferred site for the new Carlisle substation south of Carlisle in CSZ9.A. This option would also include a connection to the existing electricity network via the 400 kV Harker-Hutton line.

These route corridor options represent the most preferred opportunity to limit environmental and socio-economic impacts and technical complexity.

Connection from the new Carlisle substation to the existing network

For Option A, connection to the existing network would be via an overhead line connection between the new Carlisle substation north of Carlisle and the existing Harker substation. For Option B, there would be an overhead line connection between the new Carlisle substation south of Carlisle and the existing transmission network via the 400 kV Harker Hutton line. These connections are included within the identified emerging preferred route corridors.

Graduated swathe

A graduated swathe has been identified within the emerging preferred corridors, Siting Zones and Siting Areas. The graduated swathe is a way of showing the areas within the emerging preferred corridors, Siting Zones and Siting Areas where the infrastructure required for the Proposed Development is considered more or less likely to be located. The graduated swathes are shown with a colour shading, with the depth of shading indicating National Grid's emerging view of where infrastructure would be better located based on the work undertaken to date. Darker shading indicates more likely locations, while lighter shading indicates less likely locations.

The use of a graduated swathe is intended to emphasise the preliminary nature of judgements made to date in respect of infrastructure locations within the emerging preferred corridor, Siting Zones and Siting Areas. The graduated swathe represents the current thinking on where the infrastructure required for the Proposed Development may be located. This will be informed by feedback received during Stage 1 consultation as set out in **Chapter 10**. This will be fully considered through the development of the Proposed Development, whilst maintaining the principles used to develop the current graduated swathe, for instance the avoidance of areas of highest constraint such as settlements.

The emerging preferred route corridors and the graduated swathe at the England-Scotland border for both Option A and B of the Proposed Development, align with the proposed route for the Scottish section of the Project as selected by SP Energy Networks, which was subject to public consultation in Autumn 2024 and Spring 2025.

Next steps

The CPRSS will be used to inform the Stage 1 consultation and engagement with key stakeholders, including landowners. The Stage 1 consultation is planned to take place in late 2025.

During Stage 1 consultation, National Grid will be inviting feedback from local communities and stakeholders about the work undertaken to date, the proposed route option and graduated swathe and matters that they would like National Grid to consider as detailed proposals are developed. The feedback from Stage 1 consultation, along with information from surveys undertaken to obtain baseline data and ongoing design studies will inform the further design development of the Proposed Development. Following this, the design will be developed and will be subject to statutory Environmental Impact Assessment and consultation as part of the application for a Development Consent Order.

1. Introduction

1.1 Overview

1.1.1 National Grid Electricity Transmission Plc (NGET) (referred to in this report as 'National Grid) owns, builds and maintains the high-voltage electricity transmission system in England and Wales. National Grid is responsible for making sure electricity is transported safely and efficiently from where it's produced to where it is needed and for developing upgrades to the network as agreed with the industry regulator, Office of Gas and Electricity Markets (OfGEM).

1.1.2 The UK's 2023 Energy Act[5] established an independent system planner and operator to help accelerate Great Britain's energy transition, this included the separation of the National Energy System Operator (NESO) from the National Grid group. The NESO (formally the Electricity System Operator (ESO)) controls and operates the high-voltage electricity transmission system, balancing supply and demand to ensure homes and businesses in Great Britain have the electricity they need 24/7. The NESO facilitates several roles on behalf of the electricity industry, including making formal offers to connection applicants to the National Electricity Transmission System (NETS).

1.1.3 National Grid's transmission system in England and Wales consists of approximately 7,250km of overhead lines and a further 1,450km of underground cabling, operating at 400 kV and 275 kV. The 275 kV grid was developed in the 1950s to provide a national transmission system and then further developed from the mid-1960s, at 400 kV to increase the power carrying capacity. The overhead lines and cables connect around 350 substations to form a highly interconnected network. The substations provide points of connection to the local distribution networks, which operate at voltages from 132 kV down to 240 V (the voltage at which the power is distributed to domestic consumers). The distribution networks are owned by Distribution Network Operators (DNOs), including SP Electricity North West in the Cumbria region of England.

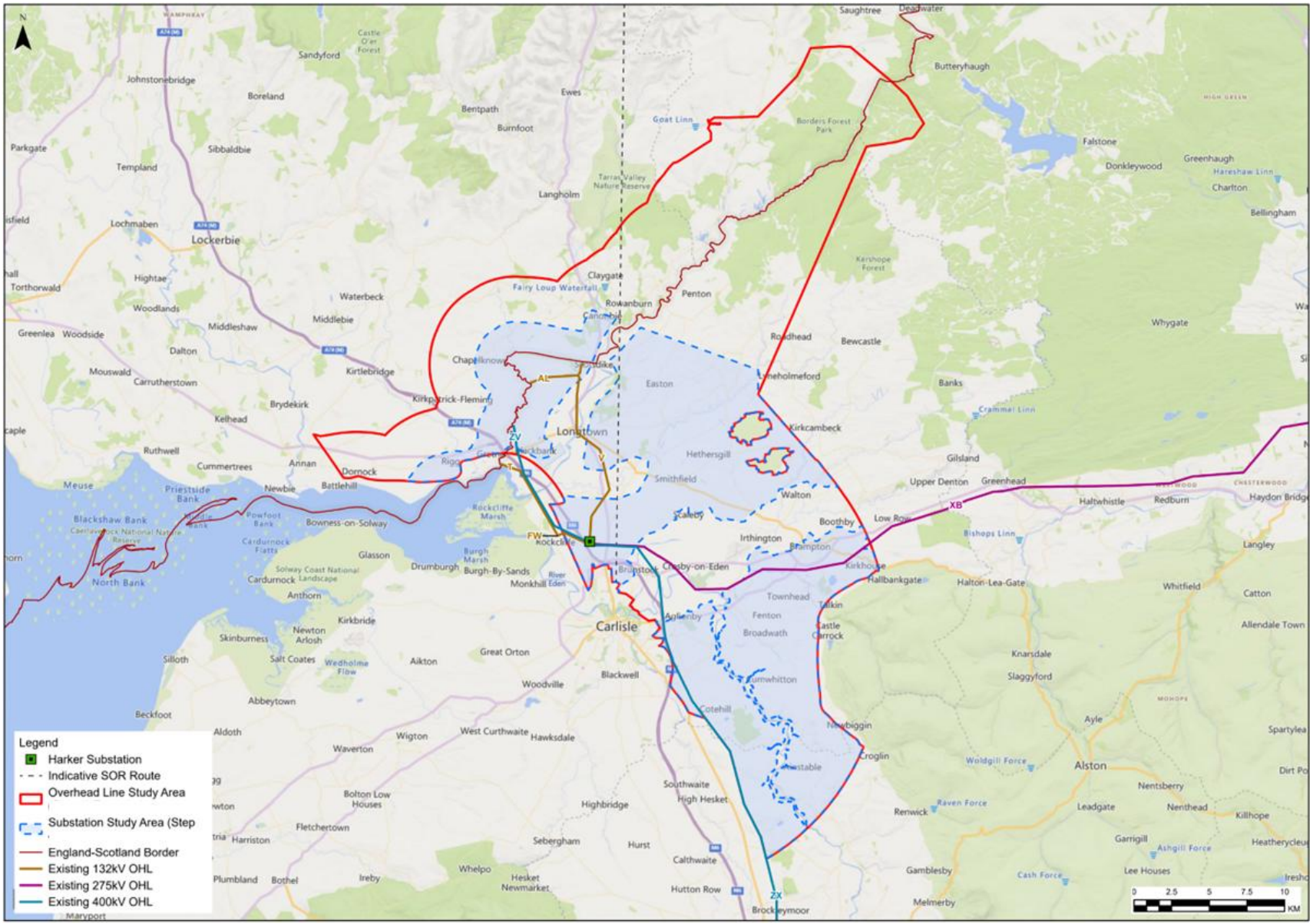
[5] Energy Act (2023) Part 5 Independent System Operator and Planner Section (3) (a). Available at: https://www.legislation.gov.uk/ukpga/2023/52

1.1.4 Example images of National Grid's transmission system are shown in **Figure 1-1**.

Figure 1-1 – Example Images of National Grid's Transmission System

1.1.5 The Cross Border Connection Project ('the Project') is a proposed reinforcement of the electricity transmission system between England and Scotland that is being developed jointly by National Grid and Scottish Power Transmission (SP Transmission plc)). National Grid is developing the section of the Project in its license area in England extending from a new substation in the Carlisle area to the England-Scotland border (referred to as 'the Proposed Development') as shown in **Figure 1-2**. SP Energy Networks is developing the section of the Project which extends from the England-Scotland border to a proposed new substation in the Scottish Borders, Gala North Substation. The Project is required to help deliver the UK Government's Net Zero targets as described in **Section 1.2**. It is one of a number of reinforcements of the electricity transmission system required to provide additional north-south power flows between Scotland and England, helping take power generated from low-carbon sources, to areas of consumer demand.

Figure 1-2 – Location of the study area



1.1.6 As Transmission Licence holders under the Electricity Act 1989 National Grid and SPT are subject to the same statutory duties and licence obligations. However, they each have their own approaches to developing new electricity transmission infrastructure. While National Grid and SPT are jointly developing the Project, the English and Scottish sections of the Project require consent through different statutory consenting regimes that are applicable to each country's jurisdiction.

1.1.7 The Scottish section of the Project was subject to an independent routeing and siting study undertaken by SP Energy Networks. At the time of writing this report SP Energy Networks has identified a proposed option for the Scottish section of the Project including a route corridor up to the Scotland-England border. This was subject to public consultation in Autumn 2024[6] and in Spring 2025. National Grid is at an earlier stage in its development and delivery process for the Proposed Development, as set out below.

1.1.8 National Grid's Approach to Consenting[7] outlines its project development and delivery process for major infrastructure projects, divided into six stages. This approach is explained in more detail in **Chapter 3**.

1.1.9 Following the publication in March 2024 of the Beyond 2030 report which identified the need for the Project (as set out in **Section 1.2**), National Grid undertook a Strategic Options Appraisal which is the first stage in its Approach to Consenting. The Strategic Options Appraisal is reported in the Cross Border Connection / Carlisle to Newcastle Strategic Options Report (SOR). The SOR considered several strategic options for the English section of the Project providing the necessary north-south power flows, between Teviot and the Carlisle areas, that would meet the need for the Project. This stage concluded with the identification of a preferred Strategic Proposal comprising a new substation in the Carlisle area and new overhead line connection between the Teviot and Carlisle areas. The Strategic Proposal was selected taking account of environmental, socio-economic, technical and cost appraisals.

1.1.10 After identifying the Strategic Proposal, National Grid then undertook an independent Corridor Preliminary Routeing and Siting Study (CPRSS), the results of which are described within this report. This has included the identification of emerging preferred corridors, Siting Zones and Siting Areas for the Proposed Development. This independent process ensures that the decision taken by National Grid on the emerging preferred options for the Proposed Development is considered on its own merit.

[6] SP Energy Networks, September 2024. Cross Border Connection: Gala North Substation to the Scottish Border. Routeing and Siting Consultation Document. Available online at: Gala_North_Substation_to_the_Scottish_Border_Routeing_and_Siting_Consultation.pdf

[7] National Grid develops projects through a six-stage process set out in the Approach to Consenting (April 2022) guidance available at https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/planning-and-development.

1.2 The need for the Project

1.2.1 Clean Power 2030 sets out the UK Government's policies in relation to decarbonising the economy and addressing three major challenges: (1) the need for a secure and affordable energy supply, (2) the creation of essential new energy industries, supported by skilled workers in their thousands, and (3) the need to reduce greenhouse gas emissions and limit our contribution to the damaging effects of climate change. It reinforces and builds upon targets established in the British Energy Security Strategy (BESS) in 2022. Specifically, Clean Power 2030 sets out targets to deliver up to 50 GW of offshore wind, 29 GW of onshore wind and 47 GW of solar by 2030, delivering the Government's vision to decarbonise the country's economy.

1.2.2 To facilitate this new renewable energy capacity and ensure that energy can be transported from where it is generated to where it is used, the NETS requires extensive reinforcement. Traditionally the electricity transmission system was developed to transport electricity in bulk from power stations to cities and towns where it is transported via the electricity distribution network, but as renewable energy sources are often more widespread, located in more geographically remote or disparate locations and being developed at scale to meet the targets described above, this requires new electricity transmission infrastructure to connect it to the NETS as well as to transport it to where it is used.

Why are National Grid required to reinforce transmission system

Need for Cross Border Connection

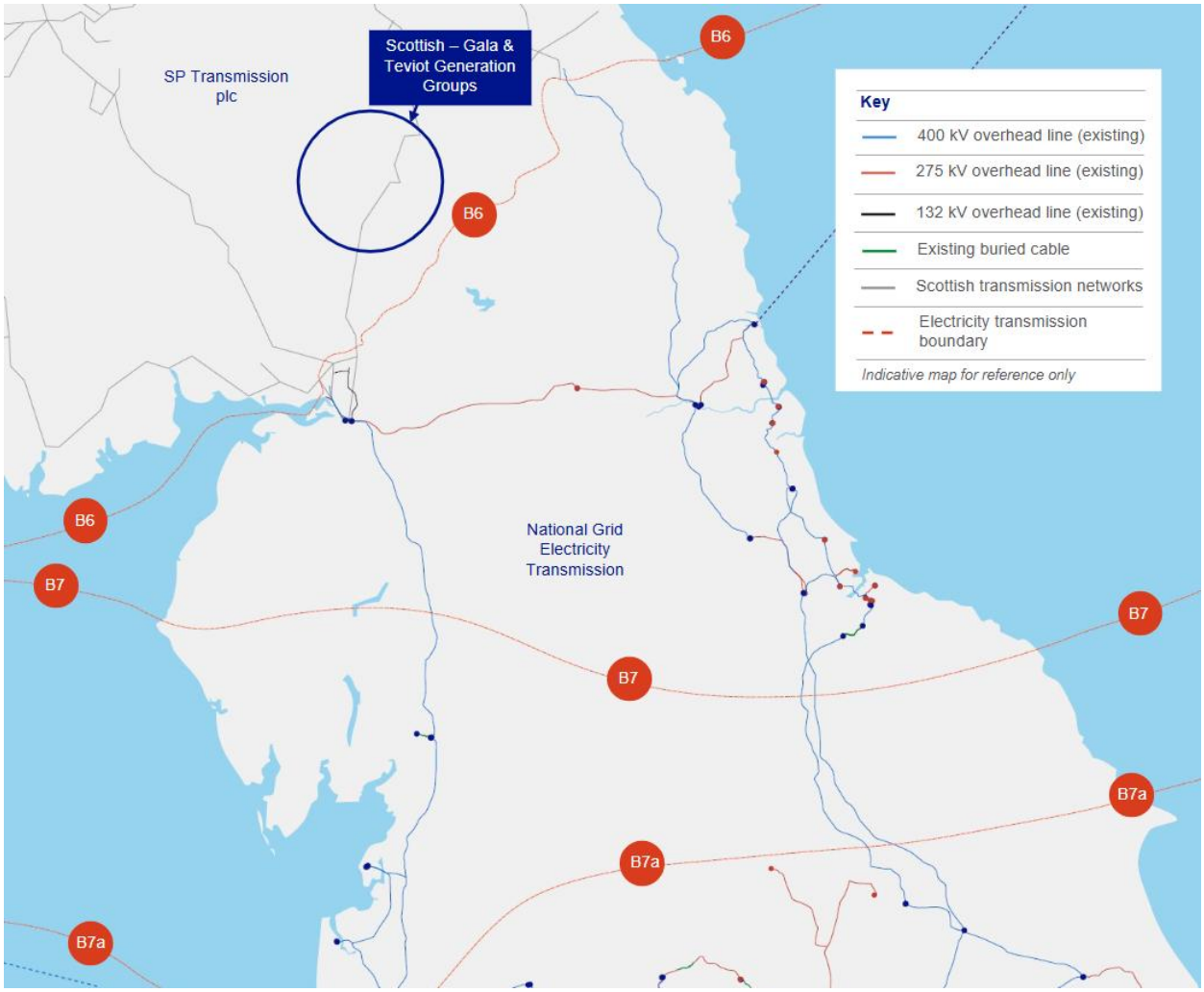
1.2.3 The existing cross-border electricity transmission network is separated by the B6 boundary. This largely follows the Scotland-England border and also delineates National Grid and SPT's licence areas, which are the geographic areas for which National Grid and SPT are the Transmission Owners (TOs) responsible for electricity transmission infrastructure in accordance with their respective transmission licences.

1.2.4 A boundary splits the system into two parts, crossing critical circuit paths that carry power between areas and where power flow limitations may be encountered. Boundaries help identify regions where reinforcement is most needed by enabling analysis of power transfers between separated areas. They can be local boundaries, which are small areas of the transmission system with a high concentration of generation, or wider boundaries, which are large areas containing significant amounts of both generation and demand. Boundary definitions have evolved over many years of planning and operating the transmission system. When required power flows are identified that would exceed the boundary capability/capacity of the transmission system, National Grid must resolve the capability/capacity shortfall under the terms of its transmission licence.

1.2.5 The existing transmission system in Scotland and the North of England is shown in

1.2.6 **Figure** 1-3.

Figure 1-3 – The National Grid Electricity Transmission System in Scotland and the North of England



1.2.7 The B6 boundary is currently crossed by two double-circuit 400 kV overhead lines, one from Strathaven in South Lanarkshire to Harker in Cumberland and the other from Eccles in the Scottish Borders to Blyth/Stella West in Northumberland, as well as the Western HVDC Link, a subsea High Voltage Direct Current (HVDC), between Hunterston in North Ayrshire and Flintshire Bridge in Flintshire.

1.2.8 The existing onshore circuits were originally constructed in the 1960s and designed to connect coastal and inland large coal-fired power stations as well as nuclear power stations in Scotland and the North of England. While Western HVDC Link became operational in 2019, and provides a further 2.2 gigawatts (GW) of additional capacity/capability, as the country continues to decarbonise in line with UK Government targets the amount of renewable energy that is required to be transported across the B6 boundary continues to increase substantially.

1.2.9 A number of subsea HVDC reinforcements which will cross the B6 boundary and provide additional capability and capacity are at various stages of development. This includes:

- Eastern Green Link 1 – Torness to Hawthorn Pit (in construction);

- Eastern Green Link 2 – Peterhead to Drax (in construction);
- Eastern Green Link 3 – Peterhead to Walpole B (in development);
- Eastern Green Link 4 – Westfield to Walpole B (in development); and
- Eastern Green Link 5 – Aberdeenshire to Lincolnshire (in development).

1.2.10 All of these links are due to become operational by 2035, however, additional onshore reinforcement is also required to address two key requirements:

- Provision of additional boundary capability and capacity on the B6 boundary to enable the economic and efficient transmission of electricity; and
- Provision of additional transmission capacity to connect planned renewable generation in the Gala and Teviot areas in Scotland.

1.2.11 In the Gala and Teviot areas, two generation groups, comprising developers with connection agreements with NESO, require SPT to provide transmission system access within its licensed area. Due to the proximity of the generation, in particular the Teviot group, to the Scotland-England border, these connections also impact National Grid, necessitating reinforcements to both SPT and National Grid.

1.2.12 Onshore reinforcement of the B6 boundary is also required to provide an increase in boundary capacity and capability. NESO develops a set of possible energy growth scenarios to 2050 and uses these to provide a 10-year view of the future transmission requirements and the capability of the NETS in the Electricity Ten Year Statement (ETYS). These scenarios mainly inform the requirement for transmission capability between regions of the system, for example between Scotland and Northern England. As described above, while there are a number of subsea HVDC links which will cross the B6 boundary, NESO forecasts in ETYS to 2035 show that there would be capability and capacity deficits on the B6 boundary of 11.6 GW and 10.4 GW respectively as a result of generation and demand requirements. These deficits require onshore reinforcement in addition to the subsea HVDC links. The largest capacity a double circuit transmission route can carry is 6.9 GW, which means two double circuit 400 kV connections may be required to cross the B6 boundary if onshore options are determined to progress for other projects identified as being required to meet the overall regional need case.

1.2.13 A number of onshore network reinforcements have been identified in the North West region by NESO in its report ‘Beyond 2030’. These comprise:

- The Project (referred to in ‘Beyond 2030’ as CMN3), a new circuit between South East Scotland and North West England, of which the Proposed Development would provide the section in England;
- WCN2, a new circuit between South West Scotland and North West England;
- FSU1, an upgrade to the existing network between North West and North East England which could involve either retrofitting the existing infrastructure with a higher voltage line, or (more likely) the upgrade could be delivered through construction of new infrastructure and associated removal of the existing infrastructure; and
- CLN2, a new circuit across North West England.

1.2.14 Each of these projects is at different stages of design development or maturity taking account of their individual drivers. In the case of the Project, this is the most well-developed reinforcement and will address both parts of the need case:

- it helps to reduce the capacity and capability deficits on the B6 boundary by providing one 400 kV double circuit overhead line capable of carrying up to 6.9 GW; and
- it provides additional transmission capacity needed to connect to the Gala and Teviot generation groups by contracted connection dates in 2033.

1.2.15 The Proposed Development would meet a proportion of the identified need to reduce the shortfall in the B6 boundary capacity and capability by providing the section in England with a new circuit between South East Scotland and North West England. In meeting a proportion of the identified need, the Project does not address the entirety of the B6 boundary capacity and capability shortfall. Whilst the other reinforcements fall outside of the scope of this CPRSS, their interactions with the Project introduce additional considerations to the routeing and siting of new infrastructure required by the Proposed Development. The strategic proposal, which was identified in the SOR, includes the siting of a new substation in the Carlisle area. This substation will facilitate the connection of the Proposed Development and of the other regional reinforcement projects identified by the Beyond 2030 report (FSU1 and CLN2).

1.2.16 As set out in the SOR, at this early stage it can already be predicted that the Harker Substation cannot be used for the intended connection to Teviot as part of this Project, due to lack of resilience within the network in this region. In the event of unavailability of Harker Substation, the network would experience loss of connection to the whole East of Scotland and loss of transfers on the East Coast of England. On that basis in this scenario, Harker substation would be a single point of connection and system constraint, and hence this solution is less resilient and results in the need for a new substation in the Carlisle Area.

1.2.17 Additionally, a new Carlisle substation will facilitate a connection point to future regional reinforcement projects as identified in NESO Beyond 2030 report. The new substation is critical in resolving the regional need to deliver a number of network improvements through regional projects whilst recognising these projects are at different stages of maturity. The Proposed Development, as the first of the regional projects to come forward, will deliver the substation and provide the connection point to future projects representing a coordinated approach to the development of projects in the region.

1.2.18 In summary, the Proposed Development will provide:

- A new 400 kV substation in the Carlisle area;
- A new double circuit 400 kV overhead line connection between the substation and the Scotland-England border; and
- A connection from the new substation to the existing transmission network, either through an overhead line connection between the new Carlisle substation and existing Harker substation, or an overhead line connection between the new Carlisle substation and the existing 400 kV Harker-Hutton line.

1.2.19 This CPRSS sets out the process for identifying and selecting emerging preferred options for substation locations and route corridors. To maintain future flexibility for considering the Proposed Development, as part of a network of projects to meet the wider regional need, options were identified which respond to both the need case for the Proposed Development alone, as well as the need to meet the overall B6 boundary capacity and capability shortfall through the Proposed Development and the wider network of other regional reinforcement projects to ensure a coordinated approach is considered.

1.2.20 On this basis the emerging preferred options identified include:

- A new Carlisle substation and route corridor north of Carlisle. This would be Option A; and
- A new Carlisle substation and route corridor south of Carlisle. This would be Option B.

1.2.21 The process to identify the emerging preferred options is described further in **Chapter 5** of this report.

1.3 Purpose of this report

1.3.1 This report is the CPRSS, which has been undertaken to facilitate feedback on the Proposed Development from all interested parties as part of the Stage 1 consultation. The CPRSS reports the process undertaken as part of the Options Identification and Selection Stage (Stage 2) described in **Chapter 3**.

1.3.2 This CPRSS report sets out the routeing and siting activities undertaken to date, including the identification, refinement and assessment of preliminary corridors in which a new overhead line connection could be routed (described in this report as 'corridors'), preliminary Siting Zones (described in this report as 'Siting Zones') and preliminary Siting Areas (described in this report as 'Siting Areas') in which a new substation could be sited.

1.3.3 This report explains National Grid's emerging preferences for the broad location of new infrastructure for the Proposed Development which will meet the need case for the Project. A description of the Proposed Development's infrastructure within the scope of this CPRSS is set out in **Chapter 2**. These emerging preferences are presented in a 'graduated swathe.'

1.3.4 The graduated swathe is a way of showing the areas within the emerging preferred corridors, Siting Zones and Siting Areas where the Proposed Development infrastructure is considered more or less likely to be located. The emerging preferred corridor, Siting Zones, and Siting Areas are shown with a colour shading, with the depth of shading indicating National Grid's emerging view of where infrastructure would be better located based on the work undertaken to date. Darker shading indicates more likely locations, while lighter shading indicates less likely locations.

1.3.5 The use of the graduated swathe is intended to emphasise the preliminary nature of judgements made to date in respect of infrastructure locations within the emerging preferred corridor, Siting Zones and Siting Areas. Feedback received from the Stage 1 consultation will be taken into account in the detailed routeing and siting work for the Defined Proposal and Statutory Consultation Stage (Stage 3). This feedback may also lead to modification of the emerging preferred corridor, Siting Zones and Siting Areas.

1.3.6 The emerging preferred corridor and graduated swathe will also be used as part of the consideration of the start to end Project, in collaboration between National Grid and SP Energy Networks. This includes the review of routeing and siting decisions already taken by either National Grid or SP Energy Networks, should that be necessary.

1.4 Structure of this Report

1.4.1 The report is structured as follows:

- **Chapter 2: Aspects of the Proposed Development** – summarises the key components of the Proposed Development.
- **Chapter 3: National Grid's Approach to Routeing and Siting** – provides an overview of key legislation, policy, and guidance, and National Grid's approach to consenting and project delivery.
- **Chapter 4: Option Identification and Selection Process** – sets out the process used to identify, appraise, and select corridors and Siting Zones (or Siting Areas), following National Grid's guidance and in line with relevant policy.
- **Chapter 5: Study Area, Corridor and Siting Zone Definition** – details the steps undertaken to identify the study area for the Proposed Development and to define the corridors and Siting Zones and Siting Areas for appraisal (including segments and links).
- **Chapter 6: Options Appraisal – New Carlisle Substation:** provides the key environmental, socio-economics and technical constraints for each new Carlisle substation's Siting Zones and Siting Areas.
- **Chapter 7: Options Appraisal – Route Corridors:** provides the key environmental, socio-economics and technical constraints for each corridor considered as part of the Proposed Development.
- **Chapter 8: Cost**– shows the range of the best and worst performing cost estimates for each of the corridors.
- **Chapter 9: Options Selection** – provides comparative analysis of the corridors, Siting Zones and Siting Areas to identify those emerging as preferred.
- **Chapter 10: Development of Graduated Swathe** – summarises the approach taken to developing the graduated swathe for the Proposed Development and its intended use.
- **Chapter 11: Summary and Next Steps** – presents the conclusions of the CPRSS and outlines the next steps.

2. Aspects of the Proposed Development

2.1 Introduction

2.1.1 To underpin its 2050 net zero ambitions, the UK Government has committed to fully decarbonising the power system by 2035. To fulfil this commitment and meet energy objectives, the UK Government has concluded that there is a critical national priority for the provision of nationally significant low carbon infrastructure. As stated within the Overarching National Policy Statement (NPS) for Energy (EN-1, see **Chapter 3** for further details) *"there is an urgent need for new electricity network infrastructure to be brought forward at pace" (paragraph 3.3.65).*

2.1.2 The Proposed Development, a critical national priority, directly supports the delivery of the UK Government's energy objectives, by reinforcing the electricity transmission system and connecting low carbon infrastructure to the National Electricity Transmission System. It forms part of a major programme of reinforcement of the electricity transmission system to accommodate major increases in north-south power flows, helping take power generated from low-carbon sources (especially from offshore wind) to areas of consumer demand across the UK.

2.1.3 The key components of the Proposed Development are described in **Section 1.2.** This includes the provision of a new double circuit 400 kV overhead line and a new 400 kV Substation in the Carlisle area. The new 400 kV transmission connection is expected wholly or largely to comprise new overhead line.

2.1.4 This chapter provides more information regarding the new 400 kV transmission connection and the new Carlisle substation, and other improvements needed to facilitate the construction of the Proposed Development.

2.1.5 The typical transmission and substation elements described in this chapter are based on National Grid infrastructure which is used in England. National Grid and SP Energy Networks will develop collective infrastructure specifications to enable the Proposed Development to operate as part of the overall Project.

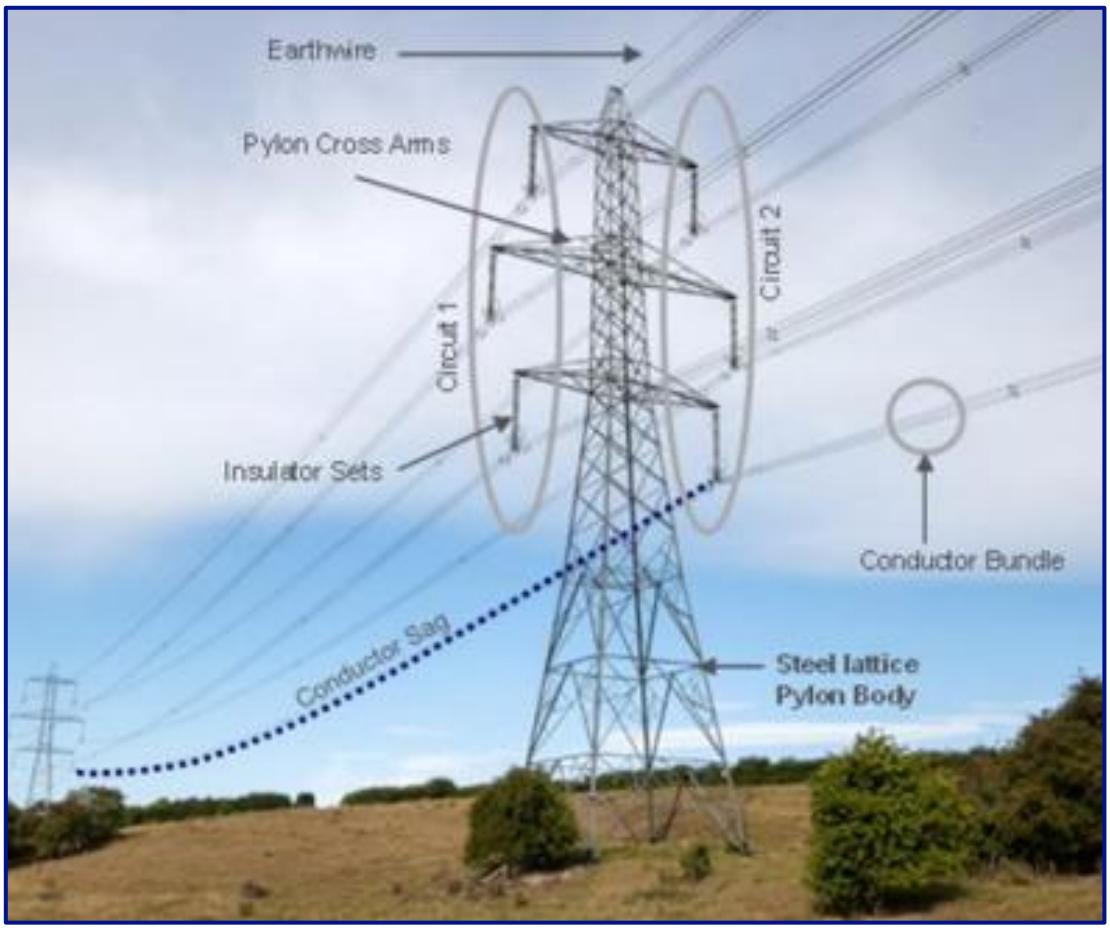
2.2 Overhead Lines

Pylons and Conductors

2.2.1 Pylons are overhead line structures which carry overhead electrical conductors, insulators and fittings. The main components of an overhead line are shown in **Figure 2-1** below. **Figure 2-1** shows a typical steel lattice pylon. Other pylon types are discussed further in this section.

2.2.2 Like most overhead lines owned and maintained by National Grid, the Proposed Development will carry a voltage of 400 kV. The overhead line for the Proposed Development will carry two discrete electrical circuits on either side of the pylons, which can be operated independently of one another, increasing the resilience of the transmission system.

Figure 2-1 – Components of a Typical Transmission Connection



2.2.3 Electrical power will be transmitted through conductors (often referred to as 'wires'). The conductors are attached to the end of a set of insulators that hang from the pylon cross arms and electrically isolate the conductors from the main structure. On a typical pylon, as shown in **Figure 2-1**, three pylon cross arms are stacked above each other, and each supports a bundle of phase conductors which together form a single electrical circuit which is operated as a three-phase system. Two circuits are therefore carried, with one on either side of the pylon (indicated by 'Circuit 1 and Circuit 2' in **Figure 2-1**). The top of the pylons supports a single smaller earthwire/fibre optic cable combined that carries data between substations and provides shielding from lightning strikes for the

conductors below. The Proposed Development is likely to comprise a maximum of three conductors per bundle, a total of 18 conductors per pylon together with the earthwire/fibre optic cable.

2.2.4 The conductors will be a minimum height above the ground. The height will be maintained by pylons spaced intermittently along the route.

2.2.5 The minimum heights[8] between the conductors, the ground and various other features must be maintained, to ensure safe operation. The minimum clearance between the conductors and the ground is 7.8 m at the maximum sag, shown in **Figure 2-1**. To maintain these sags, pylons need to be a minimum height at the point that the lowest conductor is attached to the pylon arms. This height is dependent upon a range of factors including the distance between pylons, planned operating temperature and conductor wire composition, the intervening topography and the use of the land being crossed.

2.2.6 To a lesser extent, the overall pylon height will also be influenced by pylon types. The pylon illustrated in **Figure 2-1** above is a suspension pylon, with the conductors hanging on insulator sets beneath the pylon arms. Where the route of the overhead line changes direction the use of such a pylon would see the conductors deviate in vertical arrangement. Where this occurs, larger, more bulky angle pylons are required to accommodate additional sideways strains with the insulators tensioning the conductors horizontally to keep conductors aligned. **Figure 2-2** below illustrates the difference between these three main pylon types.

2.2.7 At the end of overhead lines where they connect with substations or underground cables (if required) it is necessary to use terminal pylons, which are also of greater bulk to ensure stability.

2.2.8 A typical pylon operating at 400 kV is up to approximately 50m in height. A typical span distance between pylons is approximately 350m. In broad terms there are typically three pylons for every km of overhead line.

2.2.9 During the construction of overhead lines, activities tend to be focused at the base of each pylon and to either side of tension pylons from where the conductors are winched into position. The most noticeable effects of overhead lines are generally considered to be visual, due to the height of the pylons in relation to most buildings and trees.

[8] Electrical Networks Association TS 43-8 details the legal clearances for National Grid owned and maintained overhead lines. Third party guidance for working near overhead lines is available at: https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/working-near-our-assets.

Figure 2-2 – Suspension Pylon (Left) and Angle Pylon (Right)

Pylon Type and Design

2.2.10 Most transmission lines in Great Britain use lattice steel pylons with three sets of cross arms (as shown first in **Figure 2-2** and **Figure 2-3**). Alternative pylon types have been approved for use on the National Grid network which may achieve the technical performance required for the Proposed Development[9]. These two alternative types of pylon (low height steel lattice and T-pylon suspension) are illustrated in **Figure 2-3**. At this stage the Project is assumed to be an overhead line connection formed of steel lattice pylons.

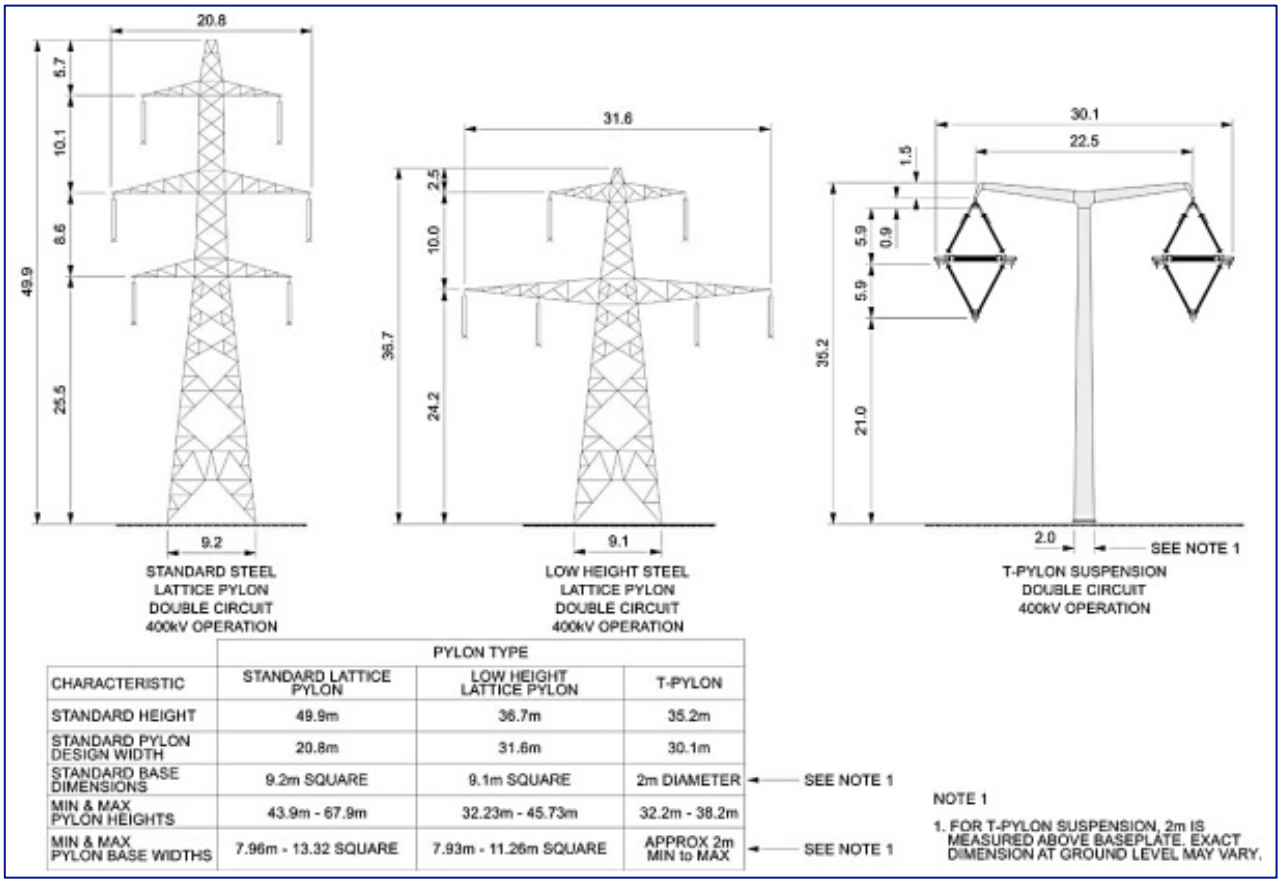
2.2.11 The first alternative pylon type is a lower height form of lattice steel pylon. This removes the top cross arm, with two bundles of conductors supported on the lowest cross arm. This requires the widening of the lowest cross arm resulting in a shorter but wider pylon when compared to the standard lattice steel pylons. The overall height of this type of pylon is approximately 37 m. This pylon type has tended to be used in proximity to airports and airfields, to avoid flight paths, to reduce landscape impacts and also where bird strike is a risk. This pylon type can also help to reduce the extent of affected views, especially in rolling or wooded landscapes.

2.2.12 The second alternative pylon type is the ‘T-pylon.’ Rather than being of lattice steel construction the ‘T-pylon’ is formed from a single steel monopole (similar to a modern wind turbine) supporting a single cast cross arm at the top, which together form a ‘T’ shape. The conductors are hung from this cross arm in two larger groups of three bundles, kept apart by solid insulating rods that together form a diamond configuration. These pylon types are also lower in height than the standard lattice steel pylons, at

[9] With the potential exception of localised requirements, such as major river crossings.

approximately 35 m. The monopole is a solid structure, approximately 2 m in diameter, in contrast to the more open lattice form of the two lattice steel pylons.

Figure 2-3 – Alternative Pylon Types



CHARACTERISTIC	PYLON TYPE: STANDARD LATTICE PYLON	LOW HEIGHT LATTICE PYLON	T-PYLON	
STANDARD HEIGHT	49.9m	36.7m	35.2m	
STANDARD PYLON DESIGN WIDTH	20.8m	31.6m	30.1m	
STANDARD BASE DIMENSIONS	9.2m SQUARE	9.1m SQUARE	2m DIAMETER	SEE NOTE 1
MIN & MAX PYLON HEIGHTS	43.9m - 67.9m	32.23m - 45.73m	32.2m - 38.2m	
MIN & MAX PYLON BASE WIDTHS	7.96m - 13.32 SQUARE	7.93m - 11.26m SQUARE	APPROX 2m MIN to MAX	SEE NOTE 1

NOTE 1
1. FOR T-PYLON SUSPENSION, 2m IS MEASURED ABOVE BASEPLATE. EXACT DIMENSION AT GROUND LEVEL MAY VARY.

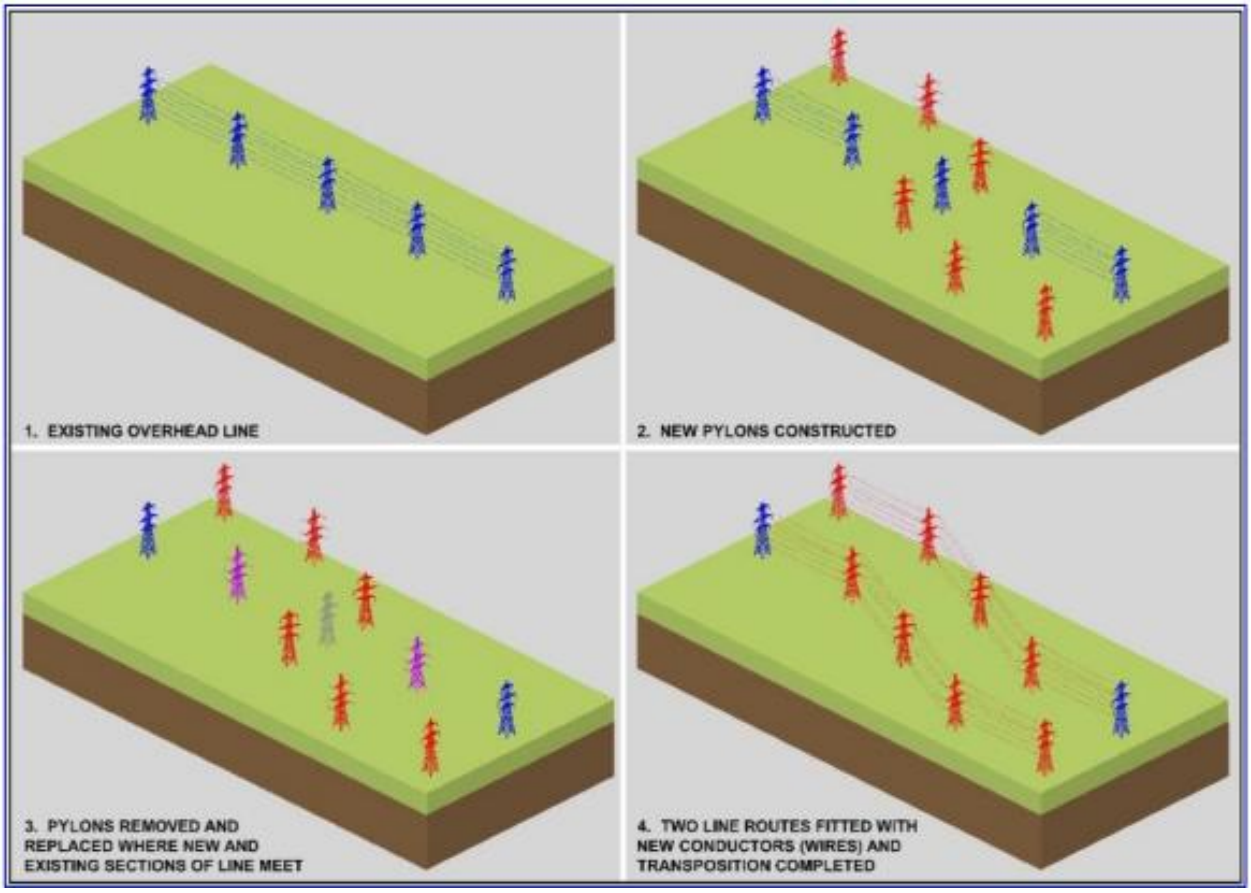
2.2.13 In previous projects the visual benefits of utilising standard lattice steel pylons, as opposed to low height steel lattice pylons or T-pylons, has been recognised, especially when siting a new overhead line close to existing lines that use a similar pylon type. The type of pylons proposed for the Proposed Development will be determined as part of the project development which will be informed through feedback from Stage 1 consultation, information from surveys and ongoing design studies but the starting assumption (in line with NPS and National Grid's Approach to Consenting) will be a standard lattice pylon.

Line Swap-Overs

2.2.14 Where two overhead electricity line routes must cross, a number of specific design considerations arise. This need might arise where an existing overhead line crosses the route of a new overhead line, including where local constraints to the routeing of an overhead line preclude its construction on the same side of an existing line throughout its entire length.

2.2.15 Where the design of existing pylons is compatible and the direction of power flows across the electricity system allow it, a 'line swap-over' can be considered. This is done through the removal of a length of the existing overhead line, allowing the two newly formed 'ends' of existing overhead line to be connected to two lengths of new route located on different sides of the existing line. The two resultant routes would then both comprise lengths of newly built and existing overhead line works to achieve line swap-overs as illustrated schematically in **Figure 2-4.**

Figure 2-4 – Sequence of Works to Achieve Line Swap-Over of New and Existing Overhead Lines



2.2.16 Where the existing and new overhead lines connect to different points of the transmission system it may be necessary to swap the route back before the destination substation is reached to maintain the same start and end points.

2.2.17 The line swap-over of the route of a new overhead line from one side of an existing overhead line to the other can be achieved on adjacent pylons, resulting in up to four angle pylons being located in close proximity. Alternatively, it may be possible to utilise existing angle pylons on the current overhead line to partly form the line swap-over, or to extend the distance over which a line swap-over is achieved. In this way the change of route direction would be more gradual, with greater separation between the angle pylons.

2.2.18 Where National Grid must maintain electricity supplies through the existing overhead line whilst line swap-over works are being undertaken it may be necessary to locally install one or more temporary overhead lines. These lines would act as a by-pass route for the power whilst the permanent overhead line arrangement is constructed. The temporary lines would be removed, and the land reinstated upon completion.

2.2.19 Any line swap-over would increase the technical complexity, cost and potential duration of any new overhead line build but may introduce greater opportunities to reduce environmental and socio-economic effects.

2.3 Underground Cables

2.3.1 Whilst it is currently assumed that the Proposed Development will be developed as an overhead line, electricity can be transmitted through buried cables as well as through

overhead conductors. However, at the alternating current (AC) transmission voltage of 400 kV, the use of buried cables represents a significant technical complexity. The size, number and complexity of the underground cables required is far greater than those that operate at lower voltages or direct current (DC) cables[10]. As a result, direct buried transmission cables at the capacity required for the Proposed Development are materially more expensive compared to an equivalent overhead line. Moreover, and as noted within NPS EN-5 which relates to transmission routes supports (described in more detail in **Chapter 3**), underground cables typically bear a significantly higher lifetime cost of repair and later uprating. The costs for a direct buried transmission cable for the Proposed Development are presented within the SOR.

2.3.2 For these reasons, NPS EN-5 supports, in most instances, the starting assumption for the development of overhead lines rather than underground cables[11].

Underground Cable Installation Methods

2.3.3 There are a number of different underground cable installation methods available including direct buried, ducted, surface troughs and trenchless crossings. The most appropriate for a given project, or location within a project, is subject to environmental, land use, cost and technical factors.

2.3.4 Where conditions allow, cables are normally installed in excavated trenches. A cement-bound sand mix is used as backfill to protect the cables and help dissipate any heat generated by the cables in operation.

2.3.5 For a new 400 kV transmission circuit installed underground, the working width of the land required for construction is typically between 40m and 100m, subject to a range of factors such as the number of circuits being installed, and the number and size of cables needed. For a low-capacity single circuit this could require only three cables. For a high capacity double circuit route up to 18 individual cables would be required. An example of a cable construction is shown at **Figure 2-5** below.

[10] More information can be found in National Grid's publication 'Undergrounding high voltage electricity transmission lines. The technical issues'. Available at: 39111-Undergrounding_high_voltage_electricity_transmission_lines_The_technical_issues_INT.pdf

[11] The National Policy Statement for Electricity Networks Infrastructure (EN-5) (2023) states at paragraphs 2.9.20 and 2.9.21 that "*Although it is the government's position that overhead lines should be the strong starting presumption for electricity networks developments in general, this presumption is reversed when proposed developments will cross part of a nationally designated landscape (i.e. National Park, The Broads, or Area of Outstanding Natural Beauty).*"…"*In these areas, and where harm to the landscape, visual amenity and natural beauty of these areas cannot feasibly be avoided by rerouting overhead lines, the strong starting presumption will be that the applicant should underground the relevant section of the line*".

Figure 2-5 – Example Underground Cable Construction

2.3.6 Due to the weight and size of underground cables needed to operate at 400 kV, the maximum single cable length that can be transported to a project location by road is typically between 800m and 1,000m. To achieve cable routes in excess of these lengths individual cables must be joined together on site. This necessitates joint bays at intervals along the route. Where joint bays are located the working width may need to be wider than 120m.

2.3.7 Works to install underground cables take considerably longer than the works associated with installing an equivalent length of overhead line. In addition, and as noted within NPS EN-5 (paragraph 2.9.25), the installation of underground cables is potentially very disruptive on local communities, habitats, archaeological and heritage assets, soil (including peat soils), hydrology, geology, and for a substantial time after construction, landscape and visual amenity. However, effective restoration of the underground cable route following construction can result in fewer long-term landscape and visual effects in comparison with an overhead line.

2.3.8 Where specific environmental or infrastructure features preclude the use of underground cables, as described above, it may be practicable to install ducts using a trenchless installation technique such as horizontal directional drilling (HDD). In this instance cables are pulled into pre-installed ducts. The maximum length of HDD installed ducts is limited by the weight of the cables to be installed. Also, where trenchless techniques are required, the working width may need to be wider than 120m.

2.3.9 Where HDD is not technically viable, then a tunnelled solution for underground cables can be considered. Tunnels can be constructed using a variety of techniques, but all involve major civil engineering activities, which result in substantial additional costs, increased construction risks and extended programme durations. Typically, permanent buildings are required at either end of the tunnel section to support operation, including access to and potential ventilation of the tunnel and for cooling of the underground cables.

Sealing End Compound

2.3.10 A sealing end compound (SEC) is needed at either end of a section of underground cable, where it commences its burial from an overhead line and where it subsequently resurfaces to connect back onto an overhead line. Within these secure compounds, the buried cables are brought to the surface through vertical sealing end structures. These are connected horizontally at a height of approximately 10m with a set of solid bars (referred to as 'busbars'). The conductor wires from the overhead line drop down to connect onto the solid bars within the secure compound. A similar arrangement occurs where the cables are reconnected to an overhead line.

2.3.11 To accommodate the one-way tension of the conductor wires where an overhead line ends, a heavier pylon is needed. Alternatively, the conductors may enter the compound at a slacker angle, connecting onto lower height gantries.

2.3.12 SECs typically extend to around 30m by 80m for a double circuit 400 kV transmission, but this will vary dependent upon local considerations. Examples of SECs are shown in **Figure 2-6** below.

Figure 2-6 – Example 400 kV Sealing End Compounds

2.4 Other Technical Considerations

2.4.1 To construct the new transmission substation a range of other minor temporary and permanent improvement works will need to be carried out to facilitate the construction of the Proposed Development. Such improvements will be to transmission system and electricity distribution networks operated by National Grid and ENW and may include modifications to existing overhead line terminations, re-routeing of local distribution circuits, installation of temporary diversions, and upgrades to accommodate the new substation configuration.

2.4.2 A number of the more significant elements of these improvement works are detailed below.

Crossings of Existing Transmission and Distribution Overhead Lines

2.4.3 Where two overhead line routes must cross but a line swap-over, as described above, is not possible or applicable (for example the design of existing pylons is not compatible or the direction of power flows across the electricity system do not allow it) then other design considerations require consideration. The Proposed Development's route may need to cross one or more existing 275 kV overhead lines in the Carlisle area (see **Figure 2-7**). Of particular note is the existing 275 kV XB line that runs from Stella West in the east to Harker substation in the west, which presents a key interface to be considered during the later design stages of the Proposed Development.

Figure 2-7 – Stella West to Harker 275 kV circuit East-West circuit

2.4.4 In addition, the Proposed Development may also cross one or more lower voltage overhead lines operated by DNOs, typically operating at 11 kV or 33 kV. These lower voltage lines are more common at the distribution level and are generally supported on shorter concrete/steel poles. Due to their lower height and reduced conductor clearance envelopes, the impact of crossing these assets is generally less complex from both an engineering and visual perspective. In most cases, adequate clearance can be achieved without requiring significant design adjustments, and standard overhead crossing techniques can be applied.

2.4.5 Whilst it is practicable to cross a transmission overhead line with another using technical solutions such as cable duck-unders, where one line is routed underneath another, this results in significantly taller pylons on the higher line and introduces

operational and safety concerns. Alternatively, line swap-overs approach can be utilised where the design of existing pylons is compatible and the direction of power flows across the electricity system allow for it. This method is described in **Chapter 2.2**.

2.4.6 Where complexities of overhead line crossing or site constraints do not allow for either of the methods above, it may be more appropriate to leave an existing overhead line in place and underground a section of a new overhead line. In this case operational and safety concerns are substantially reduced, and taller pylons which may have increased visual effects can be avoided.

2.4.7 In the context of the Proposed Development, the 275kV XB overhead line may require crossing. Further information on the 275kV XB overhead line in the context of the Proposed Development is provided in **Chapter 5.**

Managing interfaces with existing National Grid Overhead Liness

2.4.8 The route and any line swap-overs required by the Proposed Development may result in interactions with other National Grid overhead lines. For example, a line swap-over is likely to mean that the new end-to-end connection for the Proposed Development is carried in part on existing pylons through existing conductor wires. If this is the case, subject to information from surveys and ongoing design studies, it may be necessary to replace these sections of existing conductor wire to align with the new overhead line.

Managing interfaces with Other Utility Companies' Overhead lines

2.4.9 The Proposed Development may interact with transmission lines operated by other licensed TOs.

2.4.10 Crossings of any 11 kV and 33 kV distribution lines are expected to be relatively straightforward, with standard overhead clearances likely to be sufficient to maintain safety and continuity of supply. These crossings will be reviewed in detail during the design phase, and localised mitigation measures, such as scaffold protection or temporary diversions, may be implemented where required. National Grid will work with the distribution network operators to design and undertake the replacement or rationalisation of any affected low voltage overhead lines with underground cables wherever this would be technically practicable and not prohibitively expensive.

2.4.11 Where interaction with higher voltage lines is required, for example those supported on lattice steel pylons, these will require more detailed engineering consideration due to its physical scale and operational significance. Whilst it is practicable to cross one overhead line with another using technical solutions such as cable duck unders where one line is routed underneath another, this results in significantly taller pylons on the higher line and introduces operational and safety concerns. As a result, it is typically considered more appropriate to leave an existing overhead line in place and underground a section of a new overhead line. In this way operational and safety concerns are substantially reduced, and taller pylons which may have increased visual effects can be avoided. ENW will need to be engaged to confirm the spatial and operational requirements of the crossing and to agree suitable protection measures or diversion strategies. Where technically and economically appropriate, the rationalisation or undergrounding of lower voltage assets may also be considered.

2.5 New Transmission Substations

Substations

2.5.1 Substations are an essential component in the energy network, connecting sources of generation, such as wind farms and power stations. They connect overhead and underground circuits and can connect nearby utility systems. Substations manage electricity flows within the network, which can include connection and disconnection of circuits to direct the flow, transform voltages to higher or lower ratings (step-up or step-down – for example 132 kV stepping-up to 400 kV), manage the frequency of the electricity and increase efficiency and reliability of the power supply.

2.5.2 Substations are critical in maintaining an efficient and healthy energy network, as they monitor and report back to operators on statistics and events to provide live information on the network. This allows for the following functions:

- Fault monitoring and identification which allows for isolation to protect the network and allow repairs.
- Allow for redirection and disconnection of energy to allow for demand/maintenance.
- Provide data such as voltage, current and power flow to allow for efficient running and future predictions.

Types of substation

2.5.3 There are two main types of substations: Air Insulated Switchgear (AIS) substations and Gas Insulated Switchgear (GIS) substations.

2.5.4 An AIS substation is constructed with switchgear which relies on open air components, which can require large clearance areas for operation and safety, which takes up a larger area of land compared to a GIS substation. AIS substations are typically lower cost and typically involve less construction time, however they require a larger area of land take.

2.5.5 A GIS substation is constructed with switchgear using gas filled components, which allows operation and safety clearances to be reduced when compared to an AIS substation. GIS substations typically require less space, and this may have a reduced visual impact as a result. However, they tend to be more costly, require specialised operation and maintenance, have longer outage repair times.

2.5.6 As noted within NPS EN-5 (paragraph 2.9.61), it should be considered carefully whether proposed development could be reconceived during the design phase to avoid the use of SF_6-reliant assets. National Grid policy generally precludes the use of gas insulated technologies due to the negative environmental impacts of SF_6 based insulation gases, and the significantly increased cost of gas insulated equipment. There may also be additional benefits in using gas insulated technology as these generally require less land take and in some instances may be less visually intrusive to the surrounding landscape. SF_6-free alternatives are currently in development and may be type-registered by the time the Project enters the construction phase; this would reduce the environmental risk of GIS equipment although not to a level comparable to AIS as current alternatives use fluorinated gases which present another set of environmental challenges. The use of gas insulated solutions is therefore being monitored and has not been discounted completely at this point. However, based on National Grid policy an air

insulated solution is currently considered the preferred option. For the purposes of the current stage of the Proposed Development and to inform the siting work, the use of AIS substations has been assumed.

2.5.7 The size and scale requirements for a new substation are typically determined by the following:

- Connections to the transmission system to allow large powerflows across the network;
- Distribution network connections to facilitate electricity supply to the end consumers;
- Large generation and demand customer connections;
- Equipment to support the operation of the transmission system;
- Spare bays or expansion room to allow efficient long term development of the site;
- Ancillary infrastructure to support the operation of the substation such as control buildings; and
- Site-specific constraints such as orientation with respect to overhead line connections, access arrangements, security and site geometry.

2.5.8 Based on the above, the new Carlisle substation footprint is assumed to be 720m x 400m (28.8 hectares) to allow for the appraisal of potential sites. The tallest elements of any AIS substation are usually entry gantries which facilitate overhead line connection to the substation. The height of such gantries is typically up to approximately 18m with all other apparatus within the substation being substantially lower. An example illustrative image of a typical AIS substation of the type assumed for the Proposed Development is provided in **Figure 2-8** (for illustrative purposes only, the final footprint, height, and configuration of the substations will be determined at later stages of design of the Proposed Development).

Figure 2-8 – Illustrative example of typical AIS substation

3. National Grid's Approach to Routeing and Siting

3.1 Overview

3.1.1 This chapter provides an overview of the key legislation, policy, and guidance applicable to National Grid's routeing and siting, a summary of National Grid's approach to routeing and siting, and the technology options considered for the Proposed Development.

3.2 National Grid's Statutory Duties (Electricity Act 1989)

3.2.1 National Grid has duties placed upon it by the Electricity Act 1989 ('the Electricity Act') and operates under the terms of its transmission licence. Those duties and terms of particular relevance to the development of the proposed connection described in this report are set out below. Where National Grid develops new infrastructure, it is required to have regard to these following statutory duties under the Electricity Act:

- Section 9 (General duties of licence holders) of the Electricity Act states that:

  "It shall be the duty of the holder of a licence authorising him to participate in the transmission of electricity:

  (a) *to develop and maintain an efficient, co-ordinated and economical system of electricity transmission;"*

- Electricity Act – Schedule 9 (preservation of amenity including: considering impacts upon communities, landscape, visual amenity, cultural heritage, and ecological resources); and

- Section 38 and Schedule 9 of the Electricity Act state that:

  "(1) In formulating any relevant proposals, a licence holder or a person authorised by exemption to generate, distribute, supply or participate in the transmission of electricity:

  (a) shall have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest; and

  (b) shall do what he reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects."

3.2.2 National Grid have also had due regard to other statutory obligations and requirements, where relevant, in the undertaking of Options Identification and Selection Stage (Stage 2).

3.3 British Energy Security Strategy (2022)

3.3.1 In response to concerns over the security, affordability, and sustainability of the UK's energy supply the UK Government published its British Energy Security Strategy[12] in July 2022.

3.3.2 The British Energy Security Strategy proposes to accelerate the UK towards a low-carbon and energy independent future. It has a focus on expanding domestic UK energy supply and accelerating the connecting network infrastructure to support an expansion in domestic UK energy supply whilst also working with international partners to maintain stable energy markets and prices.

3.3.3 Regarding offshore wind, the British Energy Security Strategy states that:

"By the end of 2023 we are set to increase our capacity by a further 15 per cent. But now we must go further and faster, building on our global leadership in offshore wind." [It aims to] "deliver up to 50 GW by 2030, including up to 5 GW of innovative floating wind."

3.3.4 The British Energy Security Strategy recognises that:

"Accelerating our domestic supply of clean and affordable electricity also requires accelerating the connecting network infrastructure to support it. Within this decade, our modern system will prioritise two key features: anticipating need because planning ahead minimises cost and public disruption; and hyper-flexibility in matching supply and demand so that minimal energy is wasted. This more efficient, locally-responsive system could bring down costs by up to £10 billion a year by 2050."

3.3.5 To support this the British Energy Security Strategy includes several aims including, to:

- set out a *"blueprint for the whole system by the end of 2022 in the Holistic Network Design (HND) and Centralised Strategic Network Plan (CSNP). The HND will identify strategic infrastructure needed to deliver offshore wind by 2030."* This was delivered in the Pathway to 2030 HND report[13] published in July 2022; and
- *"Dramatically reduce timelines for delivering strategic onshore transmission network infrastructure by around three years. We will work with Ofgem, network operators and the supply chain to find further savings, for example in the procurement, manufacture and construction stages. Overall, we aspire to halve the end-to-end process by the mid-2020s."*

3.3.6 The Powering Up Britain paper[14] was published in March 2023 by the UK Government. This document provides an update of the strategy for secure, clean and affordable British energy for the long-term future.

3.3.7 When considering new electricity infrastructure, National Grid have had regard to the British Energy Security Strategy and Powering Up Britain paper.

[12] UK Government (2022) British energy security strategy. Available at: https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy

[13] National Grid ESO (2022) Pathway to 2030 Holistic Network Design. Available at: https://www.neso.energy/document/262681/download

[14] UK Government (2023) Powering Up Britain: Energy Security Plan Available at: https://www.gov.uk/government/publications/powering-up-britain/powering-up-britain-energy-security-plan

3.4 Transmission Acceleration Action Plan (2023)

3.4.1 The UK Government published the Transmission Acceleration Action Plan[15] in response to the Electricity Networks Commissioner's report[16] on accelerating the transmission network build.

3.4.2 The Action Plan describes "the most radical modernisation of the grid since the 1950s", seeking to halve the end-to-end build time of electricity transmission network infrastructure, from 14 to 7 years.

3.4.3 The foreword of the Transmission Acceleration Action Plan states that:

"Although we are investing hundreds of billions as a nation in clean energy projects, and in powering Britain from Britain, we don't yet have the grid infrastructure to transmit that energy to households and businesses. As we increase electrification and decarbonise heat, transport and industry in our transition to net zero, we expect a doubling in demand for electricity by 2050[17]. This underlines just how important the grid will continue to be to our way of life, and we will need around four times as much new transmission network in the next seven years as we have built since 1990[18]."

3.4.4 The Action Plan accepts the Commissioner's recommendations in all areas, spanning across eight themes: strategic spatial planning, design standards, regulatory approval, planning approval, supply chain and skills, communities and engagement, outage planning, and the end-to-end process and next steps. The resulting process is expected to be seven years in duration, from the point at which the need for new infrastructure is recognised, to construction, and final commissioning.

3.4.5 The Connections Action Plan[19] was published by the Department for Energy Security and Net Zero (Defra) and Ofgem alongside the Transmission Acceleration Action Plan. Within The Connections Action Plan, the Ofgem Chief Executive Officer describes the Plan as: *"… a call for network companies, the system operator, and the sector as a whole to deliver a major step change in the pace of connections; strengthening incentives, obligations."*

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15 Department for Energy Security and Net Zero (2023) Transmission Acceleration Action Plan. [Online] Available at: https://www.gov.uk/government/publications/electricity-networks-transmission-acceleration-action-plan.

16 Department for Energy Security and Net Zero (2023) Accelerating electricity transmission network deployment: Electricity Networks Commissioner's recommendations. [Online] Available at: https://www.gov.uk/government/publications/accelerating-electricity-transmission-network-deployment-electricitynetwork-commissioners-recommendations.

17 Department for Energy Security and Net Zero (2022) Electricity Networks Strategic Framework: Enabling a secure, net zero energy system. [Online] Available at: https://assets.publishing.service.gov.uk/media/6690f4220808eaf43b50ce41/electricity-networks-strategicframework-report.pdf.

18 Calculated using data held by the Department on the length of historic and future transmission networks.

19 Department for Energy Security and Net Zero and Ofgem (2023) Connections Action Plan: Speeding up connections to the electricity network across Great Britain. [Online] Available at: https://www.gov.uk/government/publications/electricity-networks-connections-action-plan

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3.5 National Policy Statements (NPS)

3.5.1 The Planning Act 2008 provides the statutory framework for making and deciding applications for a Development Consent Order for Nationally Significant Infrastructure Projects (NSIPs). A DCO must be obtained from the relevant Secretary of State to authorise the construction and operation of an NSIP. As the Proposed Development consists of the installation of an electric line above ground of more than 132 kV and more than 2 kilometres (km) in length, it is classified as an NSIP under Section 14(1)(b) of the Planning Act 2008, and therefore requires a DCO.

3.5.2 Section 104 of the Planning Act 2008 provides for the role of National Policy Statements (NPS) in the decision-making process by which applications for development consent are considered. Section 104(3) requires the SoS to decide the DCO application in accordance with any relevant NPS, except to the extent that one or more of the exceptions set out in Section 104 applies. As identified in paragraph 1.3.4 of the Overarching NPS for Energy EN-1, for infrastructure projects providing above ground electric lines at or above 132 kV (meeting the thresholds set out in the Planning Act 2008), the following NPSs will be the primary basis for Secretary of State decision making:

- NPS EN-1: Overarching Energy Policy; and
- NPS EN-5: Electricity Networks.

3.5.3 These documents set out the strategic need for energy infrastructure and guide how environmental and heritage impacts should be assessed. They also set the policy context within which the routeing and siting for electricity transmission infrastructure is undertaken. Taken together these NPS provide the primary national policy context for decisions on applications for overhead line electricity transmission projects that are classified as NSIPs.

3.5.4 The process undertaken as part of the Options Identification and Selection Stage (Stage 2) and reported within this CPRSS was primarily undertaken in late 2024 to mid-2025 and based on the 2023 NPSs (adopted January 2024) which comprised the designated NPS at the time of writing. The Government has signalled that the energy NPSs are to be updated in 2025, with draft updates having been published for consultation in April 2025. However the 2023 versions of EN-1 and EN-5 remain in force at the time of writing. As and when updated versions are published, they will be taken into account and given appropriate weight according to their status.

Overarching National Policy Statement for Energy – EN-1 (2023)

3.5.5 EN-1 sets out the need for new nationally significant infrastructure to be brought forward at pace to meet energy objectives. This includes meeting energy security and carbon reduction strategies, the need for more electricity capacity to support increased supply from renewables, and the need to meet future increases in electricity demand. EN-1 paragraph 3.3.70 states that all new grid projects have a role in efficiently constructing, operating, and connecting low carbon infrastructure to the National Electricity Grid.

3.5.6 EN-1 sets out the critical national priority for low carbon infrastructure. The Government's energy security and net zero ambitions will only be delivered if the UK can enable the development of new low carbon sources of energy at speed and scale. paragraph 4.2.5 of EN-1 specifically notes that all power lines in scope of EN-5 including network reinforcement and upgrade works, and associated infrastructure such

as substations are considered to be critical low carbon infrastructure. These works do not have to be associated with a specific generation technology, as it is considered that new grid projects will contribute towards greater efficiency in constructing, operating and connecting low carbon infrastructure to the existing electricity transmission system.

3.5.7 EN-1 sets out the generic impacts and means of mitigation that are anticipated to arise most frequently from energy infrastructure developments. However, EN-1 (paragraph 3.1.1 and 3.1.2) recognises that due to the significant amounts of new large-scale energy infrastructure required to meet the UK's energy objectives, it will not be possible to develop the necessary amounts of such infrastructure without some significant residual adverse effects. The application of policies set out in Parts 4 and 5 of EN-1 seek to minimise these effects.

3.5.8 In line with Part 5 of EN-1, this CPRSS considers the following topics (listed in the order used in National Grid's Approach to Consenting):

- Landscape (covering the 'landscape' impacts described in EN-1);
- Visual (as described in EN-1);
- Ecology (covering the 'biodiversity' impacts described in EN-1);
- Historic environment (as described in EN-1);
- Air quality (covering the 'air quality and emissions' and 'dust' impacts described in EN-1);
- Noise and vibration (as described in EN-1);
- Geology and soils (covering the 'geological conservation' impacts described in EN1);
- Water (covering the 'flood risk' and 'water quality and resources' impacts described in EN-1);
- Economic activity (covering the 'socio-economic' impacts and 'land use including open space, green infrastructure and green belt' impacts described in EN-1);
- Aviation and defence (covering the 'civil military aviation and defence interests' impacts described in EN-1); and
- Traffic and transport (as described in EN-1).

3.5.9 Greenhouse gases, coastal change, odour, artificial light, smoke, steam, insect infestation and waste management impacts, as described in EN-1, would not have a significant impact on the determination of the preferred routeing and siting for the Proposed Development. Where relevant these topics will be considered as part of the later stages of design development and environmental assessment.

3.5.10 Electromagnetic fields will be considered as part of the later stages of design development and environmental assessment. However, National Grid designs all of its infrastructure to be compliant with current regulations and guidance[20] on such matters.

[20] Energy Networks Association (2017) Electric and magnetic fields: the facts. London, Energy Networks Association. Present on the dedicated National Grid EMFs website www.emfs.info

3.5.11 EN-1 explains that in terms of:

- Biodiversity (paragraph 4.6.6) – applicants, such as National Grid, should seek opportunities to contribute to and enhance the natural environment by providing net gains for biodiversity;
- Historic Environment (paragraph 5.9.25) – there is a desirability to sustaining and where appropriate enhancing the significance of heritage assets, their setting, and the positive contribution they can make to communities. Paragraph 5.9.30 of EN-1 also makes clear that substantial harm to or loss of designated assets of the highest significance, including scheduled monuments; Registered battlefields; Grade I and II* listed buildings; Grade I and II* Registered parks and gardens; and World Heritage Sites, should be wholly exceptional;
- Landscape and Visual (paragraph 5.10.6) – projects need to be designed carefully, taking account of the potential impact on the landscape and on sensitive visual receptors. The aim should be to minimise harm to the landscape and sensitive visual receptors, providing reasonable mitigation where possible and appropriate. Paragraph 5.10.32 of EN-1 confirms that National Parks and National Landscapes have been confirmed by the Government as having the highest status of protection in relation to landscape and scenic beauty. It makes clear that development consent in these areas can be granted in exceptional circumstances. In such instances, the development should be demonstrated to be in the public interest and consideration of such applications should include an assessment of:
  - *"the need for the development, including in terms of national considerations, and the impact of consenting or not consenting it upon the local economy;*
  - *the cost of, and scope for, developing elsewhere outside the designated area or meeting the need for it in some other way, taking account of the policy on alternatives; and*
  - *any detrimental effect on the environment, the landscape and recreational opportunities, and the extent to which that could be moderated."*
- Socio-economics – applicants for a given project should identify the impacts of new energy infrastructure and potential mitigation measures.
- Flood Risk – The relevant policy on flood risk for an energy transmission NSIP is set out in section 5.8 of EN-1. This requires that, when making a decision on an application for an energy NSIP, the Secretary of State must be satisfied of the following:
  - *"the application is supported by a Flood Risk Assessment (FRA).*
  - *the Sequential Test has been applied and satisfied as part of site selection [discussed further below].*
  - *a sequential approach has been applied at the site level to minimise risk by directing the most vulnerable uses to areas of lowest flood risk.*
  - *the proposal is in line with any relevant national and local flood risk management strategy.*
  - *Sustainable Drainage Systems (SuDS) have been used unless there is clear evidence that their use would be inappropriate.*

- *in flood risk areas, the project is designed and constructed to remain safe and operational during its lifetime, without increasing flood risk elsewhere (subject to the exceptions set out in paragraph 5.8.42).*
- *the project includes safe access and escape routes where required, and that any residual risk can be safely managed over the lifetime of the development.*
- *land that is likely to be needed for present or future flood risk management infrastructure has been appropriately safeguarded from development to the extent."*

Sequential Test

3.5.12 The Sequential Test is set out in Planning Practice Guidance[21] and is explained within EN-1 at paragraph 5.8.21. The Sequential Test ensures that a systematic, risk-based approach is followed to guide new development to areas with the lowest risk of flooding. It applies to all types of development and is used to assess the flood risk associated with potential sites[21].

3.5.13 In summary, the Sequential Test requires the following steps:

- Initially, the focus is on locating development in low-risk areas (i.e. Flood Zone 1). Paragraph 5.8.21 of EN-1 states that preference should be given to locating new development to areas with the lowest risk of flooding.
- If it is not possible to locate development in low-risk areas, the test moves on to compare reasonably available sites[22] within medium risk areas (i.e. Flood Zone 2). If there is no reasonably available site in Flood Zone 1, then projects can be located in Flood Zone 2 provided that the Secretary of State is satisfied that the Sequential Test is met.
- Only where there are no reasonably available sites in low and medium risk areas, the test considers high-risk areas (i.e. Flood Zone 3a[23]). In these circumstances, energy NSIPs can be located in Flood Zone 3 provided that Secretary of State is satisfied that the requirements of the Sequential Test and Exception Test (discussed further below) are met.

3.5.14 Therefore, the Sequential Test must be applied both during the site selection process and at the site level when a site has been selected. In other words, as well as applying the Sequential Test when selecting a site, development should take place on the area(s) of the selected site(s) with the lowest flood risk. Note that implicitly the application of the test at the site level will inform site selection – sites best able to accommodate development will perform better against the site selection test.

[21] UK Government (2014) Flood risk and coastal change. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change

[22] 'Reasonably available sites' are defined in the PPG as those in a suitable location for the type of development with a reasonable prospect that the site is available to be developed at the point in time envisaged for the development.

[23] Note that the Flood Zone 3 category also contains Flood Zone 3b, which is 'functional floodplain'. EN-1 provides that, energy projects proposed in Flood Zone 3b should only be permitted if the development will not result in a net loss of floodplain storage and will not impede water flows.

The Exception Test

3.5.15 If, following application of the Sequential Test, it is not possible for a project to be located in zones of lower probability of flooding than Flood Zone 3 the Exception Test can be applied. The test is intended to provide a method of managing flood risk while still allowing necessary development to occur. EN-1 is clear that the Exception Test is only appropriate for use where the Sequential Test alone cannot deliver an acceptable site.

3.5.16 The Exception Test is explained in paragraphs 5.8.9, 5.8.10 and 5.8.11 of EN-1. For the test to be passed:

- it must be demonstrated that the project provides wider sustainability benefits to the community[24] that outweigh flood risk; and
- it must be demonstrated that the project will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere and, where possible, will reduce flood risk overall[25].

National Policy Statement for Electricity Networks Infrastructure – EN-5 (2023)

3.5.17 EN-5 sets out the factors influencing routeing and siting selection and the impacts and other matters which are specific to electricity networks infrastructure. In summary:

- Paragraph 1.1.2 of EN-5 states that a significant amount of new network infrastructure is required in the near term to directly support the Government's ambition to deploy up to 50 GW of offshore wind capacity by 2030.
- Biodiversity (paragraph 2.9.6) – particular consideration should be given to the effects on large birds, including feeding and hunting grounds, migration corridors and breeding grounds.
- Landscape and Visual – paragraphs 2.9.7 to 2.9.9 of EN-5 state that:

"While the Government does not believe that the development of overhead lines is incompatible in principle with applicants' statutory duty under Schedule 9 to the Electricity Act 1989, to have regard to visual and landscape amenity and to reasonably mitigate possible impacts thereon, in practice new overhead lines can give rise to adverse landscape and visual impacts.

These impacts depend on the type (for example, whether lines are supported by towers or monopole structures), scale, siting, and degree of screening of the lines, as well as the characteristics of the landscape and local environment through which they are routed.

New substations, sealing end compounds (including terminal towers), and other above-ground installations that serve as connection, switching, and voltage transformation

[24] This includes the wider benefits of the infrastructure project, including the national need for it as set out in the NPS.

[25] Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the SoS may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, the nationally significant energy infrastructure

points on the electricity network may also give rise to adverse landscape and visual impacts."

3.5.18 EN-5 makes clear that the Horlock Rules should be followed by developers when designing their proposals for substations, and EN-5 also makes clear that the Holford Rules should be followed by developers when designing their proposals for overhead lines. Paragraphs 2.9.20 to 2.9.21 state that, *"Although it is the government's position that overhead lines should be the strong starting presumption for electricity networks developments in general, this presumption is reversed when proposed developments will cross part of a nationally designated landscape (i.e., National Park, The Broads, or National Landscape). In these areas, and where harm to the landscape, visual amenity and natural beauty of these areas cannot feasibly be avoided by rerouting overhead lines, the strong starting presumption will be that the applicant should underground the relevant section of the line."*

3.5.19 However, EN-5 paragraph 2.9.22 goes on to state that *"undergrounding will not be required where it is infeasible in engineering terms, or where the harm that it causes…is not outweighed by its corresponding landscape, visual amenity and natural beauty benefits. Regardless of the option, the scheme through its design, delivery, and operation, should seek to further the statutory purposes of the designated landscape. These enhancements may go beyond the mitigation measures needed to minimise the adverse effects of the scheme."*

3.6 The Holford and Horlock Rules

3.6.1 National Grid consistently employs two sets of rules/guidelines for the routeing and siting of new energy transmission infrastructure:

- Holford Rules – guidelines for the routeing of new overhead lines; and
- Horlock Rules – guidelines for the design and siting of substations[26].

3.6.2 When considering new electricity infrastructure, National Grid have regard to the degree to which routeing and siting options comply with or deviate from these rules.

Holford Rules

3.6.3 Paragraph 2.9.16 of NPS EN-5 makes clear that the Holford Rules are *"a common-sense approach to overhead line route design"* and *"should be embodied in the applicants' proposals for new overhead lines"*. In summary, the Holford Rules state that routeing of high voltage overhead transmission lines should where practicable:

- Avoid altogether the major areas of the highest amenity value;
- Choose the most direct line with no sharp changes in direction;
- Be positioned against tree and hill backgrounds as far as possible;
- Prefer moderately open valleys with tree cover;

[26] The National Policy Statement for Electricity Networks Infrastructure EN-5 NPS has incorporated the Horlock Rules. At paragraph 2.9.18 it states "The Horlock Rules – guidelines for the design and siting of substations – were established by National Grid in 2009 in pursuance of its duties under Schedule 9 to the Electricity Act 1989. These principles should be embodied in applicants' proposals for the infrastructure associated with new overhead lines".

- Be kept as far as possible independent from smaller lines, converging routes and other poles, masts, wires, and cables to avoid a concentration of lines or 'wirescape'[27]; and
- Approach urban areas through industrial zones, where they exist; and when residential and recreational land intervenes between the approach line and the substations, carefully assess the comparative costs of undergrounding.

3.6.4 Whilst the guidelines were initially developed in 1959, they have been reviewed on a number of occasions by National Grid and by the other UK transmission licence holders. One of the reviews was against the Electricity Act 1989. The guidelines have stood the test of time and have become accepted industry best practice in overhead line routeing.

3.6.5 The general principles underlying the Holford Rules – the avoidance of adverse impacts by careful routeing – are to a degree also relevant to the routeing of underground cables, although the balance of impacts and constraints will often be different.

Horlock Rules

3.6.6 Paragraph 2.9.18 of NPS EN-5 makes clear that the Horlock Rules (guidelines for designing and siting substations) *"should be embodied in the applicants' proposals for the infrastructure associated with new overhead lines"*. The Horlock Rules state that[28]:

- In the development of system options, consideration must be given to environmental issues from the earliest stage to balance the technical benefits and capital cost requirements of new developments against the consequential environmental effects, in order to keep adverse effects to a reasonably practicable minimum;
- Siting should seek to avoid areas of the highest amenity, cultural or scientific value by the overall planning of the system connections;
- Areas of local amenity value, important existing habitats and landscape features should be protected as far as reasonably practicable;
- Siting should take advantage of the screening provided by landform and existing features and the potential use of site layout and levels;
- Proposals should keep visual, noise and other environmental effects to a minimum;
- Land use impacts of the proposal should be considered when planning siting;
- Early consideration should be given to the options available for pylons and ancillary development appropriate to individual locations;
- Space should be used effectively to limit the area required consistent with appropriate mitigation measures and to minimise the adverse impacts on existing land use and rights of way, whilst also having regard to the potential for any future extension;

[27] Caused by multiple overhead lines running in different angles or the proximity of multiple overhead lines.

[28] The National Grid Company plc. NGC substations and the environment: guidelines on siting and design. Available at: https://www.nationalgrid.com/sites/default/files/documents/13796-The%20Horlock%20Rules.pdf (nationalgrid.com)

- The design of access roads, perimeter fencing, earth shaping, planting and ancillary development should form an integral part of the site layout and design to fit in with the surroundings;
- In open landscape especially, high voltage line entries should be kept, as far as possible, visually separate from low voltage lines and other overhead lines so as to avoid a confusing appearance; and
- The inter-relationship between pylons, ancillary structures and background and foreground features should be studied to reduce the prominence of structures from main viewpoints. Where practicable the exposure of pylons on prominent ridges should be minimised by siting pylons against a background of trees rather than open skylines.

3.6.7 The Horlock Rules predominately apply to the siting of substations and line approaches. The general principles underlying the Horlock Rules – the avoidance of areas of high amenity – apply equally to the siting of SECs, although the balance of impacts and constraints will often be different.

3.7 National Planning Policy Framework (NPPF)

3.7.1 The National Planning Policy Framework (NPPF)[29] sets out the Government's economic, environmental and social planning policies for England. The policies set out in this framework apply to the preparation of local and neighbourhood plans and to decisions on planning applications.

3.7.2 Paragraph 5 of NPPF states that the:

"Framework does not contain specific policies for nationally significant infrastructure projects. These are determined in accordance with the decision-making framework in the Planning Act 2008 (as amended) and relevant national policy statements for major infrastructure, as well as any other matters that are relevant (which may include the National Planning Policy Framework). National policy statements form part of the overall framework of national planning policy, and may be a material consideration in preparing plans and making decisions on planning applications."

3.7.3 When considering new electricity infrastructure, National Grid has regard to the NPPF.

3.8 Policy Context for the Hadrian's Wall World Heritage Site

Requirement for new electricity infrastructure to cross the Hadrian's Wall WHS

3.8.1 The location and extent of the Hadrian's Wall WHS, with respect to the B6 boundary, is such that reinforcing the B6 boundary and providing additional north-south transmission capability and capacity requires new electricity transmission infrastructure crossing the WHS. Crossings of the WHS will therefore be required either as part of the Proposed Development or as part of other projects addressing the need for reinforcement of the B6 boundary. The WHS extends west to east across the country from the Solway Firth,

[29] Ministry of Housing, Communities & Local Government (2024) National Planning Policy Framework. December 2024. Available at: https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf

west of Carlisle to Wallsend, east of Newcastle, which means it cannot be avoided and must be crossed to meet the need to provide capacity over the B6 Boundary of circa 12 GW. The largest capacity a double circuit transmission route can carry is 6.9 GW, which means two double circuit 400 kV connections may be required to cross the B6 boundary if onshore options are determined to progress for other projects identified as being required to meet the overall regional need case.

3.8.2 Development of new electricity transmission infrastructure must take account of National Grid's statutory duties under Section 38 and Schedule 9 of the Electricity Act 1989, specifically the need *to 'have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest'.* Therefore, National Grid will ensure that considerations relating to the WHS will inform and guide all stages of development of the Proposed Development and of the regional reinforcement projects identified in **Section 1.2**.

3.8.3 In developing proposals for the Proposed Development there is also a requirement to take account of the different stages of development of multiple reinforcements as identified in **Chapter 1** in the cross-border and North West region. There is a need to take a coordinated approach to developing the Proposed Development through routeing and siting while also considering the implications of additional regional reinforcements and the potential overall or cumulative impact on the WHS. As far as is possible, the identification and assessment of route and siting options for the Proposed Development in this CPRSS considers potential implications for other projects and the impact on the WHS, while also accounting for the relative differences in design maturity of each project (CMN3, CLN2 and FSU1).

3.8.4 As set out above, the new Carlisle substation will facilitate connection to the Proposed Development as well as a number of future regional projects. Therefore, as described in **Chapter 1**, the strategy at this early stage of development, is to identify two emerging preferred options for the Proposed Development for the purpose of the Stage 1 consultation: one route corridor and substation option to the north of Carlisle; and one route corridor option and substation option to the south of Carlisle. This approach will maintain future flexibility for considering the Proposed Development, as part of a network of projects to meet the wider regional need.

Policy context

3.8.5 There are particular obligations under Schedule 9 of the Electricity Act for National Grid in relation to 'buildings and objects of architectural, historic or archaeological interest'. These are contained in, inter alia, the NPSs and the NPPF. Full details of the policy context for the WHS are contained in the WHS Capacity Assessment Technical Note in **Appendix A** of this report.

Planning Act 2008

3.8.6 One of the exceptions to the requirement under section 104 of the Planning Act 2008 described above applies where following the NPS policy would breach the UK's international obligations, such as those under the World Heritage Convention. The Convention obliges the UK to identify, protect, and conserve WHS and take appropriate legal and administrative measures to safeguard them.

NPS EN-1: Overarching Energy Policy

3.8.7 While WHS designation does not introduce new statutory controls, many WHS components (e.g. Scheduled Monuments) are already protected by law. WHS are recognised in NPS EN-1 as assets of the highest significance with paragraph 5.9.30 of EN-1 stating that substantial harm or loss to such assets should be "wholly exceptional". Consent may be refused unless it is clearly demonstrated that the harm is necessary to achieve substantial public benefits.

3.8.8 Under Section 5.9 of NPS EN-1, applicants must assess the impact of their proposals on heritage assets, including WHS and their settings; seek opportunities to enhance or better reveal the significance of heritage assets and justify any harm with clear and convincing evidence.

3.8.9 In their decision-making the Secretary of State should give great weight to the conservation of designated heritage assets, with any harm or loss of significant to the asset requires clear and convincing justification.

3.8.10 Where the proposed development will lead to substantial harm to (or total loss of significance of) a designated heritage asset the Secretary of State should:

"refuse consent unless it can be demonstrated that the substantial harm to, or loss of, significance is necessary to achieve substantial public benefits that outweigh that harm or loss, or all the following apply:

- *the nature of the heritage asset prevents all reasonable uses of the site;*
- *no viable use of the heritage asset itself can be found in the medium term through appropriate marketing that will enable its conservation;*
- *conservation by grant-funding or some form of not for profit, charitable or public ownership is demonstrably not possible; and*

the harm or loss is outweighed by the benefit of bringing the site back into use."

3.8.11 For less than substantial harm, the harm must be weighed against the public benefits of the proposal, including, where appropriate securing its optimum viable use.

3.8.12 Not all elements of a WHS contribute equally to its significance. The loss of a contributing element should be assessed as either substantial or less than substantial harm, depending on its importance. Proposals affecting the setting of a WHS must preserve elements that contribute positively to its significance.

NPS EN-5: Electricity Networks

3.8.13 NPS EN-5 guides the development of new electricity transmission infrastructure, particularly overhead lines (the Holford Rules) and substations (the Horlock Rules), highlighting the importance of minimising environmental and heritage impacts, including those on WHS.

3.8.14 The Holford Rules remain a core part of National Grid's approach to routeing high-voltage overhead lines. They are used to guide route corridor identification and in appraisal of options including rules which seek to avoid, where possible, areas of highest amenity value, even if this increases the overall route length.

3.8.15 These areas include the Hadrian's Wall WHS, with both the designated site and its buffer zone considered part of the area of highest amenity value due to their contribution to the site's Outstanding Universal Value (OUV).

3.8.16 However, as outlined above not all parts of a WHS contribute equally to its significance. The ability of the WHS and its buffer zone to absorb change depends on the condition and preservation of WHS components, the sensitivity of the surrounding historic landscape and the presence of existing infrastructure (e.g. overhead lines, roads). This allows for a location-specific assessment of potential impacts.

3.8.17 The Horlock Rules – guidelines for the design and siting of substations – were established by National Grid in pursuance of its duties under Schedule 9 to the Electricity Act 1989. They require developers to consider environmental effects of new substations from the earliest stages, balance technical and cost requirements and seek to avoid, where possible, internationally and nationally designated areas of high value, including WHS. These principles are intended to ensure that substations are sensitively located and that adverse effects are kept to a practicable minimum.

Ancient Monuments and Archaeological Areas Act 1979

3.8.18 The boundary of the inscribed Hadrian's Wall WHS is defined as the parts of the frontier protected as scheduled monuments under the Ancient Monuments and Archaeological Areas Act 1979. When deciding to inscribe a property on the World Heritage List, the Committee adopts a Statement of OUV for the property, as set out in the Operational Guidelines for the Implementation of the World Heritage Convention[30], paragraph 154). This forms the basis for future protection and management of the property (Operational Guidelines paragraph 155).

3.8.19 The Statement of OUV identifies the criteria under which the property was inscribed and justification for these, including the assessments of the conditions of integrity, and, for cultural and mixed properties, authenticity, and a statement on the protection and management in force and the requirements for protection and management for the future (Operational Guidelines paragraph 155).

3.8.20 Paragraphs 103 – 107 of the Operational Guidelines require that, wherever necessary for the proper protection of the property, an adequate buffer zone should be provided. A buffer zone is defined as an area surrounding the nominated property which has complementary legal and/or customary restrictions placed on its use and development in order to give an added layer of protection to the property. This should include the immediate setting of the nominated property, important views and other areas or attributes that are functionally important as a support to the property and its protection. Buffer zones are not part of the nominated property. Buffer zones are not part of the inscribed WHS and are not in themselves of OUV.

3.8.21 The World Heritage Convention obliges the UK to identify, protect, and conserve WHS and take appropriate legal and administrative measures to safeguard them.

3.8.22 In 2024, the Court of Appeal[31] upheld the Secretary of State's decision to approve the A303 Stonehenge scheme, confirming that the Convention does not require that

[30] UNESCO World Heritage Centre. (2024). *Operational Guidelines for the Implementation of the World Heritage Convention*. [Online]. Available at: https://whc.unesco.org/en/guidelines/

[31] R(on application of Save Stonehenge World Heritage Site Ltd) v Secretary of State and others [2024] EWCA Civ 1227

protection of a World Heritage Site must in every circumstance be given absolute priority over all other considerations or from striking a balance of competing considerations in decision making affecting a World Heritage Site. There are circumstances where permitting some harm to a World Heritage Site may be judged necessary and justified in the public interest. Having found that less than substantial harm would be caused to the World Heritage site, the Secretary of State was entitled, while giving great weight to that harm, to find that this harm was outweighed by other benefits. This case confirms that a balanced approach is lawful, provided heritage impacts are carefully considered and justified.

3.9 National Grid's Approach to Consenting

3.9.1 National Grid's Approach to Consenting[4] outlines the project development process for major infrastructure projects, from initial inception to consent and construction. National Grid's Approach to Consenting is divided into six stages:

- Stage 1: Strategic Proposal;
- Stage 2: Options Identification and Selection;
- Stage 3: Defined Proposal and Statutory Consultation;
- Stage 4: Assessment and Land Rights;
- Stage 5: Application; and
- Stage 6: Examination, Decision Construction.

3.9.2 The Proposed Development is at the Options Identification and Selection Stage (Stage 2). This CPRSS has been undertaken as part of the Stage 2 process.

3.9.3 A stepped approach within Stage 2 has been adopted to identify potential routeing and siting options for the Proposed Development. This considered the potential impacts on the environment, the local community, relevant planning policy, other existing and proposed developments as well as technical and engineering design information.

3.9.4 The aim of the approach is to balance consideration of these factors and identify an emerging preferred corridor, emerging preferred Siting Zones within which the overhead lines, underground cables, substations and upgrade works to existing transmission infrastructure could be routed and sited.

3.9.5 **Figure 3-1** presents an overview of National Grid's Approach to Consenting; a summary of the main objectives of this stage of the consenting process can be seen below each stage.

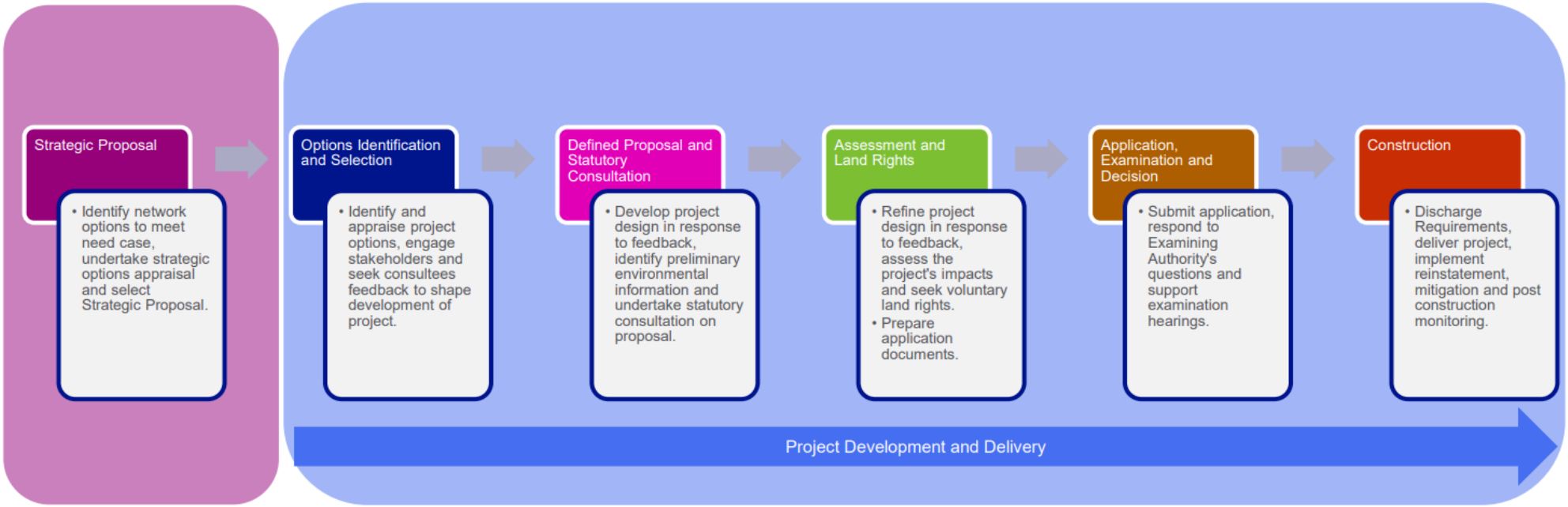
3.9.6 For the Proposed Development, the activities identified in National Grid's Approach to Consenting as being required at Stage 2 were broken down into the following nine steps (detailed in **Chapter 4**):

- Step 1 – Definition of the study area/s and data gathering;
- Step 2 – Scoping of environmental topics and baseline data-gathering;
- Step 3 – Ascribe weight to, confirm, and heat map features;
- Step 4 – Identifying and defining Siting Zones, Siting Areas and corridors;
- Step 5 – Confirm Siting Zones, Siting Areas and corridors for appraisal;

- Step 6 – Undertake site visits and refinement of Siting Zones, Siting Areas and corridors;
- Step 7 – Options appraisal of Siting Zones, Siting Areas and corridors;
- Step 8 – Confirm emerging preferred Siting Zone, Siting Areas and corridor and develop graduated swathe for consultation; and
- Step 9 – Undertake Stage 1 consultation.

3.9.7 This CPRSS sets out the findings of the first eight steps of Stage 2 for the Project. This CPRSS will inform subsequent Stage 1 consultation, which is Step 9 of Stage 2.

Figure 3-1 – National Grid's Approach to Project Development and Delivery



4. Options Identification and Selection Process (Stage 2)

4.1 Introduction

4.1.1 The Strategic Proposal Stage (Stage 1) was completed in 2024 and a Strategic Proposal was selected as described in **Section 1.1**.

4.1.2 This CPRSS presents the findings of the Options Identification and Selection Stage (Stage 2) and identifies the corridor, Siting Zones and/or Siting Areas which are emerging as preferred for the Proposed Development. The findings of this CPRSS will be used as part of the Stage 1 consultation. The feedback received on the Proposed Development during Stage 1 consultation will be used to inform the development of the design and alignment of the Proposed Development. Following Stage 1 consultation, the Proposed Development will progress to the Defined Proposal and Statutory Consultation Stage (Stage 3).

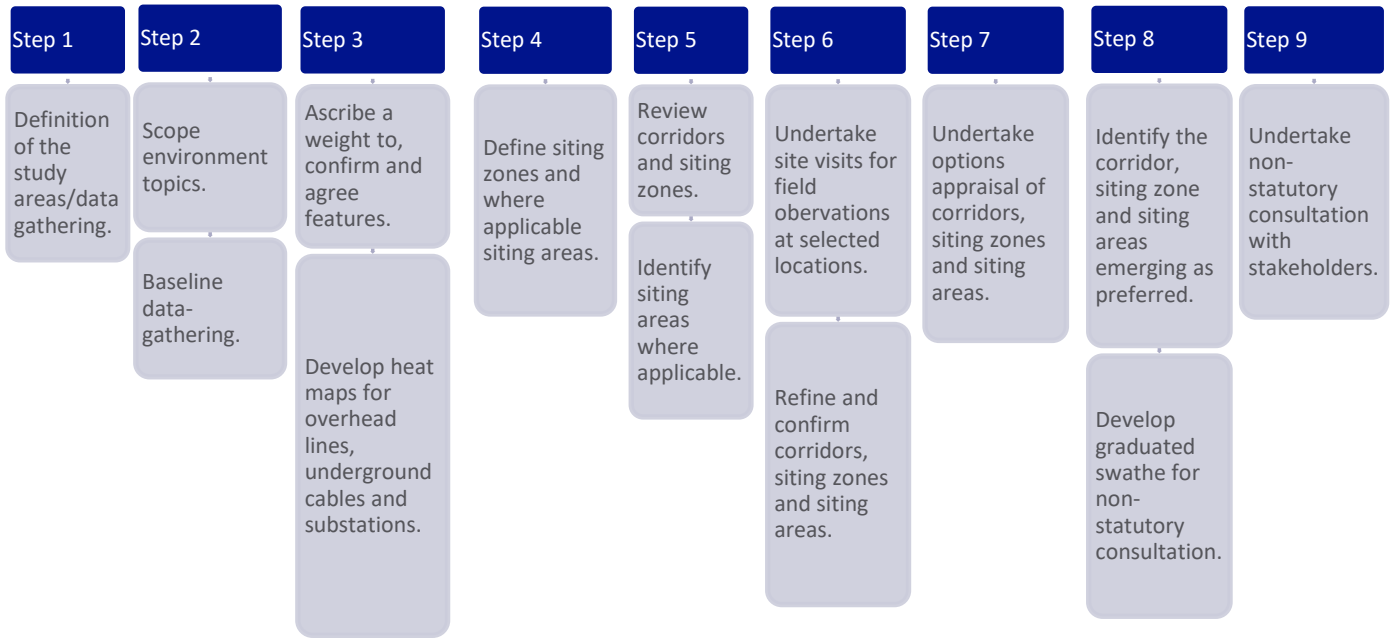
4.1.3 As described in **Section 3.9**, the methodology employed for the Options Identification and Selection Stage (Stage 2) consists of nine steps. It is summarised in **Figure 4-1.**

4.1.4 The following key terms are used throughout this CPRSS:

- Indicative Study Area – the indicative area of the preferred strategic option identified at the Strategic Options Appraisal at the Strategic Proposal Stage (Stage 1).
- Study Area – the broad areas within which infrastructure corridors and Siting Zones required for the Proposed Development could be located and within which detailed environmental and socio-economic data is gathered to inform the Stage 2 Options Appraisal.
- Corridor – a broad area within the study area, where new transmission infrastructure (overhead lines, underground cables and SECs) could be routed within. The study area will contain a number of ‘corridors.’
- Core Route Corridor – the corridor options to the north Carlisle , which would provide the 400 kV overhead line connection between the new Carlisle substation and the England-Scotland border. These sections of the routes would be common to proposals either to the north or south of Carlisle.
- Siting Zone – an area of land within which multiple Siting Areas (described below) could be located.
- Siting Area – an area of land within a Siting Zone, within which a new substation or SEC could be sited.
- Emerging Preferred Corridor – a broad area within which the overhead line and/or underground cable infrastructure for the Proposed Development may be located, based on the findings of Stage 2.
- Emerging Preferred Siting Zone – a broad area within which the Emerging Preferred Siting Area may be located, based on the findings of Stage 2.

- Emerging Preferred Siting Area – a broad area within which the substation infrastructure for the Proposed Development may be located, based on the findings of Stage 2.
- Graduated Swathe – shaded areas within the emerging preferred corridor, Siting Zones and Siting Areas within which the Proposed Development infrastructure is considered more or less likely to be located, shown by the varying levels of shading. Darker shaded areas represent where infrastructure is likely to be better located, in National Grid's emerging view at this stage, within the corridor, Siting Zone and Siting Areas.
- Stage 1 Consultation – an engagement process which will be undertaken to capture public, stakeholder and landowner feedback on the emerging preferred corridor, Siting Zone and Siting Areas, and the graduated swathe. The feedback received will inform the further development of the Proposed Development.

Figure 4-1 – CPRSS Methodology



4.2 Step 1: Define Study Areas

4.2.1 The study areas are the broad areas within which transmission infrastructure required for the Proposed Development will be located and the areas within which detailed environmental and socio-economic data will be gathered to inform the Stage 2 Option Appraisal.

4.2.2 Distinct but interrelated study areas have been defined for the new 400 kV overhead line and the new 400 kV Carlisle substation.

4.2.3 The study areas that have been developed are informed by:

- The connection points between the England-Scotland border and the strategic zones within the Carlisle Area identified by the Strategic Proposal Stage (Stage 1). The study area for the corridor was extended into Scotland to enable consideration of

environmental based receptors and cross-border impact associated with the project. (this is described further in **Chapter 5)**;

- The distribution of areas of the highest amenity value or environmental features (for example internationally designated sites;
- The nature of the physical and human geography. The presence of major geographical features such as estuaries or hills, or major settlements that may represent a natural boundary to a study area or dictate a need for a study area to extend to support routes around such features;
- Consideration of the likely balance of environmental impact between direct and indirect transmission routes; and
- Consideration of the Holford Rules (for routeing of an overhead line) and Horlock Rules (for siting of a substation, overhead line entries and SECs).

4.2.4 Based on the factors defined in this section, the study areas developed should encompass the maximum extent within which a project design that satisfies the statutory duties and obligations of National Grid and meets the objectives of the Proposed Development, is likely to be located.

4.2.5 An indicative study area was defined as part of the Strategic Proposal stage (Stage 1) undertaken in 2024. The indicative study area informed the study areas developed at this stage (Stage 2).

4.2.6 The study areas developed must encompass the area within which corridors and Siting Zones may be identified but exclude areas where these are unlikely to be feasible. They are defined in part by Holford Rule 1 and allow for the application of the principles of the Holford and Horlock Rules as described in **Chapter 3**. The study areas, described in **Chapter 5**, therefore encompass an area within which the identification and assessment of corridors and Siting Zones could be completed.

4.2.7 The study areas and factors that have influenced their definition are described in **Chapter 5**.

Hadrian's Wall WHS in the context of the study area

4.2.8 The Hadrian's Wall WHS extends across the north of England from the Solway to the Tyne. A section of the Hadrian's Wall WHS falls within the study area identified for the Proposed Development.

4.2.9 A WHS Capacity Assessment Technical Note has been prepared as part of the process for undertaking this CPRSS and is included in **Appendix A**.

4.2.10 As part of Step 1 of the CPRSS it was concluded that the substation study area should exclude locations that fall within the Hadrian's Wall WHS and associated buffer zone. This approach applies the Horlock Rules, where the advice is to seek to avoid altogether internationally and nationally designated areas of the highest amenity, cultural or scientific value, including WHS. On this basis, the WHS and buffer were excluded from the substation study area for the new Carlisle substation.

4.2.11 As described in **Appendix A**, in defining the study area for the route corridors, a section of the Hadrian's Wall WHS was identified which could be less sensitive to change. This was due to the presence of existing infrastructure and extensive hedgerow and woodland, which could help to accommodate a new overhead line in the existing

landscape. Therefore, this potentially less sensitive section of the WHS and its buffer zone was identified as a suitable location for the required crossing of the WHS and was included within the study area for the route corridors.

4.3 Step 2: CPRSS Scope Environmental Topics and Baseline Data-gathering

CPRSS Scoping Environmental Topics

4.3.1 National Grid's Approach to the appraisal of design options considers the following topics and sub-topics:

- **Environmental:** Landscape and Visual Amenity; Ecology; Historic Environment; Air Quality; Noise and Vibration; Soils and Geology; Water; Greenhouse Gas Emissions;
- **Socio-economic:** Economic Activity (including planning); Traffic and Transport; Aviation and Defence;
- **Technical:** Technical Complexity; Construction / Delivery issues; Technology issues (which includes sustainability issues); Capacity issues; Network efficiency / benefits (which includes energy efficiency); and
- **Cost:** Capital cost; Lifetime cost; and Constraint costs (where applicable).

4.3.2 The environment and socio-economic topics are aligned with applicable requirements of Section 5 of EN-1 and Section 2 of EN-5.

4.3.3 National Grid acknowledges that sub-topics (and potentially whole topics), may be scoped-out of the CPRSS if it is likely that there would be no material impact on constraints because of the nature of a project. Sub-topics may also be scoped out if they are not considered a differentiating factor between any of the options identified.

4.3.4 To identify the data-gathering required to contribute to the effective evaluation of options, and ultimately help inform decision-making, a review of the environmental topics and their constituent sub-topics was undertaken. The review considered the presence of relevant receptors and constraints for a particular topic or sub-topic within the study areas, and whether the Proposed Development could have a material impact on these. If there were either no relevant receptors or constraints, or no risk of a material impact, the topic or sub-topic was scoped-out of the appraisal process. This ensured that the CPRSS and appraisal process only addressed those sub-topics that are potentially material to the decision-making process.

4.3.5 It should be noted that scoping out a sub-topic simply reflected the fact that either: (i) there are no relevant receptors or constraints for that sub-topic in the vicinity of a study area or option that could be affected; or (ii) the different options could not be distinguished based on that sub-topic. It does not mean that the topic or sub-topic is not important, nor does it mean that it would necessarily be scoped out during subsequent stages.

4.3.6 At this early development stage of the Proposed Development, coastal change, odour, artificial light, smoke, steam, insect infestation and waste management impacts were scoped out on the basis that with the other topics applied, these topics would not be differentiating factors in the identification and selection of corridors and Siting Zones.

Furthermore, National Grid designs all its infrastructure to be compliant with current regulations and guidance on electromagnetic fields and therefore this was scoped out.

4.3.7 The environmental and socio-economic topics scoped into the appraisal of the Proposed Development at Stage 2 comprise landscape and visual amenity, ecology, historic environment, soils and geology, water, economic activity (including planning), traffic and transport, and aviation and defence.

4.3.8 At this stage, air quality and emissions and noise and vibration are accounted for by considering proximity to settlements, residential and other sensitive features and therefore not scoped in as standalone topics into the appraisal. Climate change with regards to flood risk is accounted for within the water topic. Waste management, electric and magnetic fields and climate change related to transmission losses are not considered material to the decision-making process at this stage and will be considered as part of the later stages of design development and environmental assessment.

Data Gathering

4.3.9 To identify connection options which best satisfy National Grid's statutory duties and obligations and meet the need case for the Proposed Development, it is necessary to understand the presence, and distribution of, environmental, socio-economic, and technical constraints and opportunities within the study areas. As part of this process, geographical information system (GIS)[32] web mapping was developed comprising available environmental, socio-economic, and technical data within the study areas.

4.3.10 Data for each topic was gathered through a desk-based review of information on potentially international, national, regional and locally important features. This data was collated to inform the scoping and the comparative environmental, socio-economic and technical appraisal of options. This included the following:

- Identification of designated sites and other features from British Geological Survey, Civil Aviation Authority, Environment Agency, Forestry Commission, Ministry of Defence (MoD), Natural England, Nature Scot, Office for National Statistics, Ordnance Survey (OS), Department for Environment Food and Rural Affairs (Defra), National Soil Resources Institute, Sustrans, the Royal Society for Protection of Birds (RSPB) and relevant local authorities;
- Identification of archaeological designations and other recorded sites, using GIS datasets available from Historic England and Historic Environment Scotland;
- Review of the Local Plans for Cumberland Council and Westmorland and Furness Council) (formed through local government reorganisation in April 2023, and comprising the former Carlisle City Council and Allerdale Council and Eden Council respectively) and the Local Development Plans for Dumfries and Galloway Council and Scottish Borders Council, to identify further environmental features and opportunities, such as county and regional level designation or other locations important to the public;
- Review of Landscape Character Assessments of relevance to the study areas;

[32] GIS is a system that enables the creation, management, analysis and mapping of all types of data.

- Review of OS mapping (1:50,000 mapping and terrain data) and aerial photography (where available) to identify other potential features such as settlements, properties, walking routes, cycling routes etc;
- Extrapolation of OS OpenData to identify further environmental features including locations of watercourses and waterbodies; and
- Review of other local information through online and published media such as tourism sites and walking routes.

4.4 Step 3: Ascribe a weight to, confirm and agree 'Heat Map' features

4.4.1 To allow for the identification of corridors and Siting Zones, the various elements within the scoped-in sub-topics which may constrain routeing and siting were mapped.

4.4.2 Once mapped, the data sets were assigned a classification or "sensitivity weighting" based on their sensitivity to the technology likely to be required for the Proposed Development. This classification was determined using professional judgement, whilst having regard to relevant environmental legislation, policy and best practice. A six-point scale was used to determine the sensitivity weighting, as shown in **Table 4-1.**

Table 4-1– Description Associated with Sensitivity Weighting

Classification Value	Classification Value Description
0	Areas with no identified constraint.
1	Very low potential to constrain the Proposed Development.
2	Low potential to constrain the Proposed Development.
3	Intermediate potential to constrain the Proposed Development.
4	High potential to constrain the Proposed Development.
5	Very High potential for the Proposed Development to be constrained.

4.4.3 The weighting of the different features varies between the potential features of the Proposed Development (such as overhead lines, underground cables and substations). For example, some habitats could be weighted intermediate for underground cables due to the increased risk to terrestrial species caused by the cable excavation works (which is also noted in paragraph 2.9.25 of EN-5) but lower for overhead lines as excavation works would be limited to the area required for the pylons.

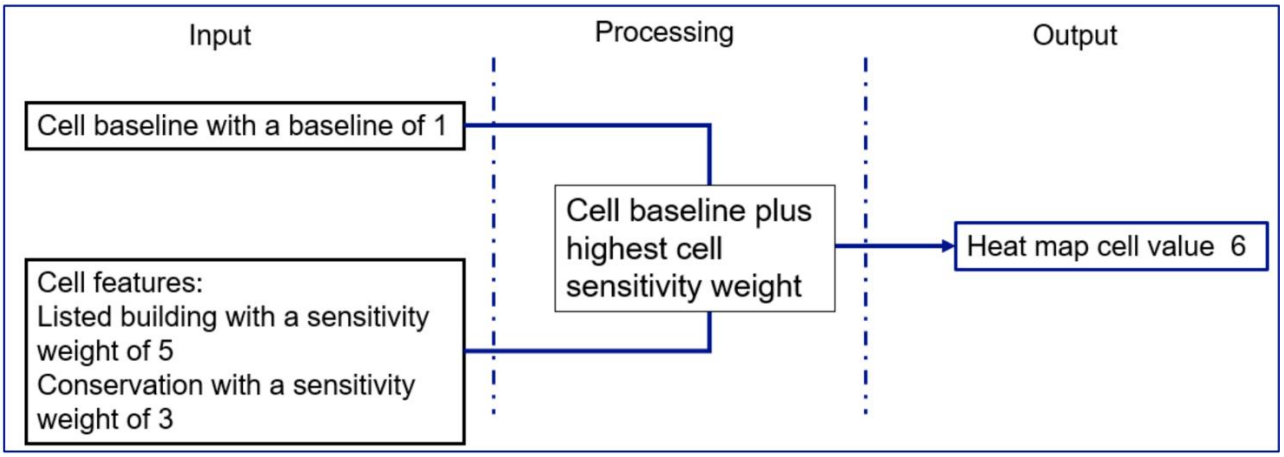
4.4.4 The sensitivity weighting effectively formed a robust scoping exercise to ensure a focus on features that materially inform decision making. This gave the highest weight to features of national or international value, whilst not excluding features of more local importance in accordance with the Holford Rules and Horlock Rules.

4.4.5 Sensitivity weightings associated with these features were reviewed and confirmed between National Grid and the Front-end engineering design (FEED) team and were then combined to produce separate composite 'heat maps'[33] showing the highest 'weight' for each cell of the map. These composite heat maps reflect the relative importance of different features and help to visualise the constraints to developing infrastructures for the Project and, when combined with professional judgement, informed the identification of corridors and Siting Zones, as described in **Chapter 5** and shown in **Figure 5-5** and **Figure 5-6.**

4.4.6 For composite heat maps, and to enable further GIS analysis of the information within the heat maps, the study areas were broken down into 10m square 'cells' based on the OS grid. Within each of these cells the sensitivity weighting of a feature is added to a 'baseline' score of one[34].

4.4.7 To avoid the risk of double-counting, the composite heat map shows the highest individual 'weight' identified in each cell, not the combined total of different weights identified. For example, if a cell has a baseline of one, contains a listed building with a weight of five and is located within a conservation area with a weight of three, then the cell would have a weight of six (baseline of one, plus listed building of five). This process is shown in **Figure 4-2**.

Figure 4-2 – Example of how sensitivity weighting is incorporated into heat mapping



4.4.8 The sensitivity weighting enabled the exercise to focus on features that materially inform decision making. This gave the highest weight to features of national or international value, whilst not excluding features of more local value. Features of the highest weight primarily informed the development of corridors and Siting Zones whilst the lower weighted features (small areas of high weight) informed the development of the corridors and Siting Zones, once the larger areas of higher weight had been avoided where practicable.

4.4.9 The sensitivity weightings were reviewed prior to the development of route corridors and Siting Zones, particularly to allow the refinement of buffer zones and to test the weighting assumptions. An example of this is for the setting of heritage assets. For the development of a corridor, Siting Zone, or where applicable, Siting Area, an appropriate

[33] A heat map is a graphical representation of data where values are depicted by colour. In the context of the Proposed Development the data is the environmental features which are weighted and the colour is determined by the sensitivity weighting allocated to each feature.

[34] The entire study areas start with an even 'weight' of one, so that the lowest cost across a 'level playing field' is a straight line – the shortest line.

buffer all-round the asset was weighted. However, prior to the development of the corridors and Siting Zones, the assets within a corridor and Siting Zones were subject to a preliminary reviewed to identify any 'directionality' in the setting. For example, a listed building with a designed outlook would have a more extensive setting along the line of that outlook than in other directions. This review was verified by site visits carried out as part of this CPRSS.

4.4.10 As part of the Step 3 heat map exercise consideration was given to the value assigned to the Hadrian's Wall WHS. The majority of the WHS was assigned an initial value of '5 – very high potential for the Project to be constrained', as set out within the WHS Capacity Assessment Technical Note (**Appendix A**). This is in line with the NPS which states that both WHS and scheduled monuments are considered to be assets of the highest significance. In assigning this value, the capacity for the Hadrian's Wall WHS and its buffer to accommodate change without potentially impacting the attributes of OUV as a result of the Proposed Development was considered.

4.4.11 Through this exercise, there were areas within the Hadrian's Wall identified as less sensitive to change, as a result of existing infrastructure including the M6 and two large existing overhead lines which were in place prior to the designation of the WHS. In these areas there is also extensive hedgerow and woodland which would help accommodate a new overhead line in the landscape. Therefore, the sensitivity value for these areas was reduced to '4 - high potential to constrain the project'.

4.4.12 The heat maps reflected the relative importance of different features and helped to visualise the constraints to developing infrastructure for Proposed Development and informed the identification of corridors, as described in **Chapter 5**.

4.5 Step 4: Identifying and Defining Corridors, Siting Zones and Siting Areas

4.5.1 At this early stage of development of the Proposed Development, identification of routeing and siting options involves little detailed engineering design. It is led by landscape and other environmental specialists who have due regard to the environmental and socio-economic considerations alongside the required technical parameters. The aim of identifying early corridors, Siting Zones and Siting Areas is balancing high-level mitigation with engineering requirements; routeing and siting to avoid designated sites and other large-scale features, to minimise impacts upon the environment and local population as far as practicable, whilst ensuring options identified meet the Proposed Development engineering requirements. In this respect, and as noted in EN-5 (paragraph 2.2.7) *"the connection between the initiating and terminating points of a proposed new electricity line will often not be via the most direct route".* Instead, as outlined above, *"…siting constraints, such as engineering, environmental or community considerations will be important in determining a feasible route"* and/or site. This approach is in accordance with the standard assumptions and approach taken by National Grid to avoid areas of highest value and amenity through option definition, if practicable.

Identifying and Defining Siting Zones and Siting Areas

4.5.2 A Siting Area is an area which has the capacity to accommodate the siting of a single substation. A Siting Zone is an area which has the capacity to accommodate one or more Siting Areas.

4.5.3 Identification of Siting Zones and Siting Areas took into consideration the key drivers for the new Carlisle substation (as set out below), the technical parameters (detailed in **Chapter 2**) and the relevant environmental and technical constraints identified from Step 2.

4.5.4 In siting substations (and where applicable SECs) areas that benefit from the below factors were identified:

- Appropriate topography;
- The availability of existing screening elements and the potential to introduce additional screening elements;
- Proximity to major roads, to minimise the extent of required new access roads; and
- Outside of flood zones of a medium risk (Flood Zone 2) and high risk (Flood Zone 3), in line with the policy tests (sequential and exception tests) as set out in Section 5 of NPS EN-1.

4.5.5 Identification of the Siting Zones and Siting Areas was informed by the Horlock Rules and Holford Rules to take account of the combined effects of both the substations and the overhead line connections. The following guiding principles informed identification:

- Using or adapting existing infrastructure will generally be of benefit/advantage compared with creating new infrastructure.
- Using available brownfield[35] land will generally be of benefit/advantage compared with utilising greenfield land[36].
- Minimising the length (for overhead line or underground connections) will generally be of benefit/advantage compared with longer routes, as smaller scale infrastructure projects are generally likely to have lower environmental, safety, sustainability, and cost implications (for comparable technology options).
- Financially less expensive options, both in terms of capital and lifetime cost, will generally be of benefit/advantage, as these support National Grid's statutory duty under Section 9 of the Electricity Act 1989 to develop and maintain an '*efficient, coordinated and economical*' transmission network.
- Options which avoid or minimise and mitigate impacts on environmental and socio-economic features will generally be of benefit/advantage compared with those which have likely significant residual effects. Consideration to less environmentally damaging or socially disruptive sites support National Grid's statutory duty under Schedule 9 of the Electricity Act 1989 to '*have regard to the desirability of preserving amenity*' and will more readily achieve consent.

4.5.6 The identification of Siting Zones and Siting Areas was then used to inform the identification of corridors for overhead lines and, where required, underground cables, as set out in this section.

[35] Land that is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure.

[36] Land, usually farmland, that has not been previously developed.

New Carlisle substation

4.5.7 As described in **Section 1.2**, there is an inherent need for the new Carlisle substation to serve a number of regional projects and it is recognised that these projects are at different stages of maturity in comparison with the Proposed Development. For the purpose of undertaking routeing and siting for the Proposed Development, the need to consider substations siting options both north and south of Carlisle was identified. This approach is considered to offer the greatest potential to ensure compliance with National Grid's statutory obligations in respect of providing an efficient and coordinated network that provides for robust technical and environmental considerations.

Identifying and Defining Corridors

4.5.8 The heat maps produced in Step 3 were used to undertake a GIS 'corridor analysis'. The GIS tool helps identify potential corridors with the likely least potential for adverse impacts on those aspects of the environment that can be mapped, by finding corridors across the heat map surface to connect the start and end points of the Proposed Development which have the least interaction with environmental features. This approach ensures that potential corridors prioritise key issues, including mapped technical constraints, whilst retaining all data to be considered so that further analysis can be undertaken to address areas identified as particularly constrained ('pinch points') and later for developing the graduated swathe.

4.5.9 The corridors generated through the GIS corridor analysis provided a starting point for the landscape and environmental specialists, working with the wider project team as appropriate, and employing professional judgement and their understanding of routeing considerations, to identify technically feasible route corridors. Corridors that were identified respond to the geographical features that have been identified; in some places this will result in a narrow corridor being available, whereas in areas with fewer features, the width could be considerably wider. This resulted in a variety of widths for the route corridors ranging between 300m and 5km. Corridors included aspects which cannot be mapped but are no less important considerations to the routeing of a transmission connection. For the overhead line options this included for example, avoiding the use of too many angle pylons (**Holford Rule 3**), finding the best 'landscape fit' i.e. how an overhead line would sit in the landscape (**Holford Rules 4** and **5**) and how it would affect visual amenity (**Holford Rule 6**).

4.5.10 The options identified were then subject to review by the project team who used their professional judgement to recommend amendments (i.e. refine or expand) to the corridors. For example, where possible, corridors were refined to avoid (or include areas where an alignment could avoid) flood zones of a medium risk (Flood Zone 2) and high risk (Flood Zone 3), in line with the policy tests (sequential and exception tests) as set out in NPS EN-1. These recommendations were reviewed and implemented by the landscape and environmental specialists to ensure that changes were made in a manner consistent with landscape and environmental considerations.

4.5.11 As part of this exercise, the distribution and density of constraints (environmental, technical and socio-economic) were examined to identify areas where it might be particularly challenging to identify a technically feasible and/or environmentally acceptable overhead line connection (subject to further analysis). NPS EN-5 supports, in most instances, the starting presumption for the development of overhead lines rather

than underground cables[37]. At this stage, for the purposes of appraisal, is assumed that the Proposed Development would comprise overhead line only.

4.5.12 To enable a clear comparative analysis and understanding of the corridors, the corridors were divided into 'segments' where the overhead line would lie. This allowed segments of corridors containing key risks or constraints to be avoided or discontinued from the appraisal without eliminating other segments of corridors which may offer a preferred route. An emerging preference for segments allowed 'end-to-end' route options for the Proposed Development to be identified, taking account of the siting of substations. The corridors and segments are described in **Chapter 5.**

4.5.13 The outcome of Step 4 is a set of Siting Zones, Siting Areas and route corridors. These were subject to further analysis, informed by site visits, at Steps 5 and 6. This approach allowed for the continued appraisal of multiple and interrelated options.

4.6 Step 5: Confirm Corridors, Siting Zones and Siting Areas for Appraisal

4.6.1 The corridors, Siting Zones and Siting Areas were then further reviewed by the project team to confirm the technical feasibility and ensure that key issues, and the interaction of constraints, had been fully considered.

4.6.2 At this point the corridors, Siting Zones and Siting Areas were reviewed to confirm that options progressing to Step 6 had the potential to form complete 'end-to-end' solutions.

4.7 Step 6: Site Visits and Refinement of Corridors, Siting Zones and Siting Areas

4.7.1 Following the identification of the corridors, Siting Zones and Siting Areas (Steps 4 and 5), site visits were undertaken by landscape, heritage and ecology specialists, the engineers and National Grid. The purpose of these visits was to ground truth the key landscape, environment, community and technical features, to allow closer consideration of particularly constrained areas during the desk studies and to identify further construction and design hazards that might mean corridors, links, Siting Zones or Siting Areas would not be feasible.

4.7.2 Once the site visits were complete, a further review was undertaken of the corridors, Siting Zones and Siting Areas by the project team to identify any options which were less preferred, any new options identified or amendments to existing options where applicable. Where agreed, these changes were incorporated into the evolving routeing and siting process before progressing to Options Appraisal (Step 7).

[37] The National Policy Statement for Electricity Networks Infrastructure (EN-5) (2023) states at paragraphs 2.9.20 and 2.9.21 that "*Although it is the government's position that overhead lines should be the strong starting presumption for electricity networks developments in general, this presumption is reversed when proposed developments will cross part of a nationally designated landscape (i.e. National Park, The Broads, or Area of Outstanding Natural Beauty).*"…"*In these areas, and where harm to the landscape, visual amenity and natural beauty of these areas cannot feasibly be avoided by rerouting overhead lines, the strong starting presumption will be that the applicant should underground the relevant section of the line*".

4.8 Step 7: Options Appraisal of Corridors, Siting Zones or Siting Areas

4.8.1 In Step 7, the corridors, Siting Zones and Siting Areas agreed at Step 6 were subject to Options Appraisal in accordance with National Grid's Approach to Consenting. National Grid's guidance provides a thorough and consistent framework to inform the appraisal of project options and decision making. Its aim is to ensure that decisions regarding the location or technology of a given project are based on a full understanding of the technical, socio-economic, environmental, and cost implications of identified options. It also enables National Grid to document in a transparent manner the information on which judgements have been based.

4.8.2 National Grid's Approach to Consenting notes that the analysis at the Options Identification and Selection Stage (Stage 2) is largely desk-based. However, as described in Step 6, the Options Appraisal for the Proposed Development was also informed by observations from site visits undertaken by the project team. These observations provided additional information to inform the Options Appraisal, which, in conjunction with that drawn from the desk-based studies, provided an evidence-base appropriate to inform this stage of design development. As the Proposed Development progresses to subsequent stages of more detailed design and assessment, additional surveys and analysis will add further information to the evidence base, which will be used to review the findings of this study.

4.8.3 The overall objective throughout the Options Appraisal was to take full consideration of all known environmental factors to minimise the risk of significant adverse effects on the environment and communities whilst also considering engineering and economic considerations.

4.8.4 As set out in **Chapter 5**, the overhead line study area was extended beyond the England-Scotland border. As described in **Chapter 1**, the border would be the northern end-point of the Proposed Development, as the Proposed Development would provide the section in England only. However, the extent of the study area was defined to enable consideration of relevant environmental, socio-economics and technical constraints beyond the England-Scotland border that may be impacted by the Proposed Development's infrastructure. In addition, for all of the route corridor options identified at Steps 4 to 6 of the CPRSS, some of the identified route corridor segments extended across the border into Scotland, albeit that any infrastructure within Scotland would not be delivered by National Grid as part of the Proposed Development. Recognising this interface, the Options Appraisal considered the potential impacts of:

- The section of the corridors located in England on relevant features in England;
- The section of the corridors located in England on relevant features in Scotland; and
- The sections of the corridors located in England and in Scotland ('the end to end corridors'), on relevant features in England and in Scotland.

4.8.5 Where relevant, the options appraisal in **Chapter 6** and **I** takes this into consideration and identifies where any key environmental and technical constraints or potential impacts fall in Scotland.

4.8.6 For each of the relevant environmental and socio-economic sub-topics (outlined in Step 2) the appraisal considered the potential impacts on relevant features, and whether such impacts could be avoided or mitigated through careful routeing or siting. Where

impacts cannot be avoided or mitigated by careful routeing, other forms of mitigation were considered in accordance with National Grid's mitigation hierarchy, including:

- Alternative pylon design (such as low height pylons); and
- Alternative transmission technology (such as undergrounding).

4.8.7 Once such mitigation measures were considered, a judgement was made as to the potential for residual effects. The identification of potential for residual effects in the Options Appraisal does not take account of further environmental, socio-economic or technical mitigation measures specific to the Proposed Development, which are likely to be included as part of the Environmental Impact Assessment (EIA) process undertaken for the Proposed Development. The findings of the Options Appraisal for the relevant sub-topics are detailed within **Chapters 6** and **I**.

4.8.8 The Environment Act introduces new environmental targets across waste and resource efficiency, air quality, water, nature, and biodiversity. The most notable of these is the mandatory 10% biodiversity net gain (BNG) requirement for developments, including in respect of NSIPs. The consideration of BNG will form part of the later stages of the Proposed Development.

4.8.9 The Proposed Development (classed as a critical national priority) is designed to enable renewable energy generation thus contributing to combating climate change. At the subsequent stages, the Proposed Development will assess climate change both in terms of greenhouse gas emissions and climate resilience and adaptation (in line with NPS EN-1).

4.9 Step 8: Confirm Emerging Preferred Siting Zone, Siting Areas and Corridor and Develop Graduated Swathe for Consultation

4.9.1 Following completion of Step 7, a 'challenge and review' workshop was held and attended by National Grid, the engineering and environmental specialists. The purpose of the workshop was to review environmental and socio-economic appraisals and, in accordance with EN-1 and EN-5, balance these against technical and cost inputs to reach a conclusion on the emerging preferred corridor, Siting Zones and Siting Areas.

4.9.2 A comparative appraisal of the route corridor and substation Siting Zone and area options was undertaken, identifying the more preferable options across all environmental, socio-economic and engineering disciplines, and taking into consideration indicative costs. The emerging preferred options selected were identified as providing the optimum balance across all disciplines.

4.9.3 As described in **Section 1.2,** the process to select the emerging preferred corridor and substation siting considered the need case for the Proposed Development itself, as well as the role of the Proposed Development as part of a network of other regional reinforcement projects. The outcome of this was to identify two emerging preferred options: one route corridor and substation option to the north of Carlisle (Option A), and one route corridor and substation option to the south of Carlisle (Option B).

4.9.4 The two identified emerging preferred options for the Proposed Development focused on the infrastructure to deliver the section of the Project in England. Following this, a review was undertaken to compare the emerging preferred route corridor options for the Proposed Development with the alignment of the proposed route for the Scottish section

of the Project, selected by SP Energy Networks and subject to public consultation in Autumn 2024 and Spring 2025. The purpose of this review was to provide a confirmatory check as to geographic alignment at the England-Scotland border, to ensure that the Project as a whole would be able to meet its objectives. The outcome of this review is described in **Chapter 9.**

4.9.5 When the two emerging preferred route corridor and substation options had been identified, the environment topic specialists and engineers identified areas within the emerging preferred corridor, Siting Zones and Siting Areas where the infrastructure for the Proposed Development might be best located, based on the information available at this stage of the process. Within the route corridors and substation locations, areas with fewer constraints and therefore a higher likelihood of having infrastructure located there were identified. This was used to develop a graphic representation showing the likelihood of infrastructure being located in any part of the emerging preferred corridor or substation Siting Area. This is referred to as the 'graduated swathe' and it shows areas with a higher likelihood of infrastructure in a darker blue, with lighter blue areas having lower likelihood of infrastructure. The graduated swathe is described further in **Chapter 10.**

4.10 Step 9: Undertake Stage 1 Consultation

The outcome of Step 8 was to prepare a report to record the entire process which would support and inform the Step 9 Stage 1 consultation. The CPRSS process and outcomes are captured in this report. This report is intended to support public consultation to engage stakeholders, statutory consultees and interested parties, including the public.

5. Study Area, Corridor, Siting Zone and Siting Area Definition

5.1.1 **Figure 1-2** shows the location of the study area, which spans from the Carlisle area in Cumbria, North West England and across the England-Scotland border. This chapter describes how:

- the study areas for the Proposed Development were defined (Step 1, **Section 5.2**) and then subject to further definition (Steps 4, **Section 5.6**);
- the baseline data were gathered for the study areas (Step 2, **Section 5.4**);
- the heat maps were produced (Step 3, **Section 5.5**); and
- the overhead line corridors, and substation Siting Zones, and Siting Areas were identified and defined (Steps 4 to 6, **Section 5.6**).

5.2 Defining the Study Areas (Step 1)

5.2.1 The indicative study area defined as part of the Strategic Proposal stage, described in **Chapter 1**, was used as a starting point for the definition of the study areas for the Proposed Development. This indicative study area was an area extending around a straight line connecting the centre of Carlisle to Teviot in Scotland by a buffer distance of approximately 10km on either side of the straight line. The straight line corresponded to a route length of approximately 58km.

5.2.2 The English section of the Project indicative study areas set out the project need for:

- A new 400 kV substation in the Carlisle area ('new Carlisle substation');
- A new double circuit 400 kV overhead line between the new Carlisle substation and the England-Scotland border; and
- A connection from the new Carlisle substation to the existing network.

5.2.3 The Scottish section of the Project indicative study areas set out the project need for:

- A new double circuit 400 kV overhead line between the new Gala North substation and the England-Scotland border; and
- A new substation in the Teviot area.

5.2.4 The following sections provide an overview of the study areas for the Proposed Development, that is the English section of the Project described in the SOR. There were two distinct but interrelated and overlapping study areas[38] for the Proposed Development: the overhead line study area and the new Carlisle substation study area. The study area for the overhead line connection extends across the England-Scotland border to support the appraisal process as described in **Section 4.8 (paragraph 4.8.4)** above.

[38] An area within which a range of potential corridor options, substation Siting Zones or areas for the new infrastructure will be considered.

5.2.5 The approach to developing the study areas for the Proposed Development was based on balancing National Grid's duty to develop an efficient, co-ordinated and economical system of transmission (Section 9 of the Electricity Act 1989), National Grid's environmental duties under Section 38 and Schedule 9 of the Electricity Act 1989, Holford Rule 1 (which is to "*avoid altogether, if possible, the major areas of highest amenity value, by so planning the general route of the first line in the first place, even if the total mileage is somewhat increased in consequence"*) and Horlock Rule 2 (which is to *"as far as reasonably practicable seek to avoid altogether internationally and nationally designated areas of the highest amenity, cultural or scientific value by the overall planning of the system connections"*).

5.2.6 The overhead line and substation study areas developed at Step 1 of this CPRSS for the Proposed Development are presented in **Figure 5-2** and **Figure 5-4.** The process to define these study areas is outlined in the sections below.

5.2.7 For the purpose of the below, when referring to overhead lines, this is based on an assumption for optioneering purposes and further design will be undertaken to confirm the technology required.

Overhead Line Study Area

5.2.8 The study area for the overhead line was defined through a four-phase process which is outlined below.

5.2.9 The approach to defining the study area for the overhead line was based on balancing National Grid's duty to develop an efficient, co-ordinated and economical system of transmission (Section 9, Electricity Act 1989), National Grid's environmental duties under Section 38 and Schedule 9 of the Electricity Act 1989 and Holford Rule 1 which is to *"avoid altogether, if possible, the major areas of highest amenity value, by so planning the general route of the first line in the first place, even if the total mileage is somewhat increased in consequence".*

Phase I: Definition of a Search Area

5.2.10 A search area, to allow identification, collection and consideration of environmental, socio-economics and technical constraints, which would then be used to determine the study area for the overhead line, was initially defined.

5.2.11 The requirements of the Proposed Development are to provide a new double circuit 400 kV overhead line connection between the new Carlisle substation and the England-Scotland border, and a connection from the new Carlisle substation to the existing network. As described in **Section 1.2**, two options were considered which would provide different connection opportunities to the existing network as follows:

- A route corridor and substation to the north of Carlisle would include an overhead line connection between the new Carlisle substation and the existing Harker substation; and
- A route corridor and substation to the south of Carlisle would include an overhead line connection between the new Carlisle substation and existing 400 kV Harker-Hutton line, which would also provide a connection to the existing Harker substation.

5.2.12 Therefore, the connection points for the Proposed Development identified were:

- the new Carlisle substation ('connection point 1'); and

- the England-Scotland border ('connection point 2'); with either
- the existing Harker substation ('connection point 3a') for the option to the north of Carlisle; or
- the existing Harker-Hutton line ('connection point 3b') for the option to the south of Carlisle.

5.2.13 In defining the study area, the position of connection point 1 and 2 was not fixed. The overhead line connection to the Scottish section of the Project to be delivered by SP Energy Networks would mark the northern terminus. The existing Harker substation would mark the southern terminus of the overhead line, if the new Carlisle substation was located north of Carlisle and north of the existing Harker substation. The new Carlisle substation would mark the southern terminus of the overhead line, if this was located south of Carlisle, and south of the existing Harker substation.

5.2.14 To identify a suitable study area, the following key assumptions were applied:

- The new Carlisle substation would be located within a 15km radius from the edge of Carlisle. This would be where the new overhead line connection would start and continue to the England-Scotland border and to the existing network via connection to Harker substation or Harker-Hutton line respectively.
- The new overhead line crossing at the England-Scotland border was not predetermined (as described in **Chapter 1**).

5.2.15 Therefore, the initial search area was defined as the combination of three areas as described below:

- An area extending by a distance of 10km from each side of the straight line from the centre of Carlisle to the Teviot region of Scotland, representing the indicative corridor of the Project as defined in the SOR. A search area 20km wide was considered sufficient to enable the development of early corridors that avoid major constraints.
- An area extending by 15km from the edge of Carlisle in all directions.
- An area extending 5km from the England-Scotland border into Scotland. This enabled consideration of technical, environmental and socio-economics constraints beyond the England-Scotland border which may be impacted by the Proposed Development's overhead line infrastructure in England. A distance of 5km was conservatively selected, based on professional judgement and the nature and extent of any likely impacts.

5.2.16 The Hadrian's Wall WHS extends west to east across the country from the Solway Firth, west of Carlisle to Wallsend, east of Newcastle, which means it cannot be avoided. However, consideration was given to the WHS through the CPRSS process for the Proposed Development.

5.2.17 The overhead line search area is illustrated in **Figure 5-1**.

Phase II: High-level Constraints Review

5.2.18 A high-level desk-based review of features representing major potential constraints within the initial search area was undertaken. These include major areas of highest amenity value, major centres of population and major technical constraints.

5.2.19 Major areas of highest amenity within the search area included:

- The Solway Coast National Landscape, circa 3.5km west of Carlisle;
- The North Pennines National Landscape, circa 10.5km east of Carlisle;
- The Hadrian's Wall WHS and associated buffer zone, extending from east to west across the search area;
- The Lake District National Park, circa 14.5km south of Carlisle;
- The Bolton Fell Special Areas of Conservation (SAC), circa 12.2km to the north-east of Carlisle;
- The Walton Moss SAC, circa 11.8km to the north-east of Carlisle;
- The North Pennine Moors SAC and SPA, circa 10.5km east of Carlisle; and
- the Solway Firth SAC, Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI), circa 7km North West of Carlisle.

5.2.20 Major centres of population included the city of Carlisle.

5.2.21 No major technical constraints were identified within the search area.

Phase III: Refinement of the Search Area

5.2.22 The search area was then refined to exclude major areas of highest amenity value and major population centres as identified in Phase II. The exception to this was the Hadrian's Wall WHS and buffer zone which, as described in **Chapter 4**, due to transecting the search area could not be excluded.

5.2.23 The overhead line study area, defined through the process described above is illustrated in **Figure 5-2**.

Phase IV: Expansion of the Search Area

5.2.24 The search area was expanded to include an area located to the east and north-east of Newcastleton following publication of the SP Energy Network's Routeing and Siting Consultation Update (March 2025) in respect of the emerging corridor for the Scottish section of the Project. The extension ensured that potential constraints were identified at the border for the overhead line route. The landscape character around the England-Scotland border to the east of Newcastleton is sparsely settled and comprises an expansive upland landscape with a simple landscape pattern and large tracts of commercial forestry. Extending the study area further east of Newcastleton, would enable greater separation to be achieved between potential overhead line corridors and the smaller scale landscape to the west, and provide an opportunity to reduce environmental impacts.

5.2.25 A Scoping Report was submitted to the Scottish Energy Consents Unit (ECU) in 2023 as part of a planning application for the Liddesdale Wind Farm (ECU reference: ECU00004833). This application included for 80 turbines across two sites - 'Waughchope Forest' and 'Newcastleton Forest'. As a result, the area of the expanded overhead line study area included the entirety of the 'Newcastleton Forest' which formed part of the wind farm site. Informed by the location of the wind turbines described in the 2023 Scoping Report, two alternative route corridors for the Proposed Development's overhead lines were identified.

5.2.26 The overhead line study area is shown in **Figure 5-2**.

Figure 5-1 – Overhead Line Search Area

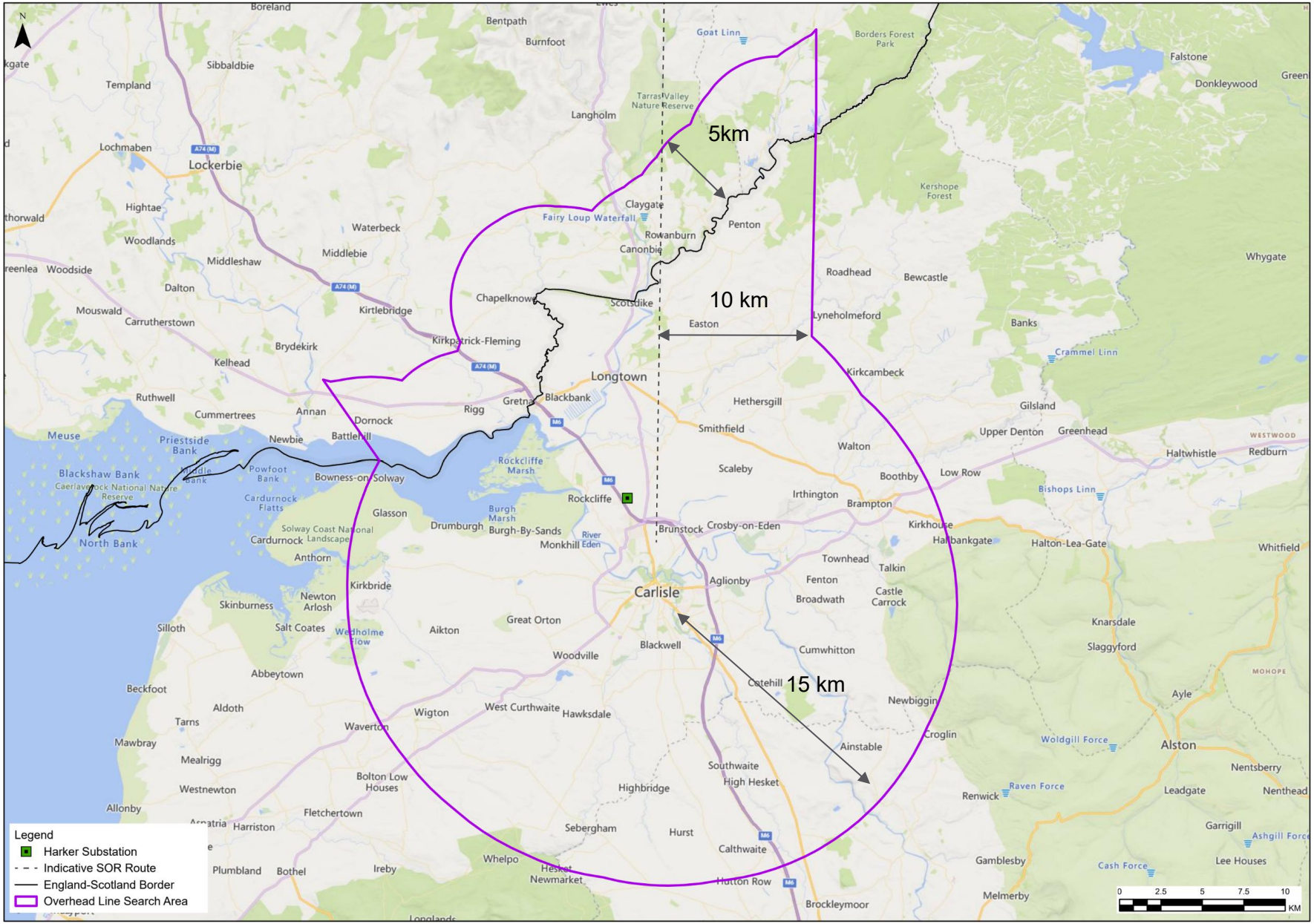
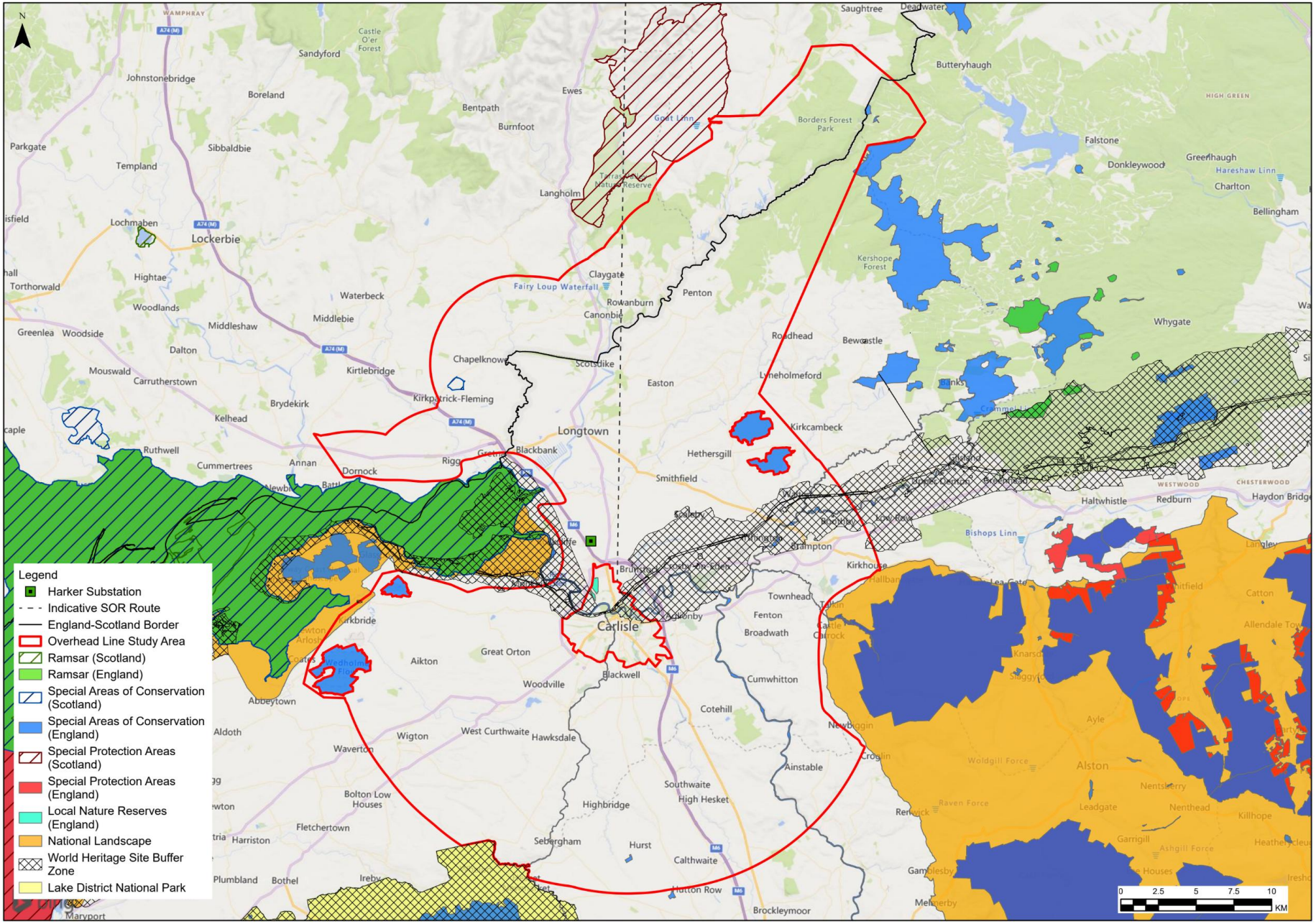


Figure 5-2 – Overhead Line Study Area (Step 1)



Substation Study Areas

5.2.27 The definition of the study area for the new Carlisle substation involved a three-phase process as described below.

Phase I: Definition of a Search Area

5.2.28 An initial search area, to allow identification and collection of environmental, socio-economics and technical constraints to be used to determine the substation study area, was defined.

5.2.29 The definition of the initial search area was informed by the assumptions set out in **paragraph 5.2.14**.

5.2.30 The initial search area was defined as the combination of three areas as described below:

- An area extending by a distance of 10km from each side of the straight line from the centre of Carlisle to the Teviot region of Scotland, representing the indicative corridor of the English section of the Project as defined in the SOR. As set out in **paragraph 5.2.15**, a search area 20km wide was considered sufficient to enable the development of early corridors that avoid major constraints. The WHS and its buffer zone transects the search area west to east.
- An area extending by 15km from the edge of Carlisle in all directions.
- An area extending 2km from the England-Scotland border into Scotland. This enabled consideration of technical, environmental and socio-economics constraints beyond the England-Scotland border which may be impacted by the Proposed Development's overhead lines which would connect into the substation. The height of the substation infrastructure is considerably lower than the overhead line infrastructure (e.g. pylons) and therefore a distance of 2km was selected, based on professional judgement and the nature and extent of any likely impacts.

5.2.31 The substation search area is illustrated in **Figure 5-3.**

Phase II: High level constraints review

5.2.32 A high-level desk-based review of the major areas of highest amenity, main centres of population and major technical constraints was undertaken. These included major areas of highest amenity value, major centres of population and major technical constraints.

5.2.33 Major areas of highest amenity and centres of population identified within the search area the same as described for the overhead line search area. However, for the substation search area, major technical constraints included Flood Zone 3 areas.

5.2.34 Flood Zone 3 areas are considered a major technical constraint for substations due to the vulnerability of ground-mounted electrical infrastructure and the requirement to maintain operability and access during flood events.

Phase III: Refinement of the Search Area

5.2.35 The search area was refined to exclude major areas of highest amenity value, major population centres and major technical constraints as defined in Phase II. Hadrian's

Wall WHS and its buffer zone are areas of the highest amenity value and have been excluded.

5.2.36 The substation search area and study area are illustrated in **Figure 5-3** and **Figure 5-4**, respectively.

Figure 5-3 – Substation Search Area

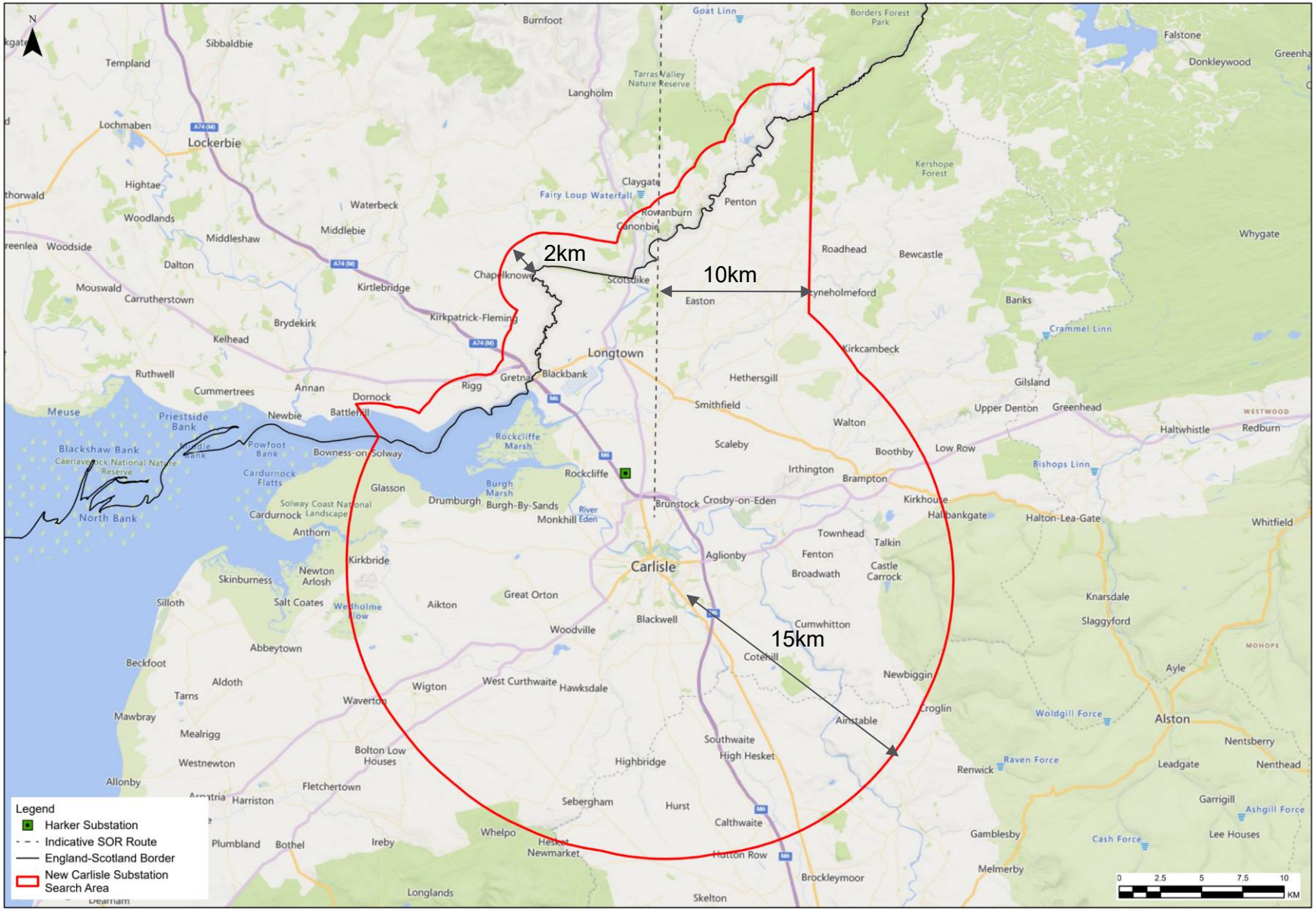
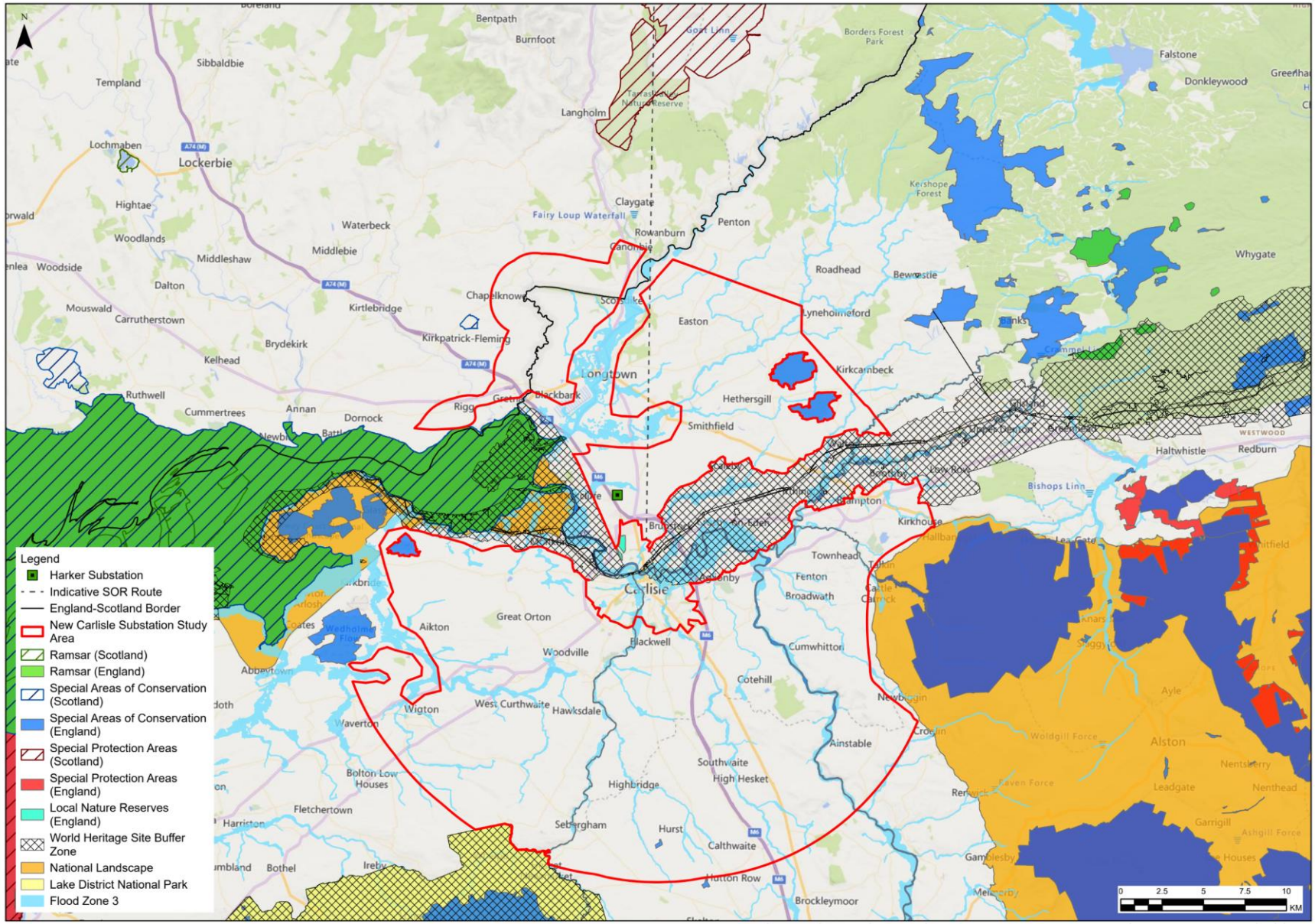


Figure 5-4 - Substation Study Area (Step 1)



5.3 Description of the Study Areas

5.3.1 As the new Carlisle substation study area and the overhead line study area largely overlap, the two study areas are described together below.

5.3.2 The study areas are centred around the city of Carlisle in Cumbria in Northern England. The Solway Coast National Landscape borders the study areas to the west and the North Pennines National Landscape borders the study areas to the east. The study areas meet the border of the Lake District National Park to the south and extend beyond the England-Scotland border in the north (5km for the overhead study area and 2km for the substation study areas).

5.3.3 There are various population centres within the study areas, the largest is the City of Carlisle, which is located within the central section of the study areas with a population of 77,730 (as of 2021). Smaller population centres within the study areas include:

- The town of Longtown, circa 8.5km to the north of Carlisle, with a population of 3,000 (as of 2023);
- The town of Gretna, circa 9.5km to the north of Carlisle, with a population of 3,110 (as of 2020);
- The village of Scotby, immediately to the east (circa 400m) of Carlisle, with a population of 2,366 (as of 2018);
- The village of Wetheral, circa 2.8km to the east of Carlisle, with a population of 4,541 (as of 2011);
- The village of Warwick Bridge, circa 4.6km to the north-east of Carlisle, with a population of 1,264 (as of 2011); and
- The village of Dalston, circa 3.2km to the south of Carlisle, with a population of 2,794 (as of 2021)
- The town of Wigton, circa 13km to the south-west of Carlisle, with a population of 6,013 (as of 2021).

5.3.4 Hadrian's Wall WHS extends across the north of England from the Solway to the Tyne. As set out in **Section 5.2** Hadrian's Wall WHS and associated buffer zone transect the overhead line search area and could not be excluded. Therefore, a section of the Hadrian's Wall WHS and associated buffer zone falls within the central section of the overhead line study area. As set out in **Section 5.2**, the Hadrian's Wall WHS and associated buffer zone was excluded from the substation study area. The Scots Dike Scheduled Monument (NHLE 1016860 and HES IS SM660) lies within the western section of the study areas, circa 4.2km to the north of Longtown.

5.3.5 Several National Character Areas (NCAs) are present within the study areas, including Solway Basin, Eden Valley, Border Moors and Forests, Tyne Gap and Hadrian's Wall, North Pennines, Cumbria High Fells.

5.3.6 Several large rivers run through the overhead line study area. The River Esk extends from the western boundary of the overhead line study area in proximity to the Ministry of Defence (MoD) Longtown and the M6 to the north-west boundary of the overhead line study area in proximity to the A7. The River Eden extends from the western boundary of the overhead line study area in proximity to the village of Kirkadrews-on-Eden to the south-eastern boundary of the overhead line study in proximity to the settlement of

Staffield. The overhead line study area also includes the River Eden SSSI and SAC. The River Esk, the River Eden and the section of Flood Zone 3 area around these rivers are excluded from the substation study area.

5.3.7 There are four SSSI within the study areas including the Scaleby Moss SSSI located circa 4.4km to the north east of Carlisle, the Kershope Bridge SSSI located circa 25.5km to the north east of Carlisle and along the England-Scotland border, Kielder Mires SSSI located circa 34km to the north-east of Carlisle and along the England-Scotland border, Cotehill Pastures and Ponds SSSI located circa 3km to the south-east of Carlisle. There are numerous sections of ancient woodland scattered throughout the study areas.

5.3.8 The study areas intersect multiple linear infrastructure assets including the A6071, A7 and the M6 motorway, and existing overhead lines operated by National Grid at 132 kV, 275 kV, and 400 kV and a 400 kV line in Scotland operated by SP Energy Network. The study areas also include the existing Harker substation, situated immediately to the north of Carlisle.

5.3.9 There is one airport within the study areas, Carlisle Lake District Airport, located approximately 6.7km to the north-east of Carlisle.

5.3.10 The study areas include the Ministry of Defence (MoD) Longtown, located approximately 9km to the North West of Carlisle and the MoD Tactical Training Area (20T) which is used for low flying training between 30 and 76 m.

5.4 Scope Environmental Topics and Data Gathering (Step 2)

5.4.1 To identify connection options which best satisfy National Grid's statutory duties and obligations and meet the Project objectives identified in the Strategic Proposal Stage (Stage 1) and described in **Chapter 1**, it is necessary to understand the distribution of environmental and technical constraints (push factors) and opportunities (pull factors) within the study areas. Data to inform this was gathered for the study areas, as well as for the immediate surrounding areas for those topic areas where it was considered that there was potential for adverse impacts on a feature outside the study area's boundary (for example, connected habitats or impacts on migrating birds from a designated site). The extent of this data gathering was based on the professional judgement, considering relevant environmental legislation, policy and best practice. Specific mitigation and enhancement measures will be developed as part of the EIA in line with NPS EN-5 (paragraph 2.9.22).

5.4.2 Features representing potential constraints to development were categorised as either 'seek to avoid' or 'seek to minimise' to, respectively, either avoid or minimise impacts whilst achieving the Project objectives for each of the technology options (overhead lines and substation). Features were categorised based on the level of constraint that the relevant environmental specialist considered them to represent based on professional judgement and relevant environmental legislation, policy and best practice. The sensitivity of particular sites and features relevant to the Proposed Development will be continually reviewed as the Proposed Development progresses in response to Stage 1 consultation feedback and further site-based assessment.

5.4.3 A list of the data obtained, to inform the onwards steps, is listed in **Table 5-1** for overhead lines, and **Table 5-2** for substations.

5.4.4 Buffers were also included for some features representing constraints, where it was considered that potentially significant indirect impacts could occur from beyond the

asset itself, for example impacts on the setting of a listed building, to avoid or minimise that impact. In addition, buffers were added to residential properties as all things being equal, avoidance of direct oversail of residential properties during routeing of new infrastructure is the preferred approach. The extent of the buffers was based upon the professional judgement of the relevant project team subject matter expert, taking into account relevant legislation, policy and best practice. The buffers were not intended to be areas where new infrastructure must be avoided but instead are areas where new infrastructure should be minimised. The buffers are shown in **Table 5-1** for overhead lines, and **Table 5-2** for substations. Where no buffer values are provided, no buffer was considered necessary to consider the constraints appropriately. Where multiple buffer values are provided, the varying buffers were assigned different sensitivity weightings, as described in **Section 5.5**.

5.4.5 As well as potential constraints to the Proposed Development, the mapping exercise also identified features that might offer potential opportunities and therefore promote the inclusion of certain areas within the route corridors. The principal opportunities were associated with the potential to route parallel in proximity (referred to as ‘close parallel’) to existing 400 kV overhead lines and thus restrict the geographic extent of environmental impacts associated with such infrastructure in line with NPS EN-5 (paragraph 2.13.16). Further discussion of the close parallel opportunity is provided in **paragraphs 5.6.79** and **5.6.80** of this report.

Table 5-1 – Data Gathering Features (Overhead Line)

Sub-topic	Constraint Name	Buffer
Air Quality	Residential Properties	25 m
	Education establishments (such as schools and colleges)	N/A
	Buildings (other than residential properties e.g. retail, industrial estates)	N/A
	Air Quality Management Areas (AQMAs)	N/A
Ecology	Ancient Woodland	50m
	Ramsar	500m, 1km and 5km
	Special Area of Conservation (SAC)	500m
	Special Protection Area (SPA)	500m, 1km and 5km
	Site of Special Scientific Interest (SSSI)	500m
	Important Bird Area	500m and 2km
	National Nature Reserve	N/A
	Local Nature Reserve (LNR)	N/A
	RSPB Reserve	250m
	Priority Habitat Inventory (England)	N/A
	Traditional Orchard	N/A
	National Forest Inventory Woodland	N/A
	Local Nature Conservation Sites (LNCS) (Scotland)	50m
	Local Nature Partnerships (England)	N/A
	Local Wildlife Sites/SINCS	N/A
	Lake District National Park	500m
Economic Activity	Business parks / Retail and shopping centres / Industrial estates	N/A
	Best and Most Versatile (BMV) agricultural land (Agricultural Land Classification (ALC) Grades 1, 2, 3)	N/A
	Solar farms	N/A
	Wind farms and wind turbines	N/A

Sub-topic	Constraint Name	Buffer
	Planning Applications/Consents (only for Nationally Significant Infrastructure Projects registered with the Planning Inspectorate and Large-Scale Housing or Infrastructure application registered with the relevant Local Authority)	N/A
	National Trust Land	N/A
	Aggregates and Mineral Resource Areas	N/A
	Local Plan Allocations	N/A
	Mineral Safeguarding Areas	N/A
Geology and Soils	Peaty Soils	N/A
	Geological Sites of Special Scientific Interest	500m
	Local Geodiversity Site	N/A
	Available Brownfield Land Sites	N/A
	Aggregates and Mineral Resource Areas	N/A
	Active Landfill Sites	N/A
	Historic Landfill Sites	N/A
	Mineral Safeguarding Areas	N/A

Sub-topic	Constraint Name	Buffer
Historic Environment	World Heritage Site buffer zone (England)	N/A
	Scheduled Monuments	250m
	Listed Buildings	250m
	Registered Parks and Gardens (England)	250m
	Gardens and Registered Landscapes (Scotland)	250m
	Conservation Areas	250m
	National Trust Properties & Inalienable Land	N/A
	Registered Battlefields (England)	500m
	Battlefields (Scotland)	500m
Landscape and Visual Amenity	National Landscapes (England)	3km and 5km
	National Cycle Network	50m
	Residential settlements and individual dwellings	25m
	Recreational Areas	50m
	Outdoor recreational facilities including golf courses, canals and caravan parks	50m
	Local Landscape Designations	N/A

Sub-topic	Constraint Name	Buffer
	Country Parks	50m
	Public Rights of Way (England)	
	Core Paths (Scotland)	N/A
	Northumberland International Dark Sky Park	N/A
	Local Landscape Areas (Scotland)	1km
	Landscape Character Areas (England)	N/A
	Landscape Character Type	N/A
Aviation and Defence	Licensed Airfield / Aerodrome	N/A
	Unlicensed Airfield / Aerodrome	N/A
	Ministry of Defence properties (including military airfields and low flying zones)	500m
	Civil Aviation Authority Airports or Aerodromes	1km
Noise and vibration	Residential properties	25m
	Education establishments (e.g. schools and colleges)	N/A
	Healthcare facilities (e.g. hospitals, hospices, clinics)	N/A
	Places of worship	
Traffic and Transport	Rail Stations	N/A
	Rail Network	N/A
	National Cycle Network	N/A
Water	Statutory Main Rivers	N/A
	Water Framework Directive (WFD) surface waters	N/A
	Flood Zones 2 & 3 excluding 'Areas Benefitting from Flood Defences'	N/A
	Ground Water Dependant Terrestrial Ecosystems	N/A
	Groundwater source protection zones - inner zone 1	N/A
	Internal Drainage Board Drains	N/A

Table 5-2 – Data Gathering Features (Substations)

Sub-topic	Constraint Name	Buffer
Air Quality	Residential Properties	25 m
	Education establishments (such as schools and colleges)	N/A
	Buildings (other than residential properties e.g. retail, industrial estates)	N/A
	Air Quality Management Areas (BCs)	N/A
Ecology	Ancient Woodland	50m
	Ramsar	500m, and 1km and 5km
	Special Area of Conservation (SAC)	500m
	Special Protection Area (SPA)	500m, 1km and 5km
	Site of Special Scientific Interest (SSSI)	500m
	Important Bird Area	500m and 2km
	National Nature Reserve	N/A
	Local Nature Reserve (LNR)	N/A
	RSPB Reserve	250m
	Priority Habitat Inventory (England)	N/A
	Traditional Orchard	N/A
	National Forest Inventory Woodland	N/A
	Local Nature Conservation Sites (LNCS) (Scotland)	50m
	Local Nature Partnerships (England)	N/A
	Local Wildlife Sites/SINCS	N/A
Economic Activity	Business parks / Retail and shopping centres / Industrial estates	N/A
	BMV agricultural land (Agricultural Land Classification (ALC) Grades 1, 2, 3)	N/A
	Solar farms	N/A
	Wind farms and wind turbines	N/A
	Planning Applications/Consents (only for Nationally Significant Infrastructure Projects registered with the Planning Inspectorate and Large-Scale Housing or Infrastructure application registered with the relevant Local Authority)	N/A

Sub-topic	Constraint Name	Buffer
	National Trust Land	N/A
	Aggregates and Mineral Resource Areas	N/A
	Local Plan Allocations	N/A
	Mineral Safeguarding Areas	N/A
Geology and Soils	Peaty Soils	N/A
	Geological Sites of Special Scientific Interest	N/A
	Local Geodiversity Sites	N/A
	Available Brownfield Land Sites	N/A
	Aggregates and Mineral Resource Areas	N/A
	Active Landfill Sites	N/A
	Historic Landfill Sites	N/A
	Mineral Safeguarding Areas	N/A
Historic Environment	World Heritage Site buffer zone (England)	N/A
	Scheduled Monuments	500m
	Listed Buildings	250m
	Registered Parks and Gardens (England)	250m
	Gardens and Registered Landscapes (Scotland)	250m
	Conservation Areas	250m
	National Trust Properties & Inalienable Land	N/A
	Registered Battlefields (England)	1km
	Battlefields (Scotland)	1km
Landscape and Visual Amenity	National Landscapes (England)	3km and 5km
	National Scenic Areas (NSA) (Scotland)	3km and 5km
	National Cycle Network	150m
	Residential settlements	500m
	Residential individual dwellings	250m
	Recreational Areas	150m
	Outdoor recreational facilities including golf courses, canals and caravan parks	150m
	Local Landscape Designations	
	Country Parks	150m
	Public Rights of Way (England)	50m
	Core Paths (Scotland)	50m

Sub-topic	Constraint Name	Buffer
	Northumberland International Dark Sky Park	N/A
	Local Landscape Areas (Scotland)	1km
	Landscape Character Areas (England)	N/A
	Landscape Character Type	N/A
Aviation and Defence	Licensed Airfield / Aerodrome	N/A
	Unlicensed Airfield / Aerodrome	N/A
	Ministry of Defence properties (including military airfields and low flying zones)	500m
	Civil Aviation Authority Airports or Aerodromes	500m
Noise and vibration	Residential properties	25m
	Education establishments (e.g. schools and colleges)	N/A
	Healthcare facilities (e.g. hospitals, hospices, clinics)	N/A
	Places of worship	N/A
Traffic and Transport	Rail Stations	N/A
	Rail Network	N/A
	National Cycle Network	N/A
Water	Statutory Main Rivers	N/A
	Water Framework Directive (WFD) surface waters	N/A
	Flood Zones 2 & 3 excluding 'Areas Benefitting from Flood Defences'	N/A
	Ground Water Dependant Terrestrial Ecosystems	N/A
	Groundwater source protection zones - inner zone 1	N/A
	Internal Drainage Board Drains	N/A

5.5 Ascribe a weight to, confirm and 'Heat Map' Features (Step 3)

5.5.1 Data gathered for features representing potential constraints to development was attributed a sensitivity weighting as described in **Chapter 4**. Sensitivity weightings were attributed by the relevant landscape and environmental specialist based on professional judgement, considering relevant environmental legislation, policy and best practice and agreed with the project team. The data, once classified, was then used to create 'heat maps' showing the relative importance of the different features. This assisted in providing a visual representation of the relevant constraints for the Proposed Development across the overhead line and substation study areas (as identified in **Figure 5-2** and **Figure 5-4**) and informed the identification of early corridors, Siting Zones and Siting Areas.

5.5.2 The heat maps were then reviewed by the project team to ensure that the sensitivity weightings applied were appropriate in terms of their relative importance in decision making for the type of infrastructure proposed, and to check whether there were features that were so extensive that they would affect all corridors or Siting Areas and thus not help in distinguishing between options. Following this review the following amendments were made:

- Removal of the MoD TTA 20T used for low flying training as this occupies a large portion of the study areas and would not represent a differentiating factor.
- Consideration given to the different sensitivity of parts of the Hadrian's Wall WHS and associated buffer. The majority of the WHS was assigned an initial sensitivity value of '5 – very high potential for the Proposed Development to be constrained'. A WHS Capacity Assessment Technical Note has been prepared as part of the process for undertaking this CPRSS and is included in **Appendix A**. This identified that there is a section of the WHS that is less sensitive to change, as a result of existing infrastructure and due to the presence of extensive hedgerow and woodland, which would help to accommodate a new overhead line in the existing landscape.

5.5.3 The review also identified the need for several additional datasets for which data was collated into the GIS and added to the heat mapping. This included:

- Planning policy land allocations, set out in relevant development plans; and
- Local airfields, data derived from OpenStreetMap and checked against aerial imagery and online searches.

5.5.4 The heat maps were used for the identification of early corridors for overhead lines, and substation Siting Zones and Siting Areas. The overhead line and substation heat maps are shown in **Figure 5-5** and **Figure 5-6**.

Figure 5-5 – Overhead line heat map (based on overhead line study area defined at Step 1)

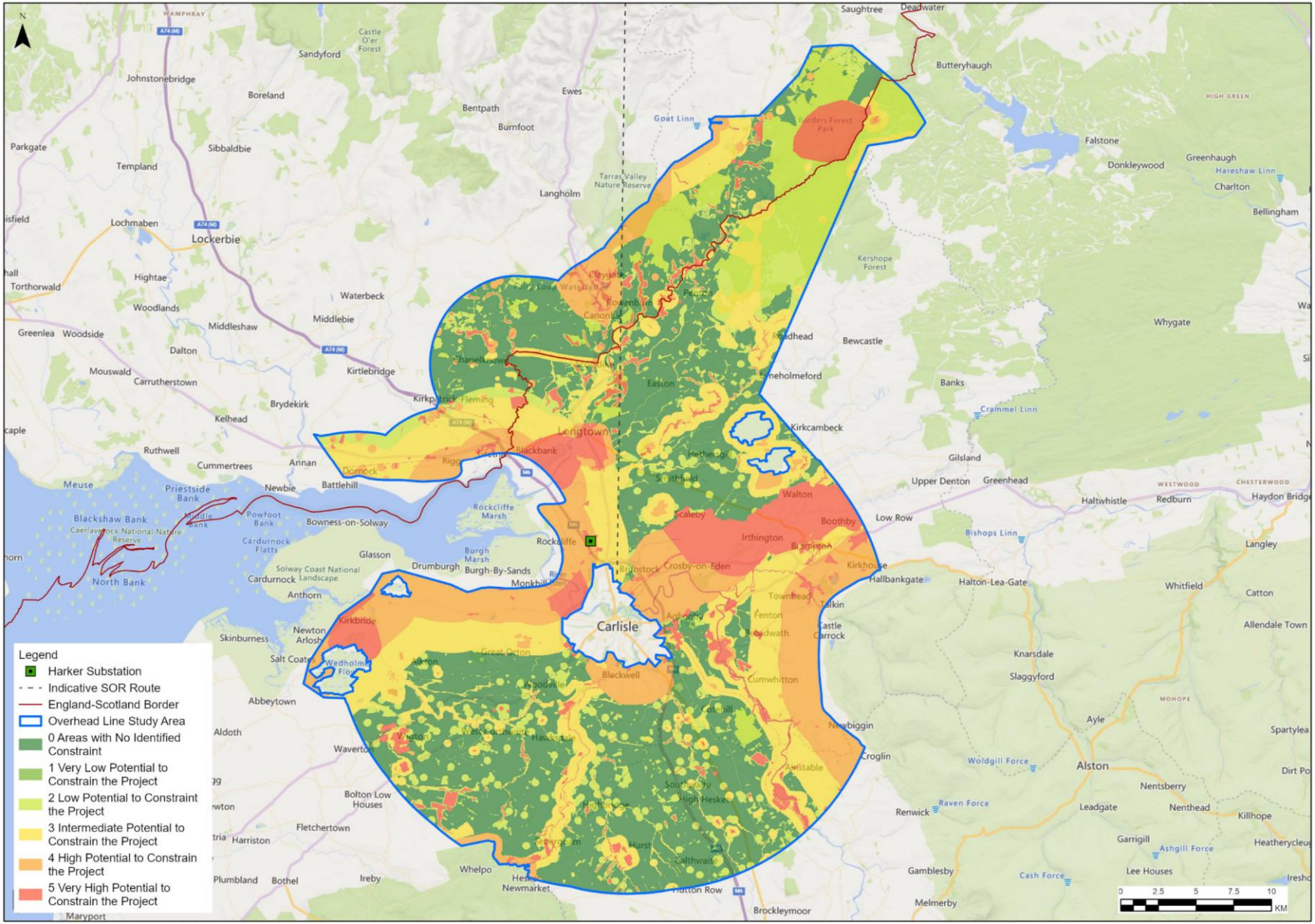
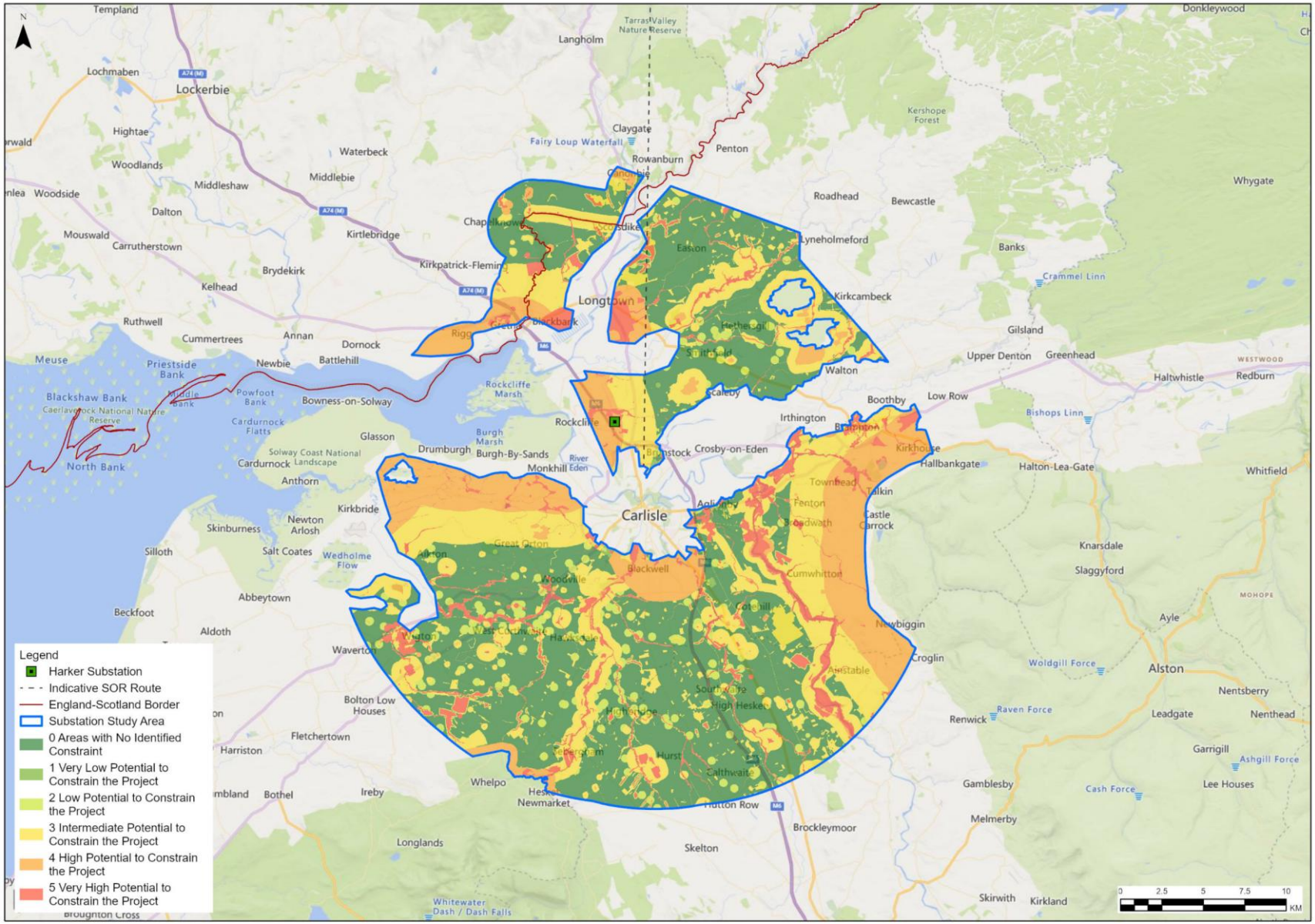


Figure 5-6 – Substation heat map (based on substation study area defined at Step 1)



5.6 Identifying and Defining Siting Zones, Siting Areas and Corridors (Steps 4 to 6)

5.6.1 As described in **paragraph 5.2.13**, the connection points at the end of the route corridor (i.e. the location of the new Carlisle substation and the point of connection to the Scottish section of the Project) were not defined. Therefore, the process for identifying the options to be considered was undertaken in the following order:

- Identification of substation Siting Zones and the substation Siting Areas within the Siting Zones; and
- Identification of route corridor options.

5.6.2 Identification of the potential substation locations in the first instance allowed route corridors to be determined, which corresponded with potential substation locations. On this basis, only route corridors which provided a holistic and deliverable option (that is that they would include a viable substation location) were identified.

5.6.3 A key consideration in identifying the Siting Zones, Siting Areas and route corridors was how the options would help deliver against the need case, described in **Chapter 1.1.11.** To maintain future flexibility for considering the Proposed Development, as part of a network of projects to meet the wider regional need, options were identified which respond to both the need case for the Proposed Development alone, as well as the need to meet the overall B6 boundary capacity and capability shortfall through the Proposed Development and the wider network of other regional reinforcement projects to ensure a coordinated approach is considered.

5.6.4 On this basis, the options considered include:

- a new Carlisle substation and route corridor north of Carlisle; and
- a new Carlisle substation and route corridor south of Carlisle (with the opportunity to connect to the existing Harker-Hutton line).

5.6.5 The process for identification of the Siting Zones and Siting Areas, and the route corridors within the study areas is set out in the sections below.

Substation Siting Zones and Siting Areas (Steps 4 to 6)

5.6.6 At commencement of Step 4, the substation study area was further defined, to exclude areas to the south and to the south-west of Carlisle and to the west of the Harker-Hutton line. This was to focus the study area on locations which would help minimise the length of overhead line connections required, which would provide operational efficiency, reduce environmental impacts (by reducing the geographical extent of effects) and provide a more cost-effective solution.

5.6.7 In further defining the substation study area, siting opportunities in proximity to the existing 400 kV Harker-Hutton line were considered. These areas were to the south of Carlisle. For these locations it was assumed that the connection from the new substation to the existing network would consist of a connection to the existing Harker-Hutton line. A connection to the existing Harker-Hutton Line would address the regional need to deliver a coordinated and efficient network. These siting options would also enable close paralleling to the existing 400 kV Harker-Hutton line of the overhead line connection from the new Carlisle substation to the England-Scotland border. Following

a high-level desk-based review, the study area was expanded to include less sensitive areas within proximity to the existing 400 kV Harker-Hutton line.

5.6.8 Through this, one additional substation Siting Area was identified for inclusion in the study area. This Siting Area is immediately adjacent to the existing Harker-Hutton line and is bordered by the M6 and the A6 to the north-west and to the south-west respectively. The study area was not expanded beyond the A6 due to environmental constraints, including areas of ancient woodland and Flood Zone 3 areas.

5.6.9 This further defined substation study area is shown in **Figure 5-7** and **Figure 5-8**.

Figure 5-7 – Further defined substation study area (Step 4)

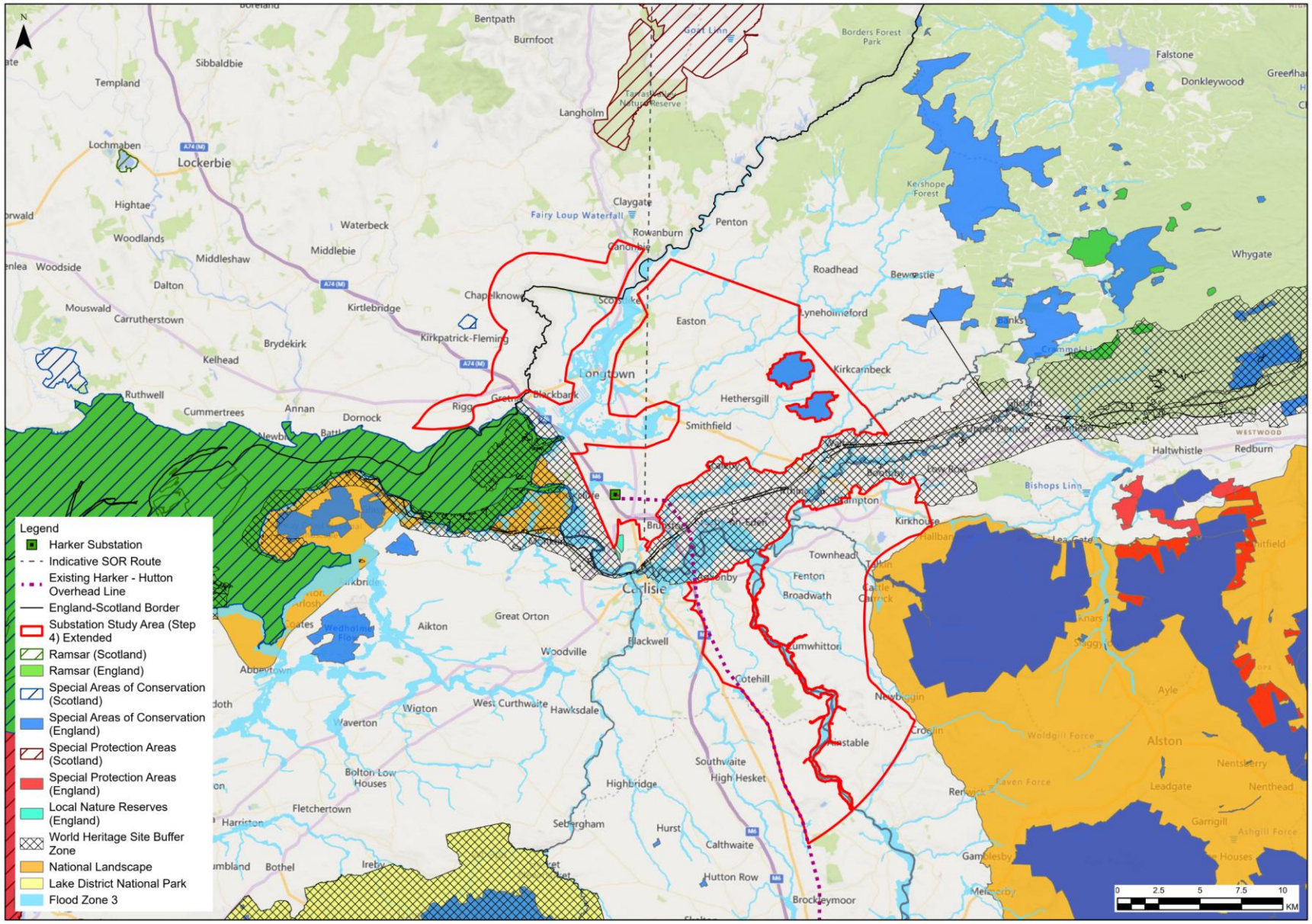
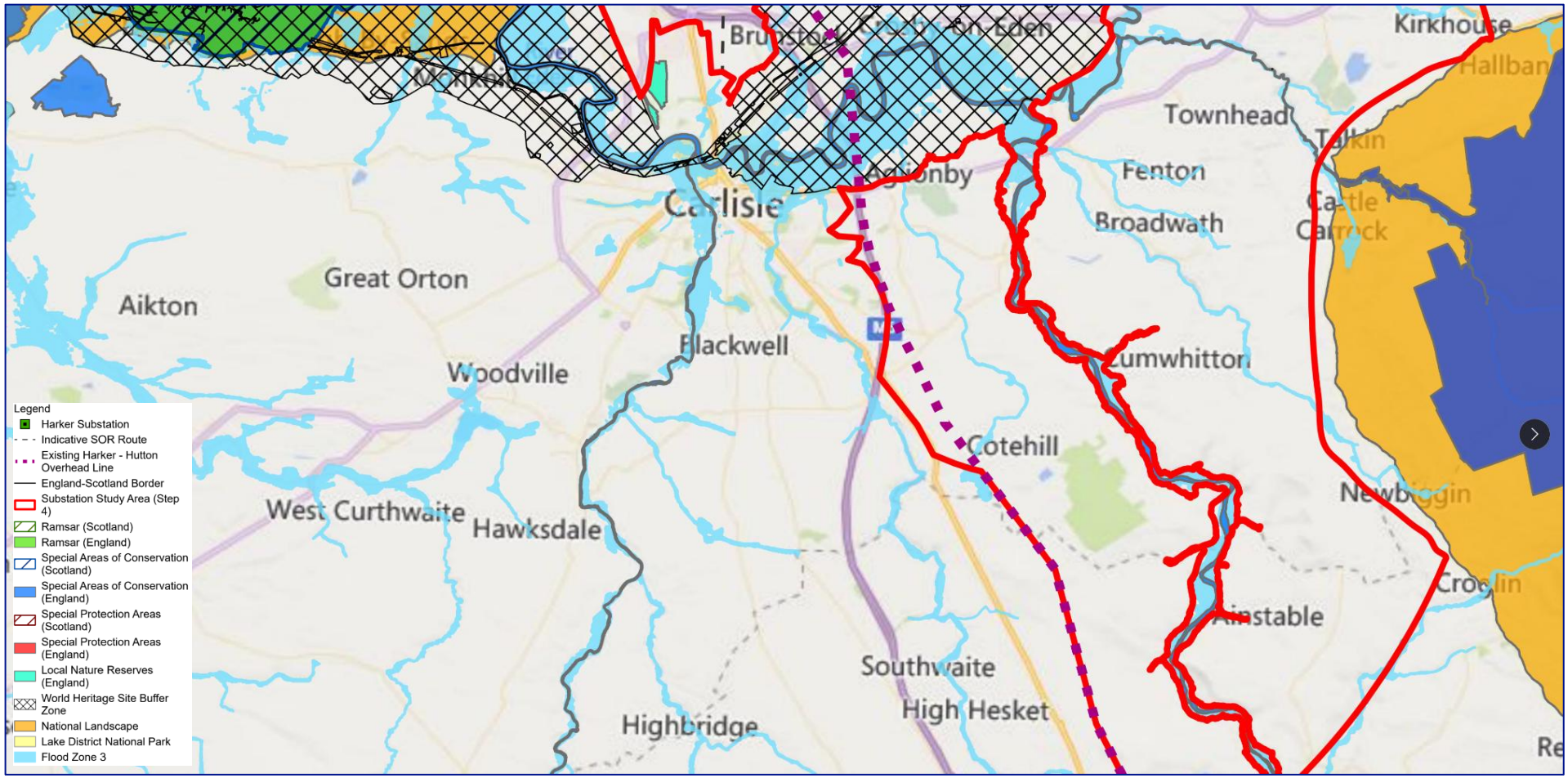


Figure 5-8 – Further defined substation study area (Step 4). Close up view around the existing Harker-Hutton line.



Identification of Siting Zones and Siting Areas (Step 4 to 5)

5.6.10 The Siting Zones and Siting Areas for the new Carlisle substation were identified based on the approach described below.

5.6.11 Preliminary examination of the heat maps and the GIS data for the further defined substation study area identified a number of relatively unconstrained areas which were used to assist in identifying Siting Zone options. Review of these unconstrained areas identified that some were contiguous; where this was the case, these areas were grouped.

5.6.12 As outlined in **Chapter 2**, an AIS substation for the new Carlisle substation, could extend to approximately 720m by 400m (approximately 288,000m2 or 28.8 ha) to allow flexibility in design such as accommodating potential future connections to the new Carlisle substation from other regional reinforcement projects. Based on this broad parameter, a multi-discipline environmental review was undertaken using GIS mapping. This review identified potential Siting Areas within the Siting Zones. The Siting Areas identified were sufficient in size for siting of the new Carlisle substation (with adequate allowance for considering different configurations or locating within the area at subsequent stages) such that, as far as reasonably practicable, they met the following criteria:

- Avoid sites of high amenity, cultural or environmental value;
- Avoid sites close to larger settlements (where reasonably possible);
- Seek to identify an area where the effect on local features (such as mature hedgerows and tree belts) is as low as reasonably practicable;
- Avoid areas that risk affecting surface or ground water sources, and sites at risk of flooding (where reasonably possible);
- Seek areas where local screening (e.g. woodlands) could be used to reduce the degree of intrusion;
- Seek areas with sufficient space around to allow for mitigation planting and/or landform; and
- Seek areas with flat landscape (minimal amount of slope) to enable less cut and fill balance.

5.6.13 In addition, the following issues which may lead to additional environmental effects were considered:

- Access: where possible seek areas in proximity to A-roads or B-roads or potential to develop access, for large indivisible loads, to minimise the risk of off-site effects from road improvements; and
- Connections: consider the likely overhead line or underground cable (if required) connection approaches to Siting Areas, and the potential effects of these (noting that these must be weighed in the balance when selecting a preferred option).

5.6.14 The presence of brownfield land was additionally considered, with the aim of using areas of previously developed land ahead of greenfield sites where possible, particularly to reduce effects on ground conditions and the water environment. However, no areas of vacant or available brownfield land were identified within the Siting Zones.

5.6.15 Taking the above factors into consideration, a total of nine Siting Zones and 19 Siting Areas were identified. Four of the Siting Zones (comprising 11 of the Siting Areas) were options, which would provide a substation to the north of Carlisle (Option A).

5.6.16 Five of the Siting Zones (comprising eight Siting Areas) were options which would provide a substation to the south of Carlisle (Option B).

5.6.17 Each of the substation Siting Zones and Siting Areas are described in this section and are illustrated in **Figure 5-9**. All dimensions and distances are approximate.

Substation Siting Zones to the north of Carlisle

5.6.18 **Siting Zone CSZ1** – a Siting Zone 2.6km by 3km (780ha), located 3km north-west of Longtown and 12km north-west of Carlisle. The England-Scotland border, the Scots' Dike scheduled monument (NHLE 1016860 and HES ID SM660) and areas of ancient woodland are immediately to the north of this Siting Zone. The Siting Zone contains two Siting Areas described below:

- CSZ1.A: a site 1.9km by 1.1km (209ha), located 200m east of the River Sark. Existing 132 kV overhead lines are routed 200m south of this Siting Area; and
- CSZ1.B: a site 1km by 0.7km (70ha), located 40m east of the River Sark. Existing 132 kV overhead lines are routed 250m north of this Siting Area.

5.6.19 **Siting Zone CSZ2** – a Siting Zone 5.4km x 3.4km (1836ha), located 2.2km north-east of Longtown and 11km north of Carlisle. The Lyne Woods SSSI is adjacent to the southern boundary of this Siting Zone. There are areas of ancient woodland to north-west and to the south-east of this Siting Zone. The Siting Zone contains three Siting Areas described below:

- CSZ2.A: a site 0.6km by 1km (60ha), located 700m east of Netherby Road and 1.3km east of the River Esk;
- CSZ2.B: a site 0.5km by 2.2km (110ha), located 700m north of the River Lyne; and
- CSZ2.C: a site 1.9km by 1.7km (323ha), located 400m north of the River Lyne.

5.6.20 **Siting Zone CSZ3** – a Siting Zone 3km x 5.6km (1680ha), located 5km south-east of Longtown and 6.6km north of Carlisle. The Lyne Woods SSSI is immediately north of this Siting Zone. The Bolton Fell and Walton Mosses SAC, National Nature Reserve (NNR), and SSSI is 100m east of the Siting Zone. The Siting Zone contains three Siting Areas described below:

- CSZ3.A: a site 2.6km by 2km (520ha), located 500m south of the River Lyne;
- CSZ3.B: a site 1km by 1km (100ha); the A6071 is adjacent to the north boundary of this Siting Area; and
- CSZ3.C: a site 0.9km by 1.3km (117ha), located 700m north of the A6071; Skytby Road is adjacent to the north-west boundary of this area.

5.6.21 **Siting Zone CSZ4** – a Siting Zone 5km x 4km (2000ha), located immediately north of Carlisle. The Siting Zone is located 1km from the existing Harker substation. The Siting Zone is bisected by the A7. The Siting Zone contains three Siting Areas described below:

- CSZ4.A: a site 1.3km by 1.3km (169ha), located 300m east of the M6;

- CSZ4.B: a site 2km by 1km (200ha); the A7 is adjacent to the west boundary of this Siting Area; and
- CSZ4.C: a site 2.3km by 2.7km (621ha), located 200m east of the A7.

Substation Siting Zones to the south of Carlisle

5.6.22 **Siting Zone CSZ5** – a Siting Zone 1km x 3km (300ha), located 1.5km east of Carlisle. The village of Wetheral is adjacent to the eastern boundary of the Siting Zone; the village of Scotby is 600m north-east of the Siting Zone. The existing 400 kV Harker-Hutton overhead line and the M6 are 1.5km west of the Siting Zone. The River Eden and Tributaries SSSI is adjacent to the eastern boundary of the Siting Zone. The Siting Zone contains two Siting Areas described below:

- CSZ5.A: a site 0.7km by 1.2km (84ha); the B6263 runs along northern and southern boundary of this Siting Area; the B6262 is 200m from the western boundary of this Siting Area; and
- CSZ5.B: a site 0.7km by 1km (70ha), located 200m south-west of the River Eden.

5.6.23 **Siting Zone CSZ6** – a Siting Zone 1.6km x 4.7km (752ha), located 700m south-east of the village of Wetheral and 4.6km east of Carlisle. The River Eden and Tributaries SSSI is 1km west of the Siting Zone. The Siting Zone contains two Siting Areas described below:

- CSZ6.A: a site 1.5km by 1.8km (270ha), located 200m south-east of Clints Roads; and
- CSZ6.B: a site 0.7km by 1.1km (77ha), located 900m south of Randlaw Lane.

5.6.24 **Siting Zone CSZ7** – a Siting Zone 1.9km x 2.3km (437ha), located 1.6km south-east of the village of Cotehill and 6.3km south-east of Carlisle. The Siting Zone is adjacent to the existing 400 kV Harker-Hutton overhead line. The River Eden and Tributaries SSSI is 1km north-east of the Siting Zone. The Siting Zone contains one Siting Area described below:

- CSZ7.A: a site 1.9km by 1.9km (361ha); Peter Gate runs along the north-east and north-west boundary of this Siting Area.

5.6.25 **Siting Zone CSZ8** – a Siting Zone 3.6km x 1.8km (648ha), located 200m east of the village of Little Corby and 5.3km east of Carlisle. The River Irthing is adjacent to the northern boundary of the Siting Zone. The Hadrian's Wall WHS buffer zone is 700m north of the Siting Zone. Carlisle Airport is 1.8km north of the Siting Zone. The Siting Zone is bisected by the A69. The Siting Zone contains two Siting Areas described below:

- CSZ8.A: a site 1.3km by 0.9km (117ha); the A69 is adjacent to the northern boundary of this Siting Area; and
- CSZ8.B: a site 1km by 0.8km (80ha); the A69 is adjacent to the northern boundary of this Siting Area.

5.6.26 **Siting Zone CSZ9** – a Siting Zone 1.7km x 1.9km (323ha), located immediately to the south of the village of Cumwhinton and 1.8km south-east of Carlisle. The existing 400 kV Harker-Hutton line bisects the Siting Zone. The M6 is adjacent to the north-west boundary of the Siting Zone. The Siting Zone contains one Siting Area described below:

- CSZ9.A: a site 1.2km by 1.4km (168ha). The A6 is adjacent to the south-west boundary of this area and the B6263 is adjacent to the northern boundary of this area. The existing 400 kV Harker-Hutton line bisects this area.

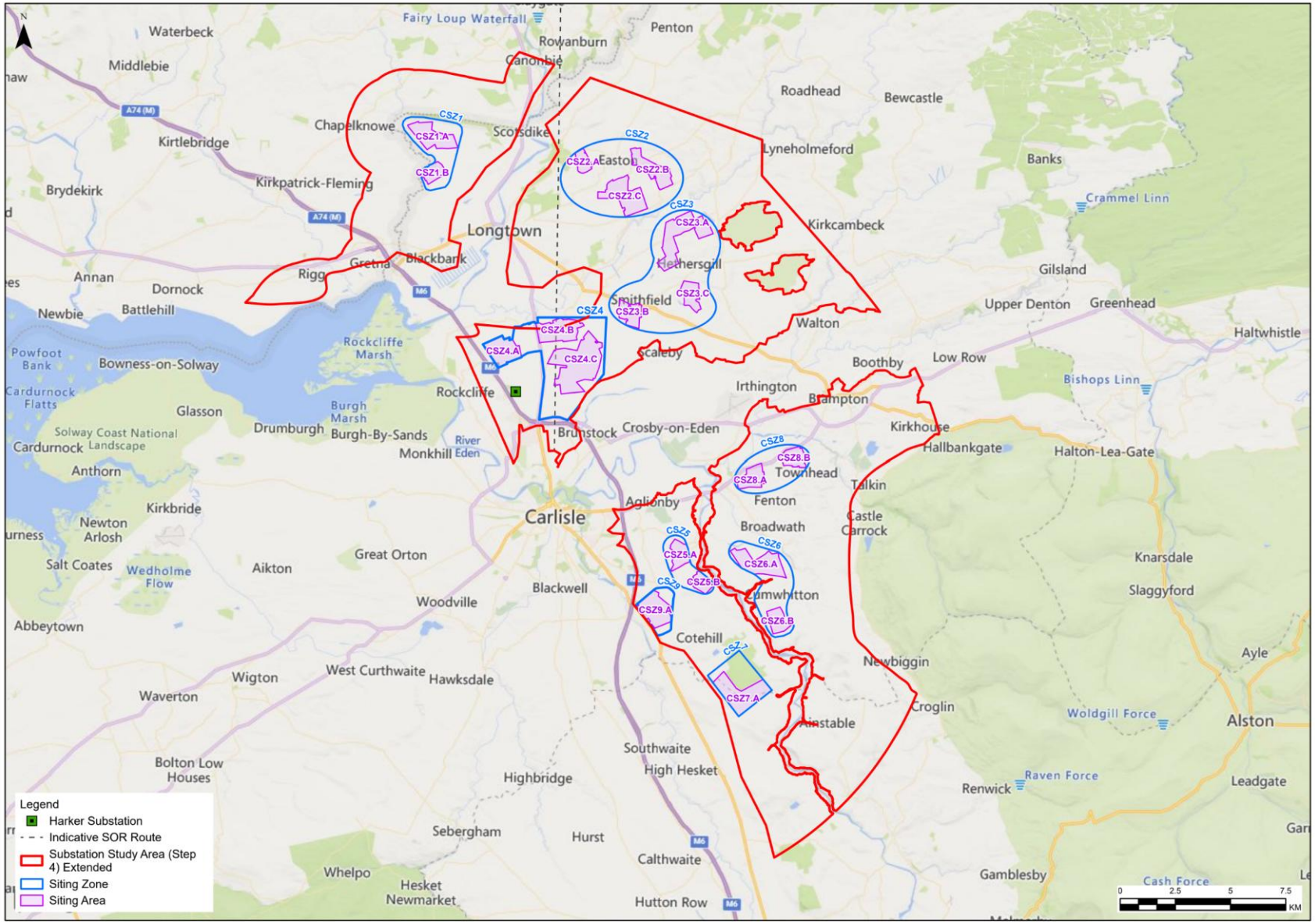
5.6.27 The identified Siting Areas were then subject to a review by the project team. The review considered information gathered from the environment and technical site visits to ground truth the desk studies, and further design and construction constraints identified by the technical team.

5.6.28 In identifying the Siting Areas for the new Carlisle substation, consideration was given to how the substation would connect into the existing network. National Grid experience has found that connections at distances greater than 2km from the existing network have the potential for system disbenefits in relation to power flow management. Therefore, it was assumed that:

- Where substation Siting Areas are located at more than 2km from the existing Harker-Hutton line, the connection to the existing network would consist of a new 400 kV overhead line connection between the new Carlisle substation to the existing Harker substation; and
- Where Siting Areas are located within 2km from the existing Harker-Hutton line, the connection to the existing network would consist of a connection to the existing 400 kV Harker-Hutton line.

5.6.29 Of the options identified, Siting Areas CSZ5.A, CSZ5.B, CSZ7.A and CSZ9.A, all to the south of Carlisle are within 2km of the Harker-Hutton line. Other Siting Areas are at more than 2km from the Harker-Hutton line.

Figure 5-9 – New Carlisle substation Siting Zones and Siting Areas



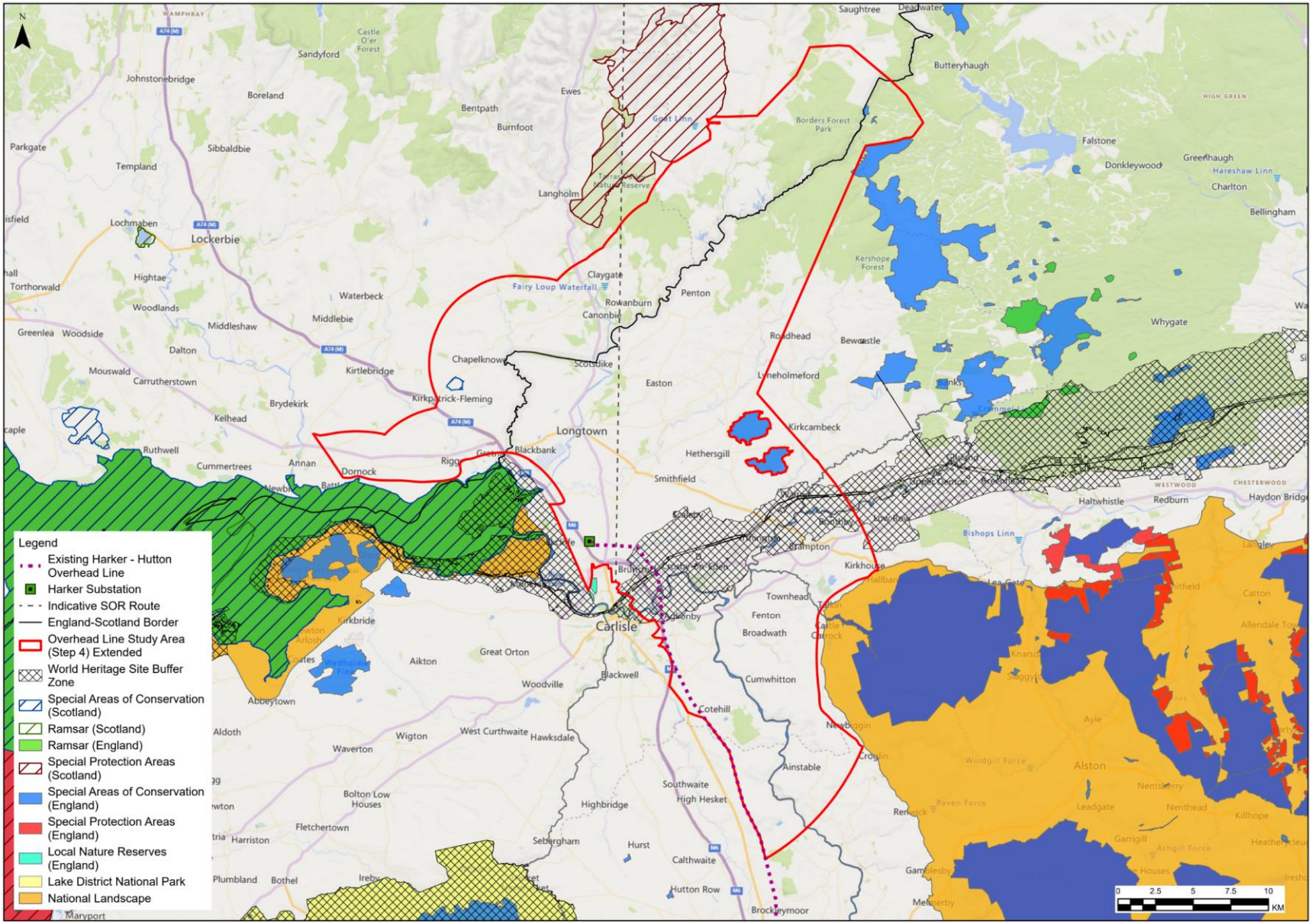
Overhead Lines

Further definition of overhead line study areas (Step 4)

5.6.30 At commencement of Step 4 the overhead line study area was further defined, to exclude areas to the south and to the south-west of Carlisle and to the west of the Harker-Hutton line. This was to focus the study area on locations which would help minimise the length of overhead line connections required, which would provide operational efficiency, reduce environmental impacts (by reducing the geographical extent of effects) and provide a more cost-effective solution.

5.6.31 As set out in **paragraph 5.6.7**, to enable consideration of additional siting opportunities for the new Carlisle substation in proximity to the existing 400 kV Harker-Hutton line, the substation study area, as further defined at Step 4, included an area immediately adjacent to the existing 400 kV Harker-Hutton line, bordered by the M6 and the A6 along the north-west and south-west direction respectively. Accordingly, the overhead line study area was expanded to include this area and enable consideration of additional routeing opportunities in proximity to the Harker-Hutton line.

Figure 5-10 – Further defined overhead line study area



Identification of overhead line route corridors (Steps 4 to 6)

5.6.32 The corridors were identified by applying professional judgement, and knowledge of routeing considerations, in particular the Holford Rules, as outlined in **Chapter 3**. This was to ensure that the corridors identified were technically feasible whilst reducing the potential for effects on the environment, including elements and nuances that cannot be digitised (e.g. **Holford Rule 3** and **7**, see below).

5.6.33 A GIS analysis using heat maps was used as a starting point to identify corridors that aimed to:

- Entirely avoid the largest areas of highest amenity in line with **Holford Rule 1**, and largest settlements (noting the exception made for crossing the Hadrian's Wall WHS as described in **paragraphs 4.2.8 to 4.2.11**);
- Avoid smaller areas of high amenity in line with **Holford Rule 2**, and smaller clusters of houses as far as possible;
- Avoid smaller areas of technical constraint as far as possible;
- Allow for enough space to accommodate reasonable lengths of straight alignment at later stages of design of the Proposed Development, in accordance with **Holford Rule 3**;
- Be broad enough to allow for smaller areas of high amenity and residential properties within the corridor to be avoided at the detailed design stage;
- Likewise, be broad enough for constraints not apparent at this stage (i.e. information arising from Stage 1 consultation, not currently known to National Grid) to be avoided at the detailed design stage; and
- Provide options to connect from one corridor to another so that constrained sections of an otherwise suitable corridor can be bypassed.

5.6.34 The consideration of the Holford Rules in the development of the corridors was led by environmental specialists, including landscape architects because the underlying aim of the rules is, in effect, to guide the design of overhead lines to have the least possible landscape and visual impact whilst avoiding important constraints. **Rule 1** addresses the areas of highest amenity and **Rule 2** addresses the areas of high amenity (i.e. environmental constraints). **Rule 1** applies at a broader scale, primarily in setting the Study Area. **Rule 2** considers amenity areas at a smaller scale and therefore was the main driver in developing the heat maps, the GIS analysis and is critical in developing corridors. **Rule 3** considers the effect of 'angle' pylons and the visual impacts that may be caused by an overhead line with frequent changes of direction. **Rules 4 and 5** consider ways to 'best fit' an overhead line in the landscape to reduce the degree to which it may be visible. **Rule 6** considers wirescape and **Rule 7** considers the approaches to urban areas.

5.6.35 Furthermore, the Holford Rules supplementary notes considers routeing close to residential areas, and state that this should be avoided as far as possible on grounds of general amenity. National Grid's preferred approach is to avoid direct oversail of residential properties during routeing of new infrastructure as far as practicable. Therefore, residential properties were excluded from the corridors where practicable.

5.6.36 The identified corridors were subject to challenge and review and further analysis by the project team.

5.6.37 The review considered information gathered from the environment and technical planning site visits undertaken (ground-truthing key issues and pinch-points identified during the desk studies) and further design and construction issues subsequently identified by the technical teams. Suggested amendments to the corridors were implemented where they were consistent with environmental considerations. The changes implemented include (but were not limited to):

- Removal of sections of corridors where clusters of residential properties were present.
- Removal of sections of corridors where sections of ancient woodland were present.

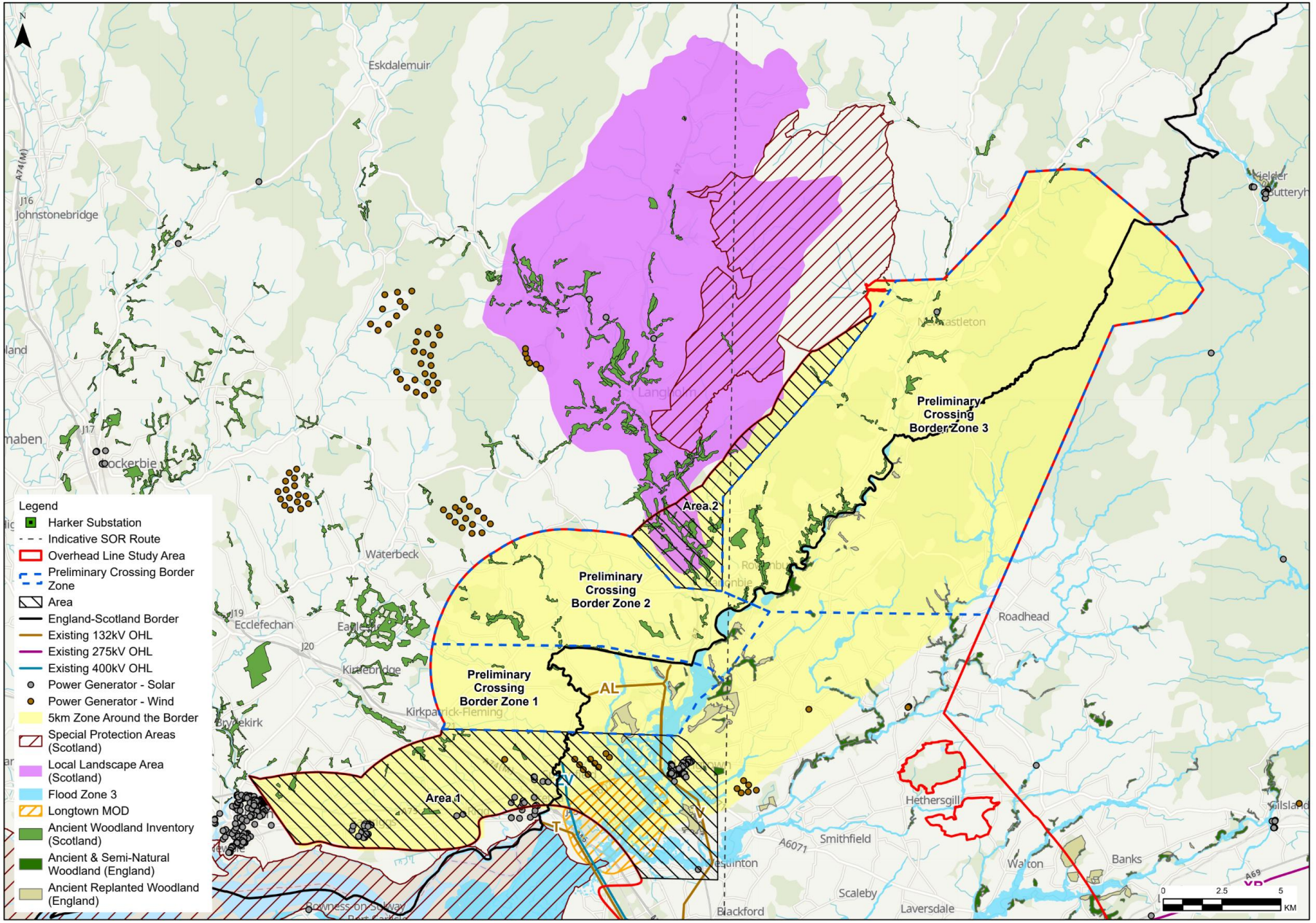
5.6.38 In addition, an exercise was undertaken to check the extent of potential constraints on both larger scale OS mapping and aerial photography.

5.6.39 In defining the corridors, suitable crossing points of the England-Scotland border were identified based on a review of environmental, socio-economic and technical constraints for a section of the overhead line study area around the England-Scotland border (extending by +/-5km from the border). Through this review, three preliminary zones that were considered to have capacity to include an environmentally and technically feasible overhead line crossing were identified (referred to in this report as 'preliminary border crossing zones'). The preliminary border crossing zones are shown **Figure 5-11** and were considered as potential connection points for the corridors at the England-Scotland border.

5.6.40 This review also identified that there are two areas, labelled as 'Area 1' and 'Area 2' in **Figure 5-11**, that include several environmental and technical constraints, such as the MoD Longtown, the town of Longtown, and areas of Flood Zone 3 (within England), and a National Scenic Area and areas of ancient woodland (within Scotland).

5.6.41 As constraints within Area 1 and Area 2 are highly sensitive to change due to the introduction of an overhead line, it was concluded that Area 1 and Area 2 do not have capacity to include an overhead line crossing. Therefore, these areas have not been considered further for the identification of corridor options.

Figure 5-11 – Preliminary border crossing zones



Stage 1 Route Corridors

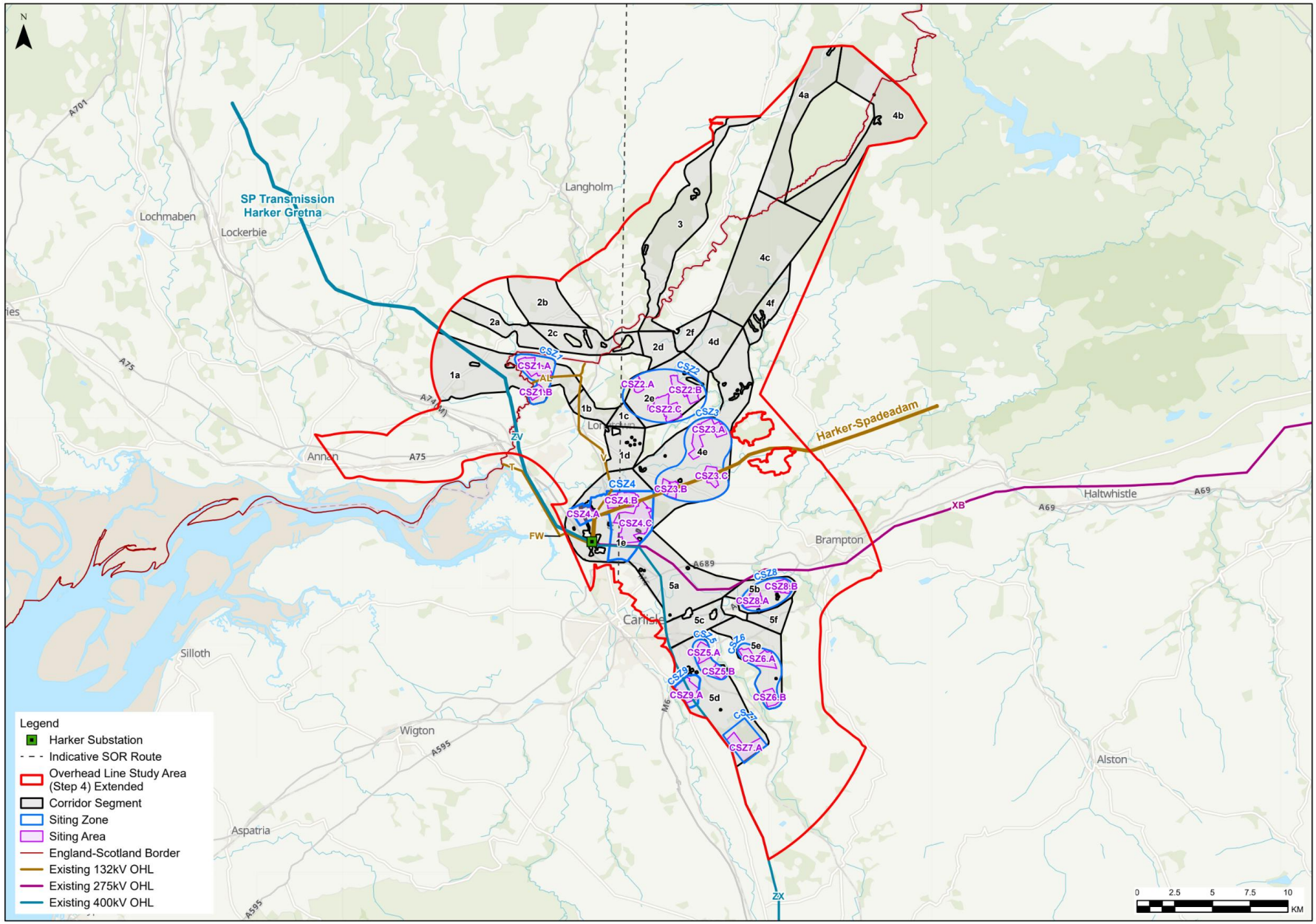
5.6.42 The corridor identification and review exercise identified a network of potential corridors. To allow for clear, comparative analysis, these were structured and individually named. The corridors were formed of segments, and the different route corridors were formed by different combinations of segments. For some corridor options, there were options to use alternative segments within the corridor. These alternatives were considered based on the environmental, socio-economic, and technical criteria allowing identification of options which were more preferable or less preferable. Following Options Appraisal, the corridor segments emerging as preferred could then be combined to form an end-to-end route corridor option.

5.6.43 In defining the corridor options, consideration was given to the requirement to identify two preferred route corridor and substation options – one to the north of Carlisle and one to the south of Carlisle. The purpose of the two options would be to provide the flexibility to meet the need case for the Proposed Development itself, as well as the role of the Proposed Development as part of a network of other regional reinforcement projects, as described in **Section 1.2**. The route corridor options to the north of Carlisle are referred to as 'Core Route Corridors'. This is because the emerging preferred corridor selected to the north of Carlisle would also be used by the emerging preferred corridor to the south of Carlisle to reach the England-Scotland border and connect with the Scottish section of the Project. On this basis, the northern corridor options were considered to be 'core' to both of the potential options.

5.6.44 This section describes the Core Route Corridor options to the north of Carlisle. It then describes the route corridor options to the south of Carlisle.

5.6.45 The location and extent of the route corridors and associated segments, and how they interact with existing overhead lines is shown in **Figure 5-12**. **Figure 5-12** also shows the location of the substation Siting Zones and Siting Areas within the corridor segments.

Figure 5-12 – Route corridor segments and substation Siting Areas



Route Corridor options north of Carlisle

5.6.46 This section describes the five Core Route Corridor options which would provide a corridor to the north of Carlisle. These Core Route Corridors were identified as options which would provide connection points between:

- the England-Scotland border, as defined by the preliminary crossing zones 1 to 3;
- the new Carlisle substation, as defined by Siting Zone options located north of Carlisle (CSZ1 to CSZ4); and
- the existing Harker substation.

5.6.47 These corridor options would include a 400 kV overhead line connection between the new Carlisle substation and the England-Scotland border, and a 400 kV overhead line connection between the new Carlisle substation and the existing Harker substation.

5.6.48 Core Route Corridors 1 to 5 are formed from combinations of the corridor segments as set out in **Table 5-3**.

5.6.49 Core Route Corridors 1 to 5, and the substation Siting Zones within each corridor, are summarised in **Table 5-3** and below.

Table 5-3 – Core Route Corridors 1 to 5

Core Route Corridor	Indicative length (km)	Segments	Relevant Siting Zone(s)
1	17.9	1e, 1d, 1c, 1b, and 1a	1 and 4
2	25	1e, 1d, 1c, 2e, 4d, 2d, 2f, 2c, and either segment 2a or 2b	2 and 4
3	18.6	1e, 1d, 1c, 2e, 2d, 3	2 and 4
4	28 using segment 4a 39.4 using segment 4b	1e, 1d, 1c, 2e, 4d, 4c, and either segment 4a or 4b	2 and 4
5	34.8 using segment 4a 46.2 using segment 4b	1e, 4f, 4e, 4d, 4c, and either segment 4a or 4b	3 and 4

Note: The indicative length of the section of the route corridor is the section of route within England only.

5.6.50 Core Route Corridor 1 is formed by segments 1e, 1d, 1c, 1b, and 1a. It follows a predominantly south to north-west alignment, extending from the existing Harker substation (within segment 1e) to an area located approximately 5km west of the England-Scotland border (within segment 1a). The southern end of the corridor (segment 1e) is adjacent to the WHS buffer zone. The Scots' Dike scheduled monument (NHLE 1016860 and HES ID SM660) and areas of ancient woodland are adjacent to the northern section of the corridor (segment 1a). The Solway Firth SAC, SPA, Ramsar Site and SSSI is located 1.3km west of the corridor (segment 1e) at its closest point. From south to north-west, the corridor crosses various watercourses

including the Rivers Lyne, Esk, and Sark. A large section of Flood Zone 3 area lies within segment 1e and 1b. The corridor intersects key transport infrastructure such as the A7, M6 and A6071. It also intersects existing 132 kV, 275 kV, and 400 kV overhead lines operated by National Grid. The corridor (segment 1e) lies within 5km from Carlisle Airport at its closest point. The Ministry of Defence (MoD) Longtown is located 2km from the corridor (segment 1d) at its closest point.

5.6.51 Core Route Corridor 2 is formed by segments 1e, 1d, 1c, 2e, 4d, 2d, 2f, 2c, and either segment 2a or 2b at its north-eastern extent. It follows a predominantly south to north-west alignment, extending from the existing Harker substation (within segment 1e) to an area located approximately 5km north-west of the England-Scotland border (segment 2a, 2b and 2c). The southern end of the corridor (within segment 1e) is adjacent to the WHS buffer zone. The Solway Firth SAC, SPA, Ramsar Site and SSSI is located 1.3km west of the corridor (segment 1e) at its closest point. From south to north-west, the corridor crosses various watercourses including the Rivers Lyne and Esk. A large section of flood zone 3 area lies within segment 1e. The corridor intersects multiple linear infrastructure assets including the A6071, A7, B6357, B6318, the M6 motorway, and existing 132 kV, 275 kV overhead lines operated by National Grid. The corridor (segment 1e) lies within 5km from Carlisle Airport at its closest point. The MoD Longtown is located 2km from the corridor (segment 1d) at its closest point.

5.6.52 Core Route Corridor 3 is formed by segments 1e, 1d, 1c, 2e, 2d, 3. It follows a predominantly south to north alignment, extending from the existing Harker substation (within segment 1e) to an area west of Newcastleton and approximately 6.7km north of the England-Scotland border (within segment 3). The southern end of the corridor (segment 1e) is adjacent to the WHS buffer zone. The Solway Firth SAC, SPA, Ramsar Site and SSSI is located 1.3km west of the corridor (segment 1e) at its closest point. From south to north-west, the corridor crosses various watercourses including the Rivers Lyne and Liddel Water. A large section of flood zone 3 area lies within segment 1e. The northern section of the corridor (segment 3) lies in proximity to areas of ancient woodland and to the Langholm-Newcastleton Hills SPA. The corridor intersects multiple linear infrastructure assets including the A7, B6357, B6318 and the M6 motorway, and existing 132 kV, 275 kV and 400 kV overhead lines operated by National Grid. The corridor (segment 1e) lies within 5km from Carlisle Airport at its closest point. The MoD Longtown is located 2km from the corridor (segment 1d) at its closest point.

5.6.53 Core Route Corridor 4 is formed by segments 1e, 1d, 1c, 2e, 4d, 4c and either segment 4a or 4b at its northernmost extent. It follows a predominantly south to north-east alignment. The southern end of the corridor (segment 1e) is adjacent to the WHS buffer zone. The Solway Firth SAC, SPA, Ramsar Site and SSSI is located 1.3km west of the corridor (segment 1e) at its closest point. The corridor crosses various watercourses Rivers Lyne (within segment 1e). A large section of Flood Zone 3 area lies within segment 1e. The corridor intersects multiple linear infrastructure assets including the A6071, A7, the B6357 and the M6 motorway, and existing 132 kV, 275 kV and 400 kV overhead lines operated by National Grid. The corridor (segment 1e) lies within 5km from Carlisle Airport at its closest point. The MoD Longtown is located 2km from the corridor (segment 1d) at its closest point.

5.6.54 Core Route Corridor 5 is formed by segments 1e, 4f, 4e, 4d, 4c, and either segment 4a or 4b at its northernmost extent. It follows a predominantly south to north-east alignment. The southern end of the corridor (segment 1e) is adjacent to the Hadrian's Wall WHS buffer zone. The Solway Firth SAC, SPA, Ramsar Site and SSSI is located 1.3km west of the corridor (segment 1e) at its closest point. The corridor crosses various watercourses Rivers Lyne (within segment 1e). A large section of Flood Zone 3

area lies within segment 1e. The corridor intersects multiple linear infrastructure assets including the A6071, A7, the B6357 and the M6 motorway, and existing 132 kV, 275 kV and 400 kV overhead lines operated by National Grid. The corridor (segment 4e) lies within 3km from Carlisle Airport at its closest point. The MoD Longtown is located 2.7km from the corridor (segment 1e) at its closest point.

Route corridor options extending to the south of Carlisle

5.6.55 As described in **paragraph 5.6.43**, the Core Route Corridor options would provide the section of route corridor to the north of Carlisle to the England-Scotland border. To help meet the wider regional network capacity need, options for a route corridor and substation to the south of Carlisle were also considered. If the new Carlisle substation was located to the south of Carlisle this would require the alignment of the selected Core Route Corridor to be extended to the south of Carlisle.

5.6.56 Two options were identified which would extend the core route corridors to the south:

- Core Route Corridor to the north of Carlisle + segments 5a and 5b; and
- Core Route Corridor to the north of Carlisle + segments 5a, 5c and 5d.

5.6.57 These corridor options would include a 400 kV overhead line connection between a new Carlisle substation to the south of Carlisle and the England-Scotland border, and a 400 kV overhead line connection between the new Carlisle substation and the existing Harker substation.

Core Route Corridors 1 to 5 + segments 5a and 5b

5.6.58 Core Route Corridor 1 to Core Route Corridor 5 + segments 5a and 5b are summarised in **Table 5-4**.

Table 5-4 – Core Route Corridors 1 to 5 + segments 5a, 5b

Route Corridor	Indicative length (km)	Segments within Core Route Corridor (north of Carlisle)	Segments south of Carlisle	Siting Zone(s)
Core Route Corridor 1 + segment 5a, 5b	40.6	1e, 1d, 1c, 1b, and 1a	5a, 5b	8
Core Route Corridor 2 + segment 5a, 5b	47.7	1e, 1d, 1c, 2e, 4d, 2d, 2f, 2c, and either segment 2a or 2b	5a, 5b	8
Core Route Corridor 3 + segment 5a, 5b	41.3	1e, 1d, 1c, 2e, 2d, 3	5a, 5b	8
Core Route Corridor 4 + segment 5a, 5b	50.7 using segment 4a 62.1 using segment 5b	1e, 1d, 1c, 2e, 4d, 4c, and either segment 4a or 4b	5a, 5b	8
Core Route Corridor 5 + segment 5a, 5b	57.5 using segment 4a	1e, 4f, 4e, 4d, 4c, and either segment 4a or 4b	5a, 5b	8

Route Corridor	Indicative length (km)	Segments within Core Route Corridor (north of Carlisle)	Segments south of Carlisle	Siting Zone(s)
	68.9 using segment 4b			

Note: The indicative length of the section of the route corridor within England only is provided

5.6.59 These options would extend the base alignment of the five Core Route Corridor options 1 to 5 by continuing to the south of Carlisle through segments 5a and 5b.

5.6.60 Segment 5a lies immediately to the north-east and east of Carlisle. The WHS lies within the segment. The River Eden SAC lies within this segment. The segment features key infrastructure such as the A689, the existing 132 kV overhead lines, and an ethylene pipeline. Carlisle Airport lies within 1.1km from the segment at its closest point.

5.6.61 Segment 5b includes the village of Hayton and the village of Warwick Bridge is 100m to the west of the segment. The WHS is immediately to the north of the segment. The River Irthing crosses segment from west to north-east. The existing 275 kV XB overhead line is immediately to the north of the segment. Carlisle Airport is 1.3km from the segment at its closest point.

5.6.62 The only substation Siting Zone within these corridor options would be CSZ8. CSZ8 is more than 2km from the existing Harker-Hutton line which would introduce the potential for system disbenefits in relation to power flow management. If this CSZ8 and one of the associated route corridor options were selected, this would require an overhead line connection back to the existing Harker substation to secure resilience within the network.

Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d

5.6.63 Core Route Corridor 1 to Core Route Corridor 5 + segments 5a, 5c and 5d are summarised in **Table 5-5**.

Table 5-5 – Core Route Corridors 1 to 5 + segments 5a, 5c and 5d

Route Corridor	Indicative length (km)	Segments within Core Route Corridor (north of Carlisle)	Segments south of Carlisle	Siting Zone(s)
Core Route Corridor 1 + segments 5a, 5c and 5d	37.0	1e, 1d, 1c, 1b, and 1a	5a, 5c and 5d	5, 7, 9
Core Route Corridor 2 + segments 5a, 5c and 5d	44.1	1e, 1d, 1c, 2e, 4d, 2d, 2f, 2c, and either segment 2a or 2b	5a, 5c and 5d	5, 7, 9
Core Route Corridor 3 + segments 5a, 5c and 5d	37.7	1e, 1d, 1c, 2e, 2d, 3	5a, 5c and 5d	5, 7, 9

Route Corridor	Indicative length (km)	Segments within Core Route Corridor (north of Carlisle)	Segments south of Carlisle	Siting Zone(s)
Core Route Corridor 4 + segments 5a, 5c and 5d	47.1 using segment 4a 58.5 using segment 4b	1e, 1d, 1c, 2e, 4d, 4c, and either segment 4a or 4b	5a, 5c and 5d	5, 7, 9
Core Route Corridor 5 + segments 5a, 5c and 5d	53.9 using segment 4a 65.3 using segment 4b	1e, 4f, 4e, 4d, 4c, and either segment 4a or 4b	5a, 5c and 5d	5, 7, 9

Note: The indicative length of the section of the route corridor within England only is provided.

5.6.64 These corridor options would include a new overhead line connection between the new Carlisle substation and the England-Scotland border. As Siting Zones CSZ5, CSZ7 and CSZ9 are within 2km from the Harker-Hutton line the connection to the existing network would consist of a connection to the existing Harker-Hutton line.

5.6.65 These options would extend the base alignment of the five Core Route Corridor options 1 to 5 by continuing to the south of Carlisle through segments 5a, 5c and 5d.

5.6.66 Segment 5a lies immediately to the north-east and east of Carlisle. The WHS and associated buffer zone lies within the segment. The River Eden SAC lies within this segment. The M6 is located along the western boundary of the segment. There are existing overhead transmission lines which run through segment 5a including a 275 kV overhead line and the 400 kV Harker-Hutton line. Carlisle Airport lies within 1.1km from the segment at its closest point.

5.6.67 Segment 5c includes the village of Scotby and Carlisle Golf Club and is bordered by the existing 400 kV overhead line and the M6.

5.6.68 Segment 5d is also bordered in most part by the Harker-Hutton 400 kV line and is bisected by a railway line. The villages of Cotehill and of Cumwhiton are within the segment. The village of Wetheral and the River Eden are immediately to the east of the segment. The Cotehill Pastures and Ponds SSSI lies within the segment.

Other route corridor segments not progressed for detailed appraisal

5.6.69 As shown in **Figure 5-12**, two additional segments, 5e and 5f, to the south of Carlisle were identified within the study area.

5.6.70 Segment 5e was connected to south-east of segment 5c and included substation Siting Zone 6 (CSZ6). Segment 5f connected segment 5b with segment 5e. Therefore, in principle it would have been feasible to identify route corridors that extended the five Core Route Corridor options 1 to 5 to the south of Carlisle through segment combinations of either:

- segments 5a, 5b, 5f and 5e; or
- segment 5a, 5c and 5e.

5.6.71 These route corridors would provide a connection to CSZ6, located in segment 5e, which would represent the southern terminus of the overhead line.

5.6.72 However, at the stage of defining the potential corridor options, the emerging environmental and engineering appraisal had identified substantive access constraints associated with CSZ6. The detailed appraisal of CSZ6 is described in **Chapter 6**. On the basis that there were more preferable alternative options for a corridor route, and with regard to the identified constraints, segment 5e and 5f were discounted from further consideration and not included as part of a southern route corridor option or carried into the detailed appraisal.

Appraising 'Close Parallel' Opportunities

The Opportunity of a Close Parallel Alignment

5.6.73 In general terms, a close parallel route may have the potential to reduce the overall extent of environmental impacts arising from the Proposed Development by intensifying the degree of impact on receptors already affected by existing overhead lines, rather that spreading impacts to areas not currently affected.

5.6.74 Whilst the efficacy of close paralleling in reducing environmental impacts would be strongly influenced by local factors (e.g. topography, settlement pattern, woodland cover etc.), the optimum level of benefit is likely to result from lines that, as stated in **Holford Rule 6**, are planned with pylon types, spans and conductors forming a coherent appearance. In most circumstances, this is likely to be more achievable the closer the overhead lines are to each other, as local conditions would be likely to be similar for both overhead lines.

5.6.75 The minimum distance between lines is determined by technical and safety constraints and would typically be approximately 85m. The maximum distance at which the benefits of close paralleling might be achieved depends on local factors which are described in more detail below. Whilst this maximum cannot be precisely defined, it is considered to be unlikely to be more than approximately 200m in most circumstances.

Challenges with a Close Parallel Alignment

5.6.76 As mentioned above, the benefit of a close parallel alignment is realised when the pylon types, spans and conductors form a coherent appearance. This is difficult to achieve, as the appearance of the infrastructure can change depending on the direction and level it is being viewed from. It is not always feasible to site pylons adjacent to each other if there are constraints present alongside the existing pylon(s), and this can also result in an inconsistent span length and clearance level for the overhead line.

5.6.77 There are technical challenges associated with construction of a close parallel alignment, including difficulties with achieving the required offset from the existing overhead line and access where the existing overhead line is already within a constrained working area. In some locations, there will be a need to cross the existing overhead line where routeing is not continually viable on one side. In these circumstances, a line swap-over, or duck-under would be required and it can be challenging to accommodate these within the existing infrastructure. For instance, existing overhead lines may need to be re-routed or require temporary diversions under system outages to accommodate a line swap-over or duck-under.

5.6.78 In some locations, where constraining features impede a close parallel alignment, there may be a need to cross the existing overhead line. In these circumstances, subject to engineering preference as well as detailed landscape and visual impact assessment, a

line swap over, overhead line duck-under or cable duck-under would be required (an example of which is shown in **Figure 5-13**), increasing technical complexity and required permanent infrastructure. As such it can be challenging to accommodate these interactions with existing overhead line assets within proximity to such constraining features. For instance, existing overhead lines may need to be re-routed or require temporary diversions to accommodate a line swap over.

Defining Close Parallel Opportunities

5.6.79 Subject to site selection, if a substation option south of Carlilse was taken forward there are opportunities to have a parallel alignment to the existing 400 kV Harker-Hutton overhead line in part. This has been considered whilst defining corridor options to restrict the environmental and socio-economic impacts of the new line.

5.6.80 The Harker Hutton 400 kV line runs along the western boundary of corridor segments 5c and 5d, which creates an opportunity of a close parallel alignment for Core Route Corridor 1 to 5 plus segment 5a, 5c and 5d. This would allow the overhead line connection from the new Carlisle substation to the England-Scotland border to be routed parallel to the existing 400 kV Harker-Hutton line within segments 5a, 5c and 5d if this corridor option was selected as the emerging preferred option to the south of Carlisle.

Figure 5-13 – Example of an Overhead Line Duck Under

5.7 Mitigation of impacts through avoidance

5.7.1 The study areas, corridors, Siting Zones and Siting Areas defined through the above process are effectively the first two stages of an iterative process looking at features which represent constraints at an in increasingly smaller scale. They were designed to comply with **Holford Rules 1** and **2** and **Horlock Rules 2**, avoiding the major areas of highest amenity value altogether, where practicable, and allowing room within the corridors to avoid smaller areas of high amenity value by local deviation. They were also designated to avoid major technical constraints. This approach seeks to minimise impacts from the outset. The main constraints which influenced the formation of the corridors, Siting Zones and Siting Area and whether they have been avoided by this process, are listed in **Table 5-6**.

Table 5-6 – Major Features Representing Constraints within the Study Area

Topic	Constraint Type and Name/No. within Study Area	Avoided by Corridors, Siting Zones, and Siting Areas?
Aviation and Defence	Carlisle Lake District Airport	Avoided
	MoD Longtown and associated hazard zone[39]	Avoided
	MoD Tactical Training Area	Partially within all route corridors. Within Siting Zones CSZ1, CSZ2 and partially within Siting Zone CSZ3.
Ecology	Sites of Special Scientific Interest (SSSI): Scaleby Moss SSSI, Kershope Bridge SSSI, Kielder Mires SSSI, Cotehill Pastures and Ponds SSSI	Within core route corridor 5. Within core route corridor 1 to 5 + segment 5a, 5c, 5d.
	Ancient woodland	Avoided
Economic Activity	Wind Farms	Avoided
	Solar Farms	Avoided
	Golf Courses	Within core route corridor 1 to 5 + segment 5a, 5c, 5d and within core route corridor 1 to 5 + segment 5a, 5b
	Known Nationally Significant Infrastructure Projects in the public domain	Avoided

[39] Guidance prepared by Cumberland Council (available at: https://www.cumberland.gov.uk/sites/default/files/2025-03/mod_longtown_warning_and_informing_leaflet.pdf) identifies a hazard area around the MoD Longtown, which extends by 2km from the centre of the site.

Geology and Soils	Peaty Soils	Within core route corridor 1 to 5 + and within core route corridor 1 to 5 + segment 5a, 5c, 5d.
	North Pennines Geopark	Avoided
Historic Environment	Registered Park and Gardens	Avoided
	World Heritage Sites	Within core route corridor 1 to 5 + segment 5a, 5c, 5d and within core route corridor 1 to 5 + segment 5a, 5b
	Conservation Areas	Within core route corridor 1 to 5 + segment 5a, 5c, 5d.
	Scheduled Monuments	Within core route corridor 1. Within core route corridor 1 to 5 + segment 5a, 5c, 5d and within core route corridor 1 to 5 + segment 5a, 5b
Landscape and Visual	Northumberland National Park, North Pennines National Landscape, and Solway Coast National Landscape and their setting	Avoided
	Lake District National Park	Avoided
	Country Parks	Avoided
Water Environment	Statutory Main Rivers	Within all corridors
	Flood Zones 2 and 3	Within all corridors

5.8 High Level Costs

5.8.1 Costs have been developed for the corridors using National Grid's cost estimating factors consistent with assumptions in the SOR. The route lengths are used with a per km cost factor derived from previous examples. The cost estimates do not include capital cost associated with a new substation or any connection works. The costs of applying normal industry 'best practice' mitigation measures during construction and operation are inherent within the cost base used. Costs can therefore be compared at Step 7 (Options Appraisal) on a consistent basis noting that they could be higher or lower, but consistent in relative terms.

5.8.2 Cost estimates in relation to the proposed substation are not considered materially different when 400 kV connections are excluded, between each Siting Zone or Siting Area. Substation costs are primarily driven by the number of circuits and the level of generation they must connect into the wider transmission system. These drivers are not affected by the choice of Siting Zones and Siting Areas, and as such are common across all options for the new substation. Therefore, cost is not a differentiating factor in

the comparison of Siting Zones or Siting Areas and costs in respect of these elements are not considered in **Chapter 8**.

5.8.3 The indicative costs, set out in **Chapter 8**, provide a consistent cost point for relative comparison of corridor options at this stage.

5.9 Next Step – Options Appraisal (Step 7)

5.9.1 As explained in **Chapter 4**, Options Appraisal (Step 7) is a structured process by which the environmental, socio-economic, technical and cost implications are identified, reported and compared. It is a tool to aid objective and justified decision making and it enables National Grid to document in a transparent manner the information on which judgements have been based. Options Appraisal is therefore focussed on those sub-topics which assist in distinguishing between options.

5.9.2 Through the definition of study areas and preliminary options as areas that seek to comply with **Holford Rules 1** and **2** (seeking to minimise environmental effects from the outset), the options identified have already avoided several features such that they no longer represent differentiating factors. The constraints initially considered but found not to be differentiating factors for the Options Appraisal include:

- National Parks and National Landscapes and their setting, none are located within the study area;
- Air Quality Management Areas, as none are located within the study area;
- RSPB Boundaries, as none are located within the study area; and
- MoD Tactical Training Area 20T. This constraint occupies a large section of the overhead line study area and as there is potential for adverse impacts resulting from all route corridor options, this was not considered a differentiating factor. Mitigation measures would be required for all route corridor options such as change in pylon design and/or infrared lighting could be implemented to mitigate effects.

5.9.3 The Options Appraisal, undertaken for each component of the Proposed Development, described in **Chapters 6** and **Chapter I** below account for the environmental and socio-economic sub-topics and constraints shown in **Table 5-7**.

Table 5-7 – Options Appraisal Sub-Topics and Constraints

Sub-Topic	Constraint Name
Ecology	Ancient Woodland
	National Nature Reserves
	Ramsar
	SAC
	SPA
	SSSI
	Important Bird Area
	Priority Habitat Inventory

	National Forest Inventory
Geology and Soils	Peaty soils
	Geological Sites of Special Scientific Interest
	Available Brownfield Land Sites
	Aggregates and Mineral Resource Areas
	Landfill Sites
Historic Environment	Scheduled Monuments
	Listed Buildings
	Registered Parks and Gardens
	Conservation Areas
	World Heritage Site
Landscape and Visual	National Parks, National Landscapes and their setting.
	Residential settlements and individual dwellings
	Recreational areas
	Outdoor recreational facilities including golf courses, canals and caravan parks
Water Environment	Statutory Main Rivers
	WFD surface waters
	Flood Zones 2 and 3
	Groundwater Source Protection Zones – Inner/Zone 1
	Drinking Water Protected Areas
Economic Activity (including Planning)	Residential areas
	Education establishments (e.g., schools and colleges)
	Health care facilities (e.g., hospitals, hospices, clinics)
	Places of worship
	Business parks / Retail and shopping centres / Industrial estates
	Solar Farms
	Wind farms and wind turbines

	Planning Applications/Consents (only for NSIPs registered with the Planning Inspectorate and Large Scale Housing or Infrastructure application registered with the relevant Local Authority)
	Local Plan Allocations
Aviation and Defence	Licensed Airfield / Aerodrome
	Unlicensed Airfield / Aerodrome
	Ministry of Defence Properties

5.9.4 For the environmental, socio-economic and technical issues the appraisal considers the potential impacts on relevant receptors, and whether such effects could be avoided or mitigated through careful routeing or siting as the primary form of mitigation. Where impacts cannot be avoided or mitigated by careful routeing or siting, other forms of mitigation have been considered in accordance with National Grid's mitigation hierarchy as detailed in **paragraph 4.8.6**. These other forms of mitigation are described as 'other mitigation' in **Chapters 6** and **7**.

5.9.5 It should be noted that whilst consideration of residential properties is not included within the economic activity sub-topic appraisal, consideration of direct oversail of residential properties was considered as part of the comparative appraisals and as part of the end-to-end solution. Avoidance of direct oversail of residential properties during routeing of new infrastructure is National Grid's preferred approach.

5.9.6 The environmental, socio-economic and technical appraisals for the corridors and substation Siting Zones and Siting Areas are described in **Chapters 6** and **7** respectively, with the cost and programme implications outlined in **Chapter 8**.

6. Options Appraisal – New Carlisle Substation

6.1 Introduction

6.1.1 This chapter provides a summary of the outcomes of the Options Appraisal (Step 7 as described in Chapter 4) for the preliminary Siting Zones and Siting Areas for the new Carlisle substation. The new Carlisle substation Siting Zones and the Siting Areas within them have been developed through the definition of a study area (Step 1), mapping and weighting of features (Step 2 and 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6).

6.1.2 Nine Siting Zones were progressed for appraisal, each of which contain one or more Siting Areas.

6.1.3 The following Siting Zones would provide a substation location to the north of Carlisle (Option A):

- Siting Zone 1 (CSZ1), containing two Siting Areas CSZ1.A and CSZ1.B;
- Siting Zone 2 (CSZ2), containing three Siting Areas CSZ2.A, CSZ2.B and CSZ2.C;
- Siting Zone 3 (CSZ3), containing three Siting Areas CSZ3.A, CSZ3.B and CSZ3.C; and
- Siting Zone 4 (CSZ4), containing three Siting Areas CSZ4.A, CSZ4.B and CSZ4.C.

6.1.4 The following Siting Zones would provide a substation location to the south of the Carlisle (Option B):

- Siting Zone 5 (CSZ5), containing two Siting Areas CSZ5.A and CSZ5.B;
- Siting Zone 6 (CSZ6), containing two Siting Areas CSZ6.A and CSZ6.B;
- Siting Zone 7 (CSZ7), containing one Siting Area CSZ7.A;
- Siting Zone 8 (CSZ8), containing two Siting Areas CSZ8.A and CSZ8.B; and
- Siting Zone 9 (CSZ9), containing one Siting Area CSZ9.A.

6.1.5 The Siting Areas have been developed to accommodate an AIS substation that could extend to approximately 720m by 400m (approximately 288,000m² or 28.8ha). The Siting Area options progressed for option appraisal are described in detail in **paragraphs 5.6.12** to **5.6.20**. The locations of the Siting Zones and Siting Areas are shown in **Figure 6-1** to **Figure 6-9**.

6.1.6 The options appraisal of environmental, socio-economic and technical issues for the new Carlisle substation, as detailed in Chapter 5, has considered the potential for impacts on relevant receptors, and whether these could likely be avoided or mitigated through routeing and careful siting. Where the potential impacts cannot be avoided or mitigated by careful routeing, other forms of mitigation have been considered in accordance with National Grid's mitigation hierarchy (as described in **paragraph 4.8.4**).

6.1.7 This chapter summarises the location of each Siting Zone and the Siting Areas within them. For each Siting Zone it provides an appraisal of the Siting Areas within the Siting Zone. Where there is more than one Siting Area within a Siting Zone, and there is a preferred Siting Area within the Siting Zone based on the appraisal outcomes, this is reported for each discipline.

6.1.8 For the current stage of the Proposed Development (Stage 2), the relevant data to inform the appraisal comprises desk study information, supplemented by site visits to select locations, for important receptors.

6.1.9 Chapter 2 provides details of the typical infrastructure that would be provided for the substations.

6.2 New Carlisle Substation Siting Zone 1 (CSZ1)

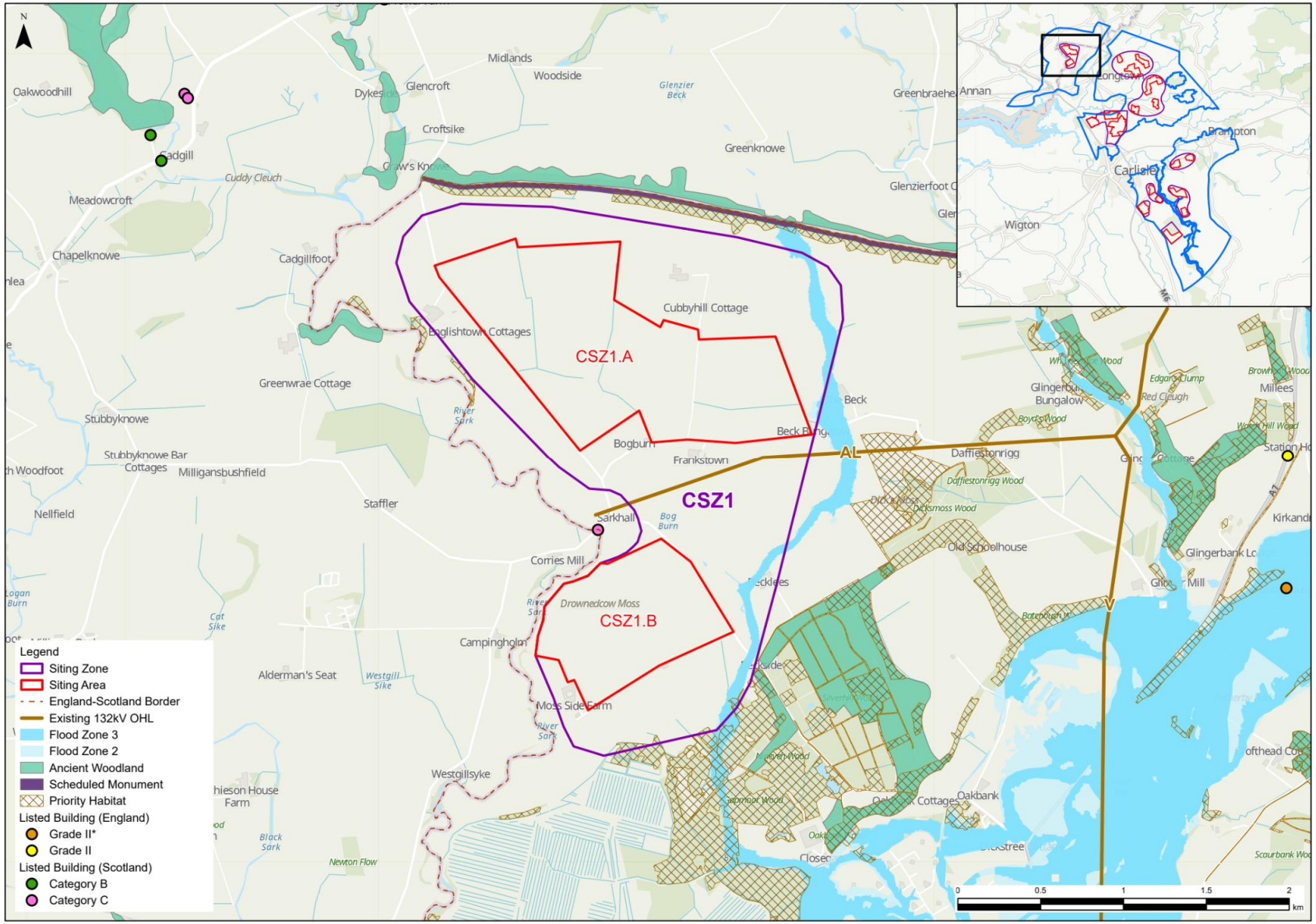
6.2.1 CSZ1 is a substation Siting Zone located to the north of Carlisle (Option A).

6.2.2 CSZ1 occupies an area of approximately 525ha adjacent to the England-Scotland border, 3km north-west of Longtown town centre, and 2km east of the village of Chapelknowe with few scattered residential and agricultural properties throughout. There are no A or B roads within CSZ1, the nearest A road being the A7 located within 3km east. The Siting Zone is bordered by the River Sark to the west and Beck Burn to the east. Scots' Dike scheduled monument (NHLE 1016860 and HES ID SM660) is adjacent to the north. There is an existing National Grid 132 kV overhead line which bisects the Siting Zone from east to west.

6.2.3 CSZ1 is further described in **paragraph 5.6.18** and shown in **Figure 6-1**. The Siting Zone contains two Siting Areas described below:

- Siting Area CSZ1.A: a site 1.9km by 1.1km, approximately 253ha, located 200m east of the River Sark and 3km west of the A7 road. Existing 132 kV overhead lines are routed 200m south of this Siting Area.
- Siting Area CSZ1.B: a site 1km by 0.7km, approximately 69ha, located 40m east of the River Sark and 2.4km east of the A7 road. Existing 132 kV overhead lines are routed 250m north of this Siting Area.

Figure 6-1 – New Carlisle Substation Siting Zone 1 (CSZ1) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.2.4 CSZ1 is within National Character Area 6: Solway Basin, a low-lying landscape framed by upland areas including the Lake District and North Pennines. The Siting Zone is approximately 5km from the nearest designated landscape, the Solway Coast National Landscape, and not considered to be likely to form part of its setting. The Siting Zone predominantly falls within Cumbria Landscape Character Assessment (LCT) Sub-type 5b: Low Farmland, with smaller areas of 2b: Coastal Mosses and 8b: Broad Valleys to the south and southeast respectively. The landscape is characterised by gently undulating farmland, patchy woodland, and a large-scale field pattern, with existing infrastructure, such as pylons and wind turbines, influencing the visual context.

6.2.5 CSZ1.A is situated in a slightly elevated and open landscape, making it more visually prominent within the wider area when compared to CSZ1.B. There is the potential for impacts on visual amenity due to its visibility from approximately ten nearby residential properties and a public right of way (PRoW) that crosses CSZ1.A. The scale of the proposed substation and lack of existing mature vegetation, limits opportunities to effectively mitigate impacts.

6.2.6 In contrast, CSZ1.B is located in a relatively lower-lying position of the Siting Zone with more mature vegetation and woodland nearby, offering a greater degree of containment. Although there would be potential for impacts on visual amenity, including visibility from three nearby residential properties and users of the National Cycle Network (NCN) and surrounding PRoW, the lower lying nature of the Siting Area and proximity to existing woodland means there is opportunity for careful siting that could provide visual containment to help reduce impacts. The presence of wind turbines and pylons in the wider landscape reduces the susceptibility of the landscape character to change. Careful siting and design of the proposed substation and development of mitigation planting would reduce impacts on landscape character and visual amenity within CSZ1.B.

6.2.7 Overhead line infrastructure is present in the wider landscape setting of CSZ1, which reduces the sensitivity of the landscape and there are limited visual receptors. CSZ1.B is considered preferable to CSZ1.A as it is in a less prominent, lower-lying position with greater opportunities to mitigate landscape and visual impacts, including from the northern edge of Longtown, by use of landform and existing vegetation.

Historic Environment

6.2.8 There are no designated heritage assets within CSZ1.A, however, several designated assets are located nearby. The nearest designated asset is the Scots' Dike scheduled monument, which is located approximately 100m to the north of CSZ1.A and was constructed to settle disputes over a short section of the Anglo-Scottish border. If CSZ1.A was selected as preferred, detailed assessment would take place at a later stage to determine how the setting of the Scots' Dike scheduled monument contributes to the monument's significance. On a precautionary basis, there is potential for impacts on the setting of the monument, particularly from southern viewpoints where a proposed substation may partially obscure views of the monument or the woodland surrounding it. The potential for any screen planting associated with a substation to further obscure or detract from the prominence of the woodland that now flanks the monument has the

potential to further impact the setting of the monument. Access to CSZ1.A may require crossing the Category C listed Corries Mill Bridge in Scotland, which could necessitate structural upgrades and result in physical impacts. No physical impacts or impact on setting are expected on the Hadrian's Wall WHS or its Outstanding Universal Value (OUV) due to the distance (located over 11km south) and the intervening topography and vegetation. Physical impacts on potential non-designated archaeological assets within the Siting Area are assumed to be manageable through standard archaeological mitigation measures.

6.2.9 The nearest high value asset to CSZ1.B is the Scots' Dike scheduled monument, located over 2km north. The distance, combined with topographical features, limits the potential for impacts on the monument's setting. The nearest designated asset to CSZ1.B is the Corries Mill Bridge in Scotland which is approximately 200m to the north-west. Access to the Siting Area may involve crossing the Corries Mill Bridge, with potential for physical impacts. Any impacts on potential non-designated archaeological assets are assumed to be mitigable through standard archaeological mitigation measures. As with CSZ1.A, no physical or setting impacts are expected on the Hadrian's Wall WHS.

6.2.10 Overall, within CSZ1, CSZ1.B is preferable to CSZ1.A, due to the proximity of CSZ1.A to the Scots' Dike scheduled monument. Neither Siting Area is considered likely to impact Hadrian's Wall WHS due to the separation distance. There would be potential impacts on the designated Corries Mill Bridge in Scotland from both Siting Areas. The potential for undesignated heritage assets to be present is also similar for both Siting Areas and therefore is not a differentiating factor between the two.

Ecology

6.2.11 CSZ1 lies within multiple Site of Special Scientific Interest (SSSI) Impact Risk Zones (IRZ) associated with the Solway Firth SSSI. It is also in proximity to several designated ecological sites, including the Solway Firth Ramsar, SAC, SPA, and SSSI (approximately 8km south-west), Greenwrae Flow Local Nature Conservation Site (LNCS) (400m west), and Scots' Dike Plantation ancient woodland (200m north). A network of priority habitats and ancient woodland overlaps with the southeastern edge of the Siting Zone but not the Siting Areas. Habitats likely present include arable field margins, hedgerows, watercourses, and individual trees, with potential for protected species such as badgers, bats, birds, great crested newts, otters, water voles, and reptiles.

6.2.12 The ecological appraisal for CSZ1.A and CSZ1.B reveals broadly similar potential impacts, however, there are some differences in relation to the proximity to sensitive habitats and the scale of potential impacts. Both Siting Areas would experience impacts from habitat loss, fragmentation, and degradation due to construction-related activities such as noise, lighting, and pollution. Both Siting Areas contain drainage ditches that may serve as tributaries to the Beck Burn, with potential to support protected species.

6.2.13 At this stage it is anticipated that impacts on protected and notable species, habitats, and designated sites could be mitigated. Both Siting Areas fall within IRZs which would require engagement with Natural England and NatureScot. Furthermore, priority habitat and ancient woodland to the south, east, and north, could constrain overhead line routing for both Siting Areas.

Other Environmental Considerations

6.2.14 Water, geology and soils were also considered as part of the options appraisal.

6.2.15 All of CSZ1 is located within Flood Zone 1 indicating a low probability of flooding. While each of the Siting Areas is in close proximity to surface waterbodies, neither are considered to be significantly constrained, potential impacts are considered to be mitigable following standard practices.

6.2.16 The underlying geology and soils within CSZ1 do not significantly vary. Peat and peaty soils are potentially present in both Siting Areas and would be avoided where practicable.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.2.17 There are various parts of CSZ1, which are identified as Mineral Safeguarding Areas (MSAs) and Mineral Consultation Areas (MCA)[40], including sections within CSZ1.A and CSZ1.B. While it is preferable to avoid these areas as far as possible, they would not be determining factors of the appraisal of the development of a new substation in CSZ1. Careful routeing and siting may avoid direct impacts and indirect impacts to these features.

6.2.18 All of the agricultural land within this Siting Zone is designated as ALC Grade 3, the extent of BMV (Grade 3a) is not known at this stage and ALC or BMV are therefore not key differentiating factors.

6.2.19 There are a small number of other proposed agricultural and energy developments in the wider vicinity of CSZ1. None of these nearby developments are a determining factor in the appraisal of the development of a new substation in CSZ1.A or CSZ1.B although they may result in cumulative impacts.

Aviation and Defence

6.2.20 Both CSZ1.A and CSZ1.B are located within the MoD Tactical Training Area (TTA) 20T, which is used for low flying training between 100 and 250 feet (30 and 76m). There is the potential for some disturbance of low flying activities during construction. However, this is not considered a determining factor in the appraisal as National Grid would engage with the MoD should this option be taken forward, to ensure that impacts were appropriately mitigated.

6.2.21 Additionally, as CSZ1.A and CSZ1.B are located outside the defined 2km hazard area for MoD Longtown[41] (4.5km and 3km north, respectively) no potential impacts would be expected.

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[40] Cumbria (now Cumberland) Council (2017) Cumbria Minerals and Waste Local Plan 2015-2030. [online] Available at: https://www.cumberland.gov.uk/sites/default/files/2025-02/cumbria_minerals_and_waste_local_plan_-_2015_to_2030.pdf

[41] Guidance prepared by Cumberland Council (available at: https://www.cumberland.gov.uk/sites/default/files/2025-03/mod_longtown_warning_and_informing_leaflet.pdf) identifies a hazard area around the MoD Longtown, which extends by 2km from the centre of the site.

Traffic and Transport

6.2.22 One un-named unclassified road crosses CSZ1.A, which is also bound by two un-named roads. There is an unclassified road (namely UC1) to the south and an unclassified road (namely UC2) to the west. CSZ1.B is bounded by two un-named roads. There is a C road to the east and an unclassified road to the south. None of the roads that cross and or are adjacent to the Siting Areas have footways, and none are bus routes.

6.2.23 NCN Route 7 is to the south of CSZ1.A and to the north, east and west of CSZ1.B. The C road to the east of CSZ1.B is part of NCN Route 7. Whilst there would be some impacts on users of NCN7 and other recreational routes, including Public Footpath 122011, during construction and potentially operation, these are considered to be mitigable and are therefore not a determining factor in the appraisal of a new substation within CSZ1.

6.2.24 The nearest A road to CSZ1 is the A7, located approximately 3km to the east/south east of the Siting Zone, vehicular access would likely be via UC1. Overall, it is expected that road improvement works to minor roads may be required to accommodate the size of vehicles required to transport equipment to the substation. The 90-degree double bend on UC1 would require traffic management to enable access.

Engineering and Systems Appraisal Summary

6.2.25 There are a number of existing assets within CSZ1 including overhead lines and underground pipelines. While there is an existing 132 kV line that runs through the centre of CSZ1 towards Gretna substation, it is not located within the Siting Areas. The existing 132 kV line although, not considered to be a determining factor for the siting of a substation, would likely constrain new overhead line routes connecting to the new substation. Similarly, the existing North West Ethylene Pipeline (NWEP) runs through the centre of CSZ1, but not within either Siting Areas. It is not considered to be a constraint to the siting of the substation but may be a constraint to new overhead line routes to/from the new substation. An existing DNO overhead line is routed through CSZ1.A that would require a diversion to enable construction of a new substation. There is no existing infrastructure located within CSZ1.B.

6.2.26 Underlying ground conditions comprise glacial material, which have the potential to be variable in terms of composition, thickness and strength and may include localised soft spots and less favourable ground including peat, alluvium and alluvial materials that may require treatment or removal and replacement. While this would be a design consideration if CSZ1 was selected as preferred, it is not a determining factor in the appraisal of a substation within the Siting Zone.

Horlock Rules

6.2.27 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.2.28 At this early stage of development **Horlock Rules 7, 9, 10** and **11** are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.2.29 In the context of the appraisal of CSZ1 and the Siting Areas within it (CSZ1.A and CSZ1.B), the Horlock Rules have been considered as follows:

- Consideration of Environmental Features (**Horlock Rule 1**): The definition of the Siting Areas has taken into account environmental features, such as designated heritage assets, ecological designations, and landscape character, and the potential impacts on them.
- Avoidance of Areas of Highest Amenity Value (**Horlock Rules 2** and **3**): Both CSZ1.A and CSZ1.B have been defined to avoid areas of highest amenity value, including designated landscapes and key heritage assets. However, CSZ1.A is located in proximity (100m) to the Scots' Dike scheduled monument, and there is potential for impacts on the settings of this monument resulting from the introduction of a substation within this site. CSZ1.B is located further from the Scots' Dike scheduled monument, reducing the potential for impacts on its setting.
- Opportunities for Siting and Impact Reduction (**Horlock Rules 4** and **5**): Sufficient space is available within both Siting Areas to enable siting of the substation infrastructure. This facilitates avoidance of specific environmental and socio-economic constraints, such as proximity to residential receptors or sensitive habitats, and allows for the incorporation of mitigation measures such as planting and screening.
- Use of Existing Screening Features (**Horlock Rule 4**): CSZ1.B benefits from proximity to some existing mature vegetation and woodland, which can be used to partially visually contain the development and reduce its prominence in the wider landscape. This aligns with the Horlock principle of using natural features to minimise visual intrusion.
- Minimising Effects on Agricultural Land and Drainage (**Horlock Rule 6**): Both Siting Areas are predominantly located on agricultural land and all land is ALC Grade 3. The impact on BMV agricultural land is considered using publicly available provisional data on ALC (no subgrades or survey data) only, and will be assessed at later project stages. The Siting Zone is located within Flood Zone 1 with a low probability of flooding, potential drainage impact would be mitigatable with standard practice.

Summary of Appraisal of Siting Zone 1

Environmental

6.2.30 The key environmental factors influencing the appraisal of CSZ1 are predominantly landscape and visual amenity as well as historic environment considerations. There is the potential for development within CSZ1 to result in setting impacts to the Scots' Dike scheduled monument due to proximity. CSZ1.B has a slightly increased distance from Scots' Dike scheduled monument and is surrounded by a landscape already containing energy infrastructure. There would be potential for impacts on the designated Corries Mill Bridge in Scotland from both Siting Areas CSZ1.A and CSZ1.B. Therefore, potential setting impacts to Scots' Dike are considered a determining factor in the siting of a substation in CSZ1.

Socio-economic

6.2.31 The socio-economic appraisal did not identify any constraints that were differentiating factors and potential impacts are considered to be mitigable.

Engineering and Systems

6.2.32 The main engineering factors influencing the appraisal of CSZ1 relate to existing utilities. These include an existing DNO overhead line which bisects CSZ1 west to east and the NWEP, which is routed through the Siting Zone north to south. These constraints are likely to be avoidable in siting a new substation, however, the existing overhead line is likely to be a constraint on new overhead lines connecting to a substation in CSZ1.

6.3 New Carlisle Substation Siting Zone 2

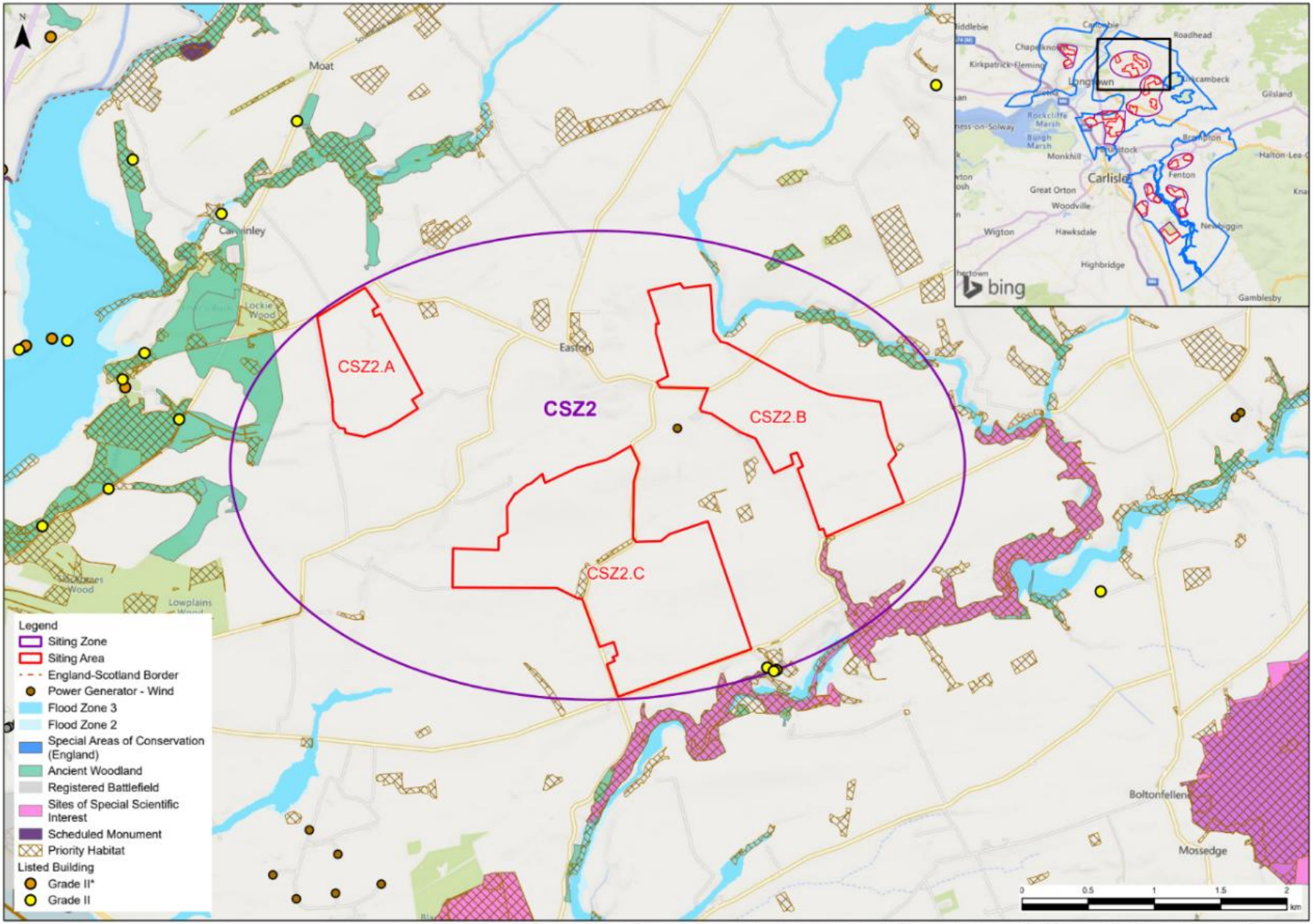
6.3.1 CSZ2 is a substation Siting Zone located to the north of Carlisle (Option A).

6.3.2 CSZ2 occupies an area of approximately 1,530ha located 2.2km north-east of Longtown and surrounding the hamlet of Easton. There are various clusters of residential properties scattered throughout CSZ2. There are no A or B roads within CSZ2, the nearest A road being the A7 located 2km west. The Siting Zone is surrounded by ancient woodland to the south-east and north-west, some of which is the Lynn Woods SSSI, which is present partially within and adjacent to the south-eastern boundary. There are multiple existing DNO overhead lines throughout the Siting Zone, each Siting Area is intersected by at least one of these lines.

6.3.3 CSZ2 is described in **paragraph 5.6.19** and shown in **Figure 6-2**. The Siting Zone contains three Siting Areas described below:

- Siting Area CSZ2.A: a site 0.6km by 1km, approximately 55ha, located 700m east of Netherby Road, 1km west of Easton, and 1.3km east of the River Esk. An existing DNO overhead line bisects the northern corner of this Siting Area.
- Siting Area CSZ2.B: a site 0.5km by 2.2km, approximately 139ha, located 600m east of Easton, 700m north of the River Lyne, with multiple DNO overhead lines intersecting through the centre. Lyne Woods SSSI is adjacent to the south of the Siting Area boundary. This Siting Area is also intersected by an unclassified road in the northern quarter.
- Siting Area CSZ2.C: a site 1.9km by 1.7km, approximately 196ha, located 400m north of the River Lyne. Lyne Woods SSSI is adjacent to the south of the Siting Area boundary. This Siting Area is also intersected by an unclassified road in the centre.

Figure 6-2 – New Carlisle Substation Siting Zone 2 (CSZ2) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.3.4 CSZ2 is located within National Character Area 6: Solway Basin, a low-lying landscape defined by gently undulating hills that transition into the coastal plain and estuarine environment of the Solway Firth. The Siting Zone is framed by the uplands of the Lake District, the North Pennines, and southern Scotland. The majority of CSZ1 falls within Cumbria Landscape Character Assessment LCT Sub-type 5b: Low Farmland with small areas of the Siting Zones extend into LCT Sub-type 8b: Broad Valleys (north-western) and LCT Sub-type 6: Intermediate Farmland (north-eastern). There are no designated landscape sites located within CSZ1, the Siting Zone is approximately 8km from the nearest designated landscape, the Solway Coast National Landscape, and not considered likely to form part of its setting.

6.3.5 CSZ2.A is located in a relatively open and elevated position, with limited containment and mature vegetation only to the west. It is likely to result in significant impacts on both landscape character and visual amenity, particularly for nearby residential receptors, including three located along the boundary. CSZ2.B spans a more varied topography compared to CSZ2.A; there is a ridgeline on the northern boundary with a locally distinctive tree line, which is a focal point, and on which impacts could be difficult to mitigate. The southern part is enclosed but still sensitive due to proximity to residential properties, including six on or close to the Siting Area boundary and PRoW. CSZ2.C is more visually contained, occupying a lower-lying position with mature vegetation along its boundaries, including Dry Beck and a distinctive row of trees. Approximately five residential properties are located adjacent to CSZ2.C and would experience foreground views towards it. This area offers greater potential for mitigation, provided that key vegetation is retained and the substation is carefully sited.

6.3.6 Overall, CSZ2.A is the most constrained in terms of landscape and visual impact due to its open character, undulating topography, and limited mitigation potential. CSZ2.B presents a split scenario: the northern part is unsuitable due to its distinctive ridgeline, while the southern part has opportunity to mitigate impacts on the two adjacent properties on higher ground with mitigation planting. Therefore CSZ2.C, although sensitive, benefits from containment and greater opportunity for mitigation.

Historic Environment

6.3.7 There are no designated heritage assets within CSZ2, the Siting Zone would potentially physically impact non-designated or previously unrecorded archaeological assets within the footprint of the proposed works during construction. These impacts would be capable of mitigation through standard archaeological measures such as excavation, recording, and watching briefs.

6.3.8 The nearest designated assets to CSZ2.A consist of listed buildings located to the northwest, including the Grade II* listed Netherby Hall and associated Grade II listed structures such as the Coachman’s House and Stables, Ice House, and East Lodge. These assets are located between approximately 1.2km and 1.6km from the Siting Area. The presence of mature woodland, local topography, and the orientation of Netherby Hall towards the River Esk are likely to limit the potential for impacts on the setting of the hall and associated structures.

6.3.9 The nearest designated assets to CSZ2.B are at least 1km from the Siting Area boundary, these include the Grade II* listed Brackenhill Tower and Brackenhill Farmhouse with associated features. The orientation of the listed buildings away from the Siting Area towards the River Lyne, as well as screening from the Siting Area by mature woodland and topography, would suggest the potential for impacts on their setting is limited.

6.3.10 The nearest designated assets to CSZ2.C are approximately 200m to the south and consist of the Grade II* listed Brackenhill Tower and associated Grade II listed buildings. An initial review would suggest that while these assets are located overlooking the River Lyne to the south, there is potential for extensive views of a substation from the complex when looking north, and when approaching from the north. This introduces the potential for impacts on the setting of designated assets compared to the other Siting Areas. Although these could potentially be reduced through careful siting of the substation in the northern part of the Siting Area and through mitigation planting.

6.3.11 The Hadrian's Wall WHS buffer lies approximately 8km from CSZ2.A (11.1km from the from the nearest scheduled component), 6.8km from CSZ2.B (9.3km from the nearest scheduled component), and 5.8km from CSZ2.C (8.7km from the nearest scheduled component). In all cases, no physical or setting impacts on the WHS or its OUV are anticipated due to the distance, intervening topography, and existing vegetation.

6.3.12 Further detailed assessment would take place if any of the Siting Areas within CSZ2 were selected at a later stage of the Proposed Development to determine how the setting contributes to the significance of the listed buildings. Overall, the potential for impacts on the setting of designated assets from CSZ2.A and CSZ2.B is limited and manageable. In contrast, CSZ2.C represents a more constrained option due to its proximity to the Grade II* listed Brackenhill Tower associate assets, and the potential for impacts on its setting.

Ecology

6.3.13 CSZ2 lies in proximity to several designated ecological sites, the Solway Firth Ramsar, SAC, SPA, and SSSI is located approximately 8km to the south-west. Lyne Woods SSSI borders CSZ2.B and lies approximately 90m south of CSZ2.C. CSZ2.B and CSZ2.C fall within a SSSI IRZ requiring engagement with Natural England on proposals including overhead lines.

6.3.14 CSZ2.A, CSZ2.B and CSZ2.C present potential ecological impacts including direct habitat loss and fragmentation of predominantly arable land, field margins, grassland, intact hedgerows, and individual trees. Habitats likely to be present across the Siting Areas include arable field margins, hedgerows, trees, deciduous woodland, and watercourses. Additional impacts may arise from habitat degradation due to airborne or waterborne pollution, and disturbance to species from noise, lighting, and vibration during construction.

6.3.15 While direct impacts on ancient woodland are unlikely, the presence of ancient woodland parcels to the north-east and west of CSZ2.A, such as Carwinley and Wisk Woods (also a Local Nature Reserve) and Cistern Wood, may constrain the routing of an overhead line connection into a new substation. The Solway Firth SPA, SAC, Ramsar Site, and SSSI is located 9km from CSZ2.A. There is potential for indirect impacts when considering the siting of a substation in this Siting Area, particularly through disturbance to birds (qualifying feature), waterborne pollution, and habitat loss

of functionally linked land, and mortality or injury due to bird strike into overhead line during operation.

6.3.16 CSZ2.B contains a drainage ditch, likely a tributary of Dry Beck, and lies immediately adjacent to Hobbie's Beck, both of which may support protected and notable species. CSZ2.B is also within 10m of Lyne Woods SSSI and falls within its IRZ, and engagement with Natural England would be required. As with CSZ2.A, there is potential for indirect impacts on the Solway Firth SPA, SAC, Ramsar Site, and SSSI located 11km from the Siting Area, though direct impacts are unlikely due to the distance.

6.3.17 CSZ2.C is ecologically sensitive due to the presence of a continuous band of priority deciduous woodland that runs in an east-west orientation across the Siting Area. The line of trees connects to Lyne Woods SSSI, located less than 100m to the south of the CSZ2.C. While the trees within the Siting Area are not part of the SSSI designation, they have potential to support features designated as part of the SSSI. Removal of these trees would fragment habitat connectivity. As with the other Siting Areas, there is also potential for indirect impacts on the Solway Firth SPA, SAC, Ramsar Site, and SSSI.

6.3.18 Overall, CSZ2.A would be preferable from an ecological perspective, as it is considered to present a lower ecological risk relative to the other options within this Siting Zone. CSZ2.A is the only Siting Area that is not located within close proximity to Lyne Woods SSSI or its IRZ and is therefore less likely to impact these sites. In contrast, CSZ2.B and CSZ2.C are more constrained due to their proximity to Lyne Woods. CSZ2.C is the most constrained option due to the additional presence of priority and non-priority woodland.

Other Environmental Considerations

6.3.19 Water, geology and soils were also considered as part of the options appraisal.

6.3.20 All CSZ2 Siting Areas lie within Flood Zone 1 indicating a low probability of flooding. While each of the Siting Areas is in close proximity to surface waterbodies none are considered to be significantly constrained. Potential impacts are considered to be mitigable following standard practices. CSZ2 is underlain by Principal aquifers, considered high importance receptors. While no public water supply abstractions are present, mitigation would be required to prevent contamination. Residual impacts would be expected to be slight and not significant. A spring in CSZ2.A is a high-value receptor. Development would avoid this feature or reinstate it based on ground investigation to maintain hydrological function. A small reservoir in CSZ2.C would require further investigation if this option is taken forward.

6.3.21 The underlying geology and soils within CSZ2 are locally variable. No specific constraints were identified for CSZ2.A at this stage. Peat/peaty soils are present in the centre of CSZ2.B and on the north-eastern boundary of the CSZ2.C. Peat can cause instability and settlement issues due to high compressibility and a variable moisture content and its presence is considered a constraint to development. Where peat is confirmed, efforts would be made to avoid or manage it and minimise disturbance to protect identified carbon sinks. Further investigation into the distribution of peat would be required if CSZ2.B was selected as preferred, although ground investigation would still be recommended at all sites. The presence of peat in CSZ2.B presents a constraint as it would be harder to avoid compared to CSZ2.C. Although it is not considered to be a determining factor in the siting of a new substation at this stage, CSZ2.B would be the least preferable.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.3.22 There are various parts of CSZ2 identified as MSAs, including areas within CSZ2.B and CSZ2.C, which are also within an MCA[40]. While it is preferable to avoid these areas as far as possible, they would not be considered a determining factor in the siting of a new substation in CSZ2. Depending on the alignment of the construction and access routes, there is the potential for a substation within CSZ2.A to impact the MSA, it is expected that careful siting of the infrastructure would be sufficient to avoid such impact.

6.3.23 All of the agricultural land within this Siting Zone is designated as ALC Grade 3, the extent of BMV (Grade 3a) is not known at this stage and ALC or BMV are therefore not key differentiating factors.

Aviation and Defence

6.3.24 The entirety of CSZ2 is located within the MoD TTA 20T which is used for low flying training between 100 and 250 feet (30 and 76m). There is the potential for some disturbance of low flying activities during construction, however, this is not considered to be a determining factor in the siting of a substation. National Grid would engage with the MoD should this option be taken forward to ensure that impacts are appropriately mitigated.

6.3.25 As CSZ2.A, CSZ2.B, and CSZ2.C are located outside the defined 2km hazard area for MoD Longtown[41] (5km, 7km and 5km, respectively), no potential impacts would be expected.

Traffic and Transport

6.3.26 There are two transport receptors that cross CSZ2.B (Public Footpath 101006 and an un-named C road) and two which cross CSZ2.C (Footpath 101010 and an un-named C road). CSZ2.A is not crossed by any transport receptors.

6.3.27 The A7, located approximately 3km to the west of CSZ2, is the nearest A road. Vehicular access to the Siting Areas would therefore be limited in this location. Road improvement works to minor roads may be required to accommodate the size of vehicles required to transport equipment to the substation.

Engineering and Systems Appraisal Summary

6.3.28 Existing infrastructure located in CSZ2.A, CSZ2.B and CSZ2.C comprises of DNO overhead lines, diversions are likely to be required to allow construction to proceed if a substation is sited in any of these areas.

6.3.29 CSZ2 is largely covered by glacial deposits, predominantly glacial till with some localised areas of glaciofluvial deposits (primarily in CSZ2.B) and some alluvium, such as that identified towards the northern half of CSZ2.C may require treatment or removal and replacement. Localised areas of peat and peaty soils particularly within the centre of CSZ2.B are also identified. While this would be a design consideration if CSZ2 was selected, it is not considered to be a determining factor in the siting of a substation.

6.3.30 There are former surface mineral workings and possible subsurface workings identified at the south-eastern corner of CSZ2.A. The surface workings appear to still be present with some evidence of former underground workings. The extent, distribution and condition of any potential subsurface workings is not known, and additional investigation and assessment would be required.

Horlock Rules

6.3.31 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.3.32 At this early stage of development Horlock Rules 7, 9, 10 and 11 are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.3.33 The appraisal of CSZ2 and the Siting Areas within it (CSZ2.A, CSZ2.B, and CSZ2.C) has been undertaken with reference to the Horlock Rules, as outlined below:

- Consideration of Environmental Features (Horlock Rule 1): The definition of the Siting Areas has taken into account environmental features such as designated heritage assets, ecological designations (e.g. Lyne Woods SSSI), and landscape character. Potential impacts on these features have been identified and considered in the comparative appraisal of Siting Areas.
- Avoidance of Areas of Highest Amenity Value (Horlock Rules 2 and 3): All Siting Areas have been defined to avoid areas of highest amenity value, including designated landscapes and the Hadrian's Wall WHS. While CSZ2.C is closer to Brackenhill Tower (Grade II*), the appraisal recognises this and identifies potential opportunities for mitigation through careful siting and planting. CSZ2.B and CSZ2.A are located further from designated heritage assets and are therefore less sensitive in this regard.
- Opportunities for Siting and Impact Reduction (Horlock Rules 4 and 5): Each Siting Area offers sufficient space to allow for siting of the substation infrastructure. The ability to refine the substation footprint at later stages supports the reduction of environmental and socio-economic impacts.
- Use of Existing Screening Features (Horlock Rule 4): CSZ2.B and CSZ2.C benefit from the presence of mature woodland and vegetation, which offer opportunities for visual containment and screening. These features can be integrated into the design to reduce visual intrusion and landscape impacts. In contrast, CSZ2.A is more open and elevated, with limited screening potential, making it less favourable in terms of visual mitigation.
- Minimising Effects on Agricultural Land and Drainage (Horlock Rule 6): All Siting Areas are predominantly located on agricultural land and all land is ALC Grade 3. The impact on BMV agricultural land is considered using publicly available provisional data on ALC (no subgrades or survey data) only, and will be assessed at later project stages. The appraisal also considers potential impacts on drainage and watercourses, particularly in CSZ2.A and CSZ2.C, where consideration would be required to manage the reservoir and spring.

Summary of Appraisal of Siting Zone 2

Environmental

6.3.34 The key environmental factors influencing the appraisal of CSZ2 are predominantly landscape and visual amenity, historic environment and ecology considerations. There are conflicting opportunities and constraints across CSZ2, for example, CSZ2.A is the furthest from designated ecological sites yet is situated in a relatively open and elevated position, with limited containment and poor screening opportunity to mitigate visual impacts. CSZ2.B may provide the best opportunity to site a substation despite the proximity to Lyne Woods SSSI, as the south of the Siting Area features suitable conditions to mitigate visual amenity impacts to nearby residential properties. Siting Area CSZ2.C is least preferred from a historic environment perspective due to the potential setting impacts to the Grade II* listed Brackenhill Tower and associated Grade II listed buildings. While other factors were considered these did not highlight any major siting constraints or impacts which would be considered a determining factor in the siting of a substation in CSZ2.

Socio-economic

6.3.35 The socio-economic appraisal did not identify any constraints that were differentiating factors and potential impacts are considered to be mitigable.

Engineering and Systems

6.3.36 The main engineering factors influencing the appraisal of CSZ2 include existing utilities and mine infrastructure. The various DNO overhead lines throughout each Siting Area would likely require diversions to facilitate construction. There are former surface mineral workings and possible subsurface workings identified in CSZ2.A, the extent and condition of which is unknown. There are no engineering constraints which would be considered a determining factor in the siting of a substation in either CSZ2.B or CSZ2.C.

6.4 New Carlisle Substation Siting Zone 3

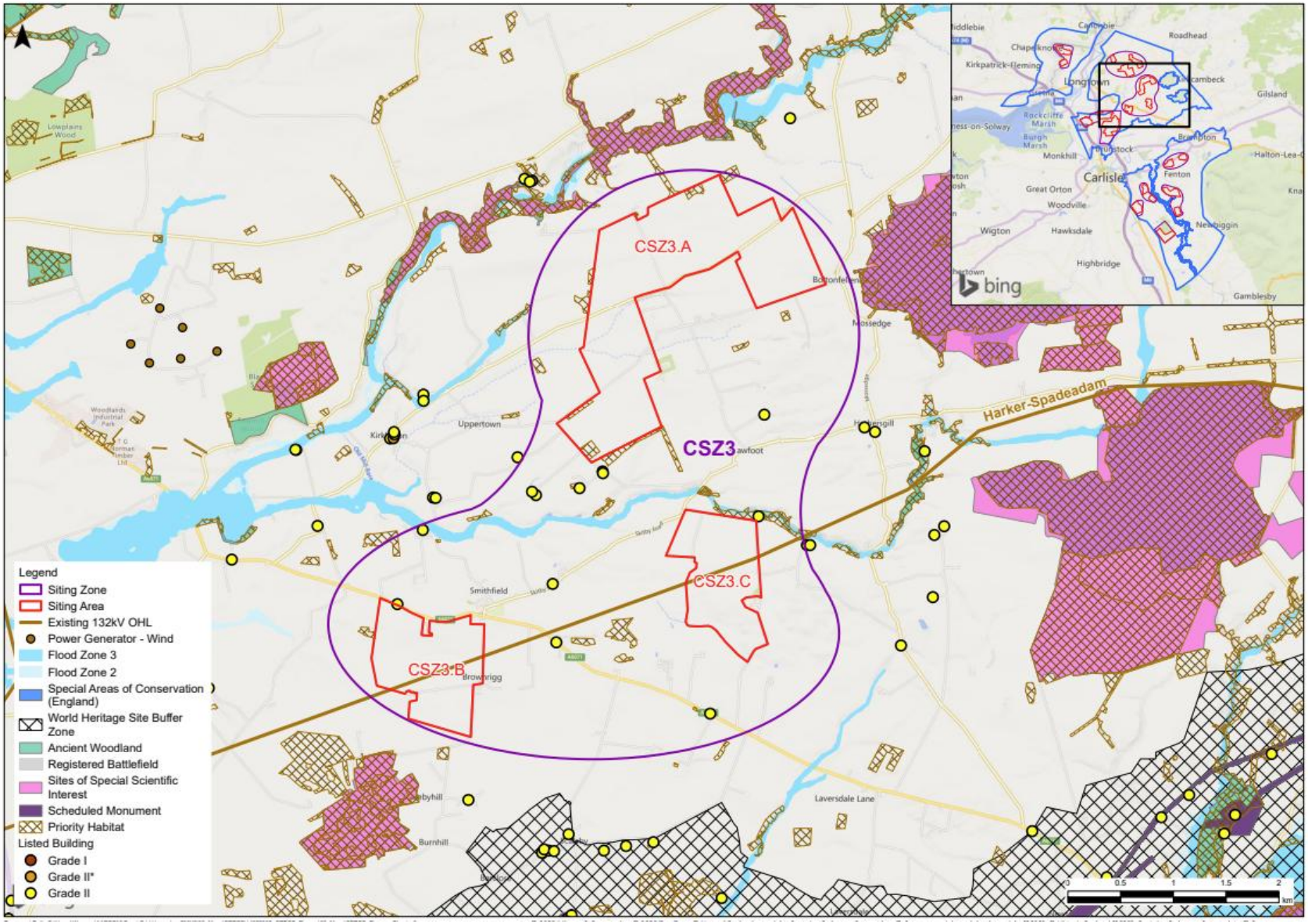
6.4.1 CSZ3 is a substation Siting Zone located to the north of Carlisle (Option A).

6.4.2 CSZ3 occupies an area of approximately 1,810ha, located 5km south-east of Longtown and 6.6km north of Carlisle, encompassing the village of Smithfield and adjacent to the west of Hethersgill. The are various agricultural farms scattered throughout CSZ3, as well as residential properties, which are predominantly within Smithfield and along Skitby Road. The A6071 road bisects the south of CSZ3, with various unclassified roads throughout. The Siting Zone is bordered by Lyne Woods SSSI to the north, with Bolton Fell and Walton Mosses SSSI, SAC and NNR to the north-east, and Scaleby Moss SSSI and Hadrian's Wall WHS 3.3km to the south (buffer located 400m south). There is an existing National Grid 132 kV overhead line which bisects CSZ3 from east to west and multiple existing DNO overhead lines throughout, each Siting Area is intersected by at least one of these lines.

6.4.3 CSZ3 is described in **paragraph 5.6.20** and shown in **Figure 6-3**. The Siting Zone contains three Siting Areas described below:

- Siting Area CSZ3.A: a site 2.6km by 2km, approximately 246ha, located 500m south of the River Lyne and 1.7km north of the A6071 road. An existing DNO overhead line intersects through the middle and to the north of this Siting Area.
- Siting Area CSZ3.B: a site 1km by 1km, approximately 92ha. The A6071 is adjacent to the north boundary of this Siting Area. This Siting Area is intersected through the middle by both an existing DNO overhead line and a National Grid 132 kV overhead line.
- Siting Area CSZ3.C: a site 0.9km by 1.3km, approximately 84ha, located 700m north of the A6071. Skytby Road is adjacent to the north-west boundary of this area. This Siting Area is intersected through the middle by both existing DNO overhead line and the National Grid 132 kV overhead line.

Figure 6-3 – New Carlisle Substation Siting Zone 3 (CSZ3) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.4.4 CSZ3 lies within National Character Area 6: Solway Basin, a gently undulating lowland landscape framed by upland areas. The entire zone falls within Cumbria Landscape Character Assessment Sub-type 5b: Low Farmland, which is characterised by a rolling pastoral landscape, large field patterns, and a mixture of hedgerows, hedgerow trees, and scattered woodland. No designated landscape sites are present within CSZ3, the nearest designated landscape, the Solway Coast National Landscape, is located 7km west. CSZ3 is not considered likely to form part of the Solway Coast setting, or the setting of the North Pennines National Landscape which is located 10km to the south-east at its closest point.

6.4.5 There are numerous PRoW within and around the Siting Areas, including routes on higher ground to the north, northeast, and southeast of CSZ3.A, and across or adjacent to CSZ3.B and CSZ3.C. These routes contribute to the visual sensitivity of the landscape, particularly where views are elevated or open. The presence of pylons and wind turbines in the wider landscape around CSZ3.C provides some visual context for energy infrastructure.

6.4.6 CSZ3.C is considered slightly preferable in terms of landscape character and visual amenity. The area benefits from a relatively lower-lying position, a larger-scale field pattern, and a degree of visual containment provided by landform and mature vegetation. Only two residential properties are located adjacent to the CSZ3.C, and the presence of existing energy infrastructure reduces the susceptibility of the landscape to change. With careful siting and mitigation planting, significant long-term impacts could be limited.

6.4.7 CSZ3.A and CSZ3.B are less favourable compared to CSZ3.C. CSZ3.A includes open and elevated land in the northeast and southeast, and a smaller-scale field pattern in the south. The area is visually sensitive due to the presence of approximately ten adjacent residential properties and several PRoW. CSZ3.B is similarly constrained, with Alstonby Beck and associated vegetation running through the centre, and around fourteen residential properties nearby. The rising landform and smaller-scale landscape pattern in both areas limit opportunities for effective mitigation, and significant long-term impacts on landscape character and visual amenity are likely.

Historic Environment

6.4.8 A number of designated assets have been identified within CSZ3, all of which are Grade II listed buildings. Most of these are farmsteads or other private dwellings and include groupings to the north of Skitby Road near the centre of CSZ3, as well as assets along the A6071. None of the designated assets are within any of the Siting Areas. There would be no physical impacts on designated assets throughout the Siting Areas, any impacts on non-designated archaeological assets are assumed to be mitigable through standard archaeological mitigation measures.

6.4.9 The designated assets nearest CSZ3.A are in two groupings with the Grade II* Brackenhill Tower and associated Grade II listed buildings 800m to the northwest, and the Kirklington Park complex including lodge and other associated buildings (all of which are Grade II listed) between 250m and 600m to the southwest. Due to the relatively large and varied landscape covered by CSZ3.A, the potential for impacts on the setting

of the designated heritage assets would depend on where within the Siting Area the substation is located. A substation in the north-west would have the potential to result in impacts on the setting of Brackenhill Tower and associated listed buildings, while a substation in the south-west would have the potential to result in impacts on the setting of several Grade II listed buildings, including Kirklington Park Lodge and associated structures, although existing screening might limit the potential for setting impacts. In contrast, the north-east of CSZ3.A is more distant from heritage assets and benefits from better screening. No physical impacts or impact on setting are expected on the Hadrian's Wall WHS or its OUV due to the significant distance (at least 3km from the WHS buffer, and 5.5km from the nearest scheduled component) and intervening topography and vegetation.

6.4.10 The nearest designated asset to CSZ3.B is a Grade II listed milestone located on the A6071, which forms the northern boundary of the Siting Area. As the milestone's setting is defined by the road itself, and no changes to the road would be expected, impacts on its setting are expected to be limited. Other designated assets in the surroundings are largely limited to Grade II listed buildings with small groupings on Skitby Road to the northeast and Scaleby to the south. Further assessment would be required if CSZ3.B was selected at a later stage of the Proposed Development to determine how the setting contributes to the significance of the listed buildings. However, based on current information, impacts on setting would be reduced as a result of existing screening provided by trees/vegetation, topography, and the built environment. No physical impacts or impact on setting are expected on the Hadrian's Wall WHS or its OUV due to the distance between the Siting Area and the WHS (at least 1km from the WHS buffer, and 3.5km from the nearest scheduled component), as well as intervening topography and vegetation.

6.4.11 CSZ3.C is located near several Grade II listed buildings, including Quarrybrow and Anguswell, which are approximately 50m and 500m away respectively. These assets are generally screened by farm buildings and mature vegetation, but the loss of surrounding agricultural land could still result in impacts on their setting. While impacts on setting are possible, they may be partially reduced through supplementary planting and careful siting of infrastructure. No physical impacts or impact on setting are expected on the Hadrian's Wall WHS or its OUV due to distance (at least 1.3km from the WHS buffer, and 3.5km from the nearest scheduled component), and intervening topography and vegetation.

6.4.12 Overall, CSZ3.B has the least potential to result in impacts on the setting of designated assets. CSZ3.A and CSZ3.C are located closer to designated assets therefore increasing the potential for impacts on the setting of nearby listed buildings. Although both CSZ3.B and CSZ3.C are closest to the WHS buffer, neither are considered likely to impact Hadrian's Wall WHS, or attributes of its OUV.

Ecology

6.4.13 CSZ3 is located (and likely ecologically connected) to two internationally designated ecological sites: Bolton Fell Moss SAC and Walton Moss SAC, and several nationally designated ecological sites, including Bolton Fell Moss National Nature Reserve, Bolton Fell and Walton Mosses SSSI, Scaleby Moss SSSI, and Lyne Woods SSSI. The entire of CSZ3 falls within the IRZs of these SSSIs, which would necessitate engagement with Natural England. CSZ3.A lies approximately 300m from Bolton Fell Moss SAC and Bolton Fell and Walton Mosses NNR and SSSI and is directly adjacent to Lyne Woods SSSI, while CSZ3.B is around 400m from Scaleby Moss and 5km from Bolton Fell and

Walton Mosses. CSZ3.C is situated between CSZ3.A and CSZ3.B, lying approximately 2km from Bolton Fell and Walton Mosses and 2.9km from Scaleby Moss. The wider landscape includes arable land, hedgerows, watercourses, and scattered trees, with several watercourses, including Longcleughside Beck and Alstonby Beck, traversing CSZ3.A and CSZ3.B respectively and offering potential habitat for protected and notable species.

6.4.14 CSZ3.A, CSZ3.B, and CSZ3.C contain water features that may influence ecological sensitivity. CSZ3.A and CSZ3.B each contain two watercourses, including Longcleughside Beck and Alstonby Beck respectively, which run through the centre of the Siting Areas and are assumed to be ecologically valuable. CSZ3.C contains a drainage ditch, potentially a tributary of Hether Burn, with more limited ecological potential. Construction activities could lead to habitat degradation through pollution, noise, lighting, and vibration.

6.4.15 In conclusion, although CSZ3.B and CSZ3.C would be marginally less constrained than CSZ3.A, all three Siting Areas in CSZ3 would have ecological constraints due to proximity to multiple designated sites and the presence of sensitive habitats.

Other Environmental Considerations

6.4.16 Water, geology and soils were also considered as part of the options appraisal. The underlying geology and soils within CSZ3 are not identified as presenting significant constraints at this stage.

6.4.17 CSZ3 is located within Flood Zone 1, indicating a low probability of fluvial flooding. All Siting Areas contain watercourses or drainage ditches that pose potential risks during construction, but these would be mitigable following standard practices. While CSZ3.A and CSZ3.C are in close proximity to surface waterbodies, they are not considered to be significantly constrained, and potential impacts are considered mitigable through standard practices. CSZ3.B is more constrained, intersected by a tributary of the River Lyne and a secondary drainage ditch, requiring more extensive mitigation.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.4.18 There are various parts of CSZ3 which are identified as MSAs, including areas within CSZ3.A and CSZ3.B, and the entirety of CSZ3.C (also each within a MCA[40]). While it is preferable to avoid these areas as far as possible, they would not necessarily constrain the development of a new substation in CSZ3. It is expected that careful siting of substation infrastructure in CSZ3.A and CSZ3.B would be sufficient to avoid the MSA, CSZ3.C is considered least preferable in terms of potential impacts on the MSA.

6.4.19 All of the agricultural land within this Siting Zone is designated as ALC Grade 3, the extent of BMV (Grade 3a) is not known at this stage and ALC or BMV are therefore not key differentiating factors.

6.4.20 Fir Ends Primary School is located approximately 150m north of CSZ3.B. If CSZ3 were selected as preferred, further assessment would be required to establish whether potential construction impacts on the Primary School could be avoided, reduced or mitigated.

Aviation and Defence

6.4.21 CSZ3.A is partially within the MoD TTA 20T which is used for low flying training between 100 and 250 feet (30 and 76m). There is the potential for some disturbance of low flying activities during construction. National Grid would engage with the MoD should this option be taken forward to ensure that impacts are appropriately mitigated.

6.4.22 As CSZ3.A, CSZ3.B, CSZ3.C are located outside the defined 2km hazard area for MoD Longtown[41] (6.9km, 5.3km and 8km respectively), no potential impacts would be expected.

Traffic and Transport

6.4.23 CSZ3 is crossed in the south by the A6071 and by a number of local roads, including Skitby Road. CSZ3.A is bisected by three unnamed roads, including a C-road which is an agreed HGV route for timber haulage without restriction, as regulated by the Road Traffic Act 1988. Vehicular access to CSZ3.A could be provided to the A6071 (or onward to the A7) via a C road through Uppertown and Kirklinton. The C road is not suitable for HGV traffic in its current form. It would require widening, passing points, junction improvements and tree removal to allow access. Issues would potentially remain due to the 90-degree double bends with limited visibility over the Fergushill crossbridge, and the narrow widths which cannot be mitigated. It is also noted that the existing road gradient is moderately steep in isolated areas along the potential access routes. In addition, CSZ3.A is also crossed by NCN Route 10 together with Public Footpath 118008 which would both require diversion. CSZ3.A would be the least preferable within CSZ3.

6.4.24 Access to both CSZ3.B and CSZ3.C would be via the A6071, which forms part of the HGV Cumbria Routes for timber haulage. Overall, it is expected that any temporary construction traffic impacts could be reduced where necessary by mitigation to enable Siting Area access. CSZ3.B is intersected by Footpath 123011 in a north to south direction and CSZ3.C by Footpath 118016 in an east to west direction. Whilst there would be some impacts on users of the PRoW, these are deemed to be mitigable and would not be considered as differentiating factors in the siting of a substation in CSZ3.

Engineering and Systems Appraisal Summary

6.4.25 Existing infrastructure located in CSZ3.A, CSZ3.B and CSZ3.C comprises of DNO overhead lines, due to the placement of these existing lines, diversions would likely be required to facilitate any future substation construction. It is noted that an existing 132 kV overhead line runs run through CSZ3.B and CSZ3.C which may need to be diverted depending on how the substation would ultimately be positioned. Furthermore, the 132 kV line would likely be a constraint to new overhead line connecting to and from the new substation, requiring a crossing or diversion to facilitate connections.

6.4.26 CSZ3 is largely covered by glacial deposits, predominantly glacial till with some localised areas of glaciofluvial deposits (primarily in CSZ3.C) and some alluvium through the centre of the wider Siting Zone that may require treatment or removal and replacement. Alluvial materials that are locally present may be identified as softer and less favourable ground.

Horlock Rules

6.4.27 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.4.28 At this early stage of development **Horlock Rules 7, 9, 10** and **11** are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.4.29 The appraisal of CSZ3 and the Siting Areas within it (CSZ3.A, CSZ3.B, and CSZ3.C) has been undertaken with reference to the Horlock Rules, as outlined below:

- Consideration of Environmental Features (**Horlock Rule 1**): The Siting Areas have been defined with consideration of environmental features including designated heritage assets, ecological designations (e.g. Lyne Woods SSSI), and landscape character. The appraisal identifies potential impacts on these features and highlights opportunities for mitigation through siting and design.
- Avoidance of Areas of Highest Amenity Value (**Horlock Rules 2** and **3**): All Siting Areas avoid designated landscapes such as National Parks or Areas of Outstanding Natural Beauty. However, CSZ3.A and CSZ3.C are located closer to listed buildings, increasing the potential for setting impacts. CSZ3.B is more distant from designated assets and benefits from greater screening, making it more favourable in this regard.
- Opportunities for Siting and Impact Reduction (**Horlock Rules 4** and **5**): Each Siting Area offers sufficient space to allow for siting of the substation infrastructure. This flexibility facilitates avoidance of specific environmental and socio-economic constraints, such as proximity to residential receptors or sensitive habitats, and allows for the incorporation of mitigation measures such as planting and screening.
- Use of Existing Screening Features (**Horlock Rule 4**): CSZ3.C benefits from mature vegetation and landform that provide natural screening, reducing visual prominence. CSZ3.B also benefits from screening by topography and vegetation. In contrast, CSZ3.A is more open and elevated, with limited opportunities for effective visual mitigation.
- Minimising Effects on Agricultural Land and Drainage (**Horlock Rule 6**): All Siting Areas are predominantly located on agricultural land and all land is ALC Grade 3. The impact on BMV agricultural land is considered using publicly available provisional data on ALC (no subgrades or survey data) only, and will be assessed at later project stages. CSZ3.C is almost entirely within a Mineral MSA for sand and gravel. While this does not constrain development, it introduces additional planning considerations. The appraisal also considers potential impacts on drainage and watercourses, particularly in CSZ3.B, where mitigation would be required to manage flood risk and protect water quality.

Summary of Appraisal of Siting Zone 3

Environmental

6.4.30 The key environmental factors influencing the appraisal of CSZ3 are predominantly ecological as well as conflicting landscape and visual and historic environment considerations. Each Siting Area in CSZ3 is similarly constrained by ecology considerations due to the proximity of the Siting Zone to multiple designated sites and

the presence of sensitive habitats. There are conflicting opportunities and constraints across CSZ3, CSZ3.A and CSZ3.C each present potential impacts on the setting of nearby listed buildings, although CSZ3.C benefits from a relatively lower-lying topography and a larger-scale field pattern, offering a degree of visual containment when siting a substation. While other factors were considered these did not highlight any major siting constraints or impacts.

Socio-economic

6.4.31 The socio-economic appraisal did not identify any constraints or differentiating factors. While CSZ3.C has the greatest proportion of MSAs, the potential impacts are considered to be mitigable.

Engineering and Systems

6.4.32 The main engineering factors influencing the appraisal of CSZ3 relate to existing utilities. These include DNO overhead lines present throughout the zone and a 132 kV overhead line which bisects through CSZ3.B and CSZ3.C. These existing overhead lines would likely constrain new lines connecting to a substation in CSZ3 and therefore may require diversions or crossings of these existing overhead lines to facilitate connections to a new substation in this siting zone.

6.5 New Carlisle Substation Siting Zone 4

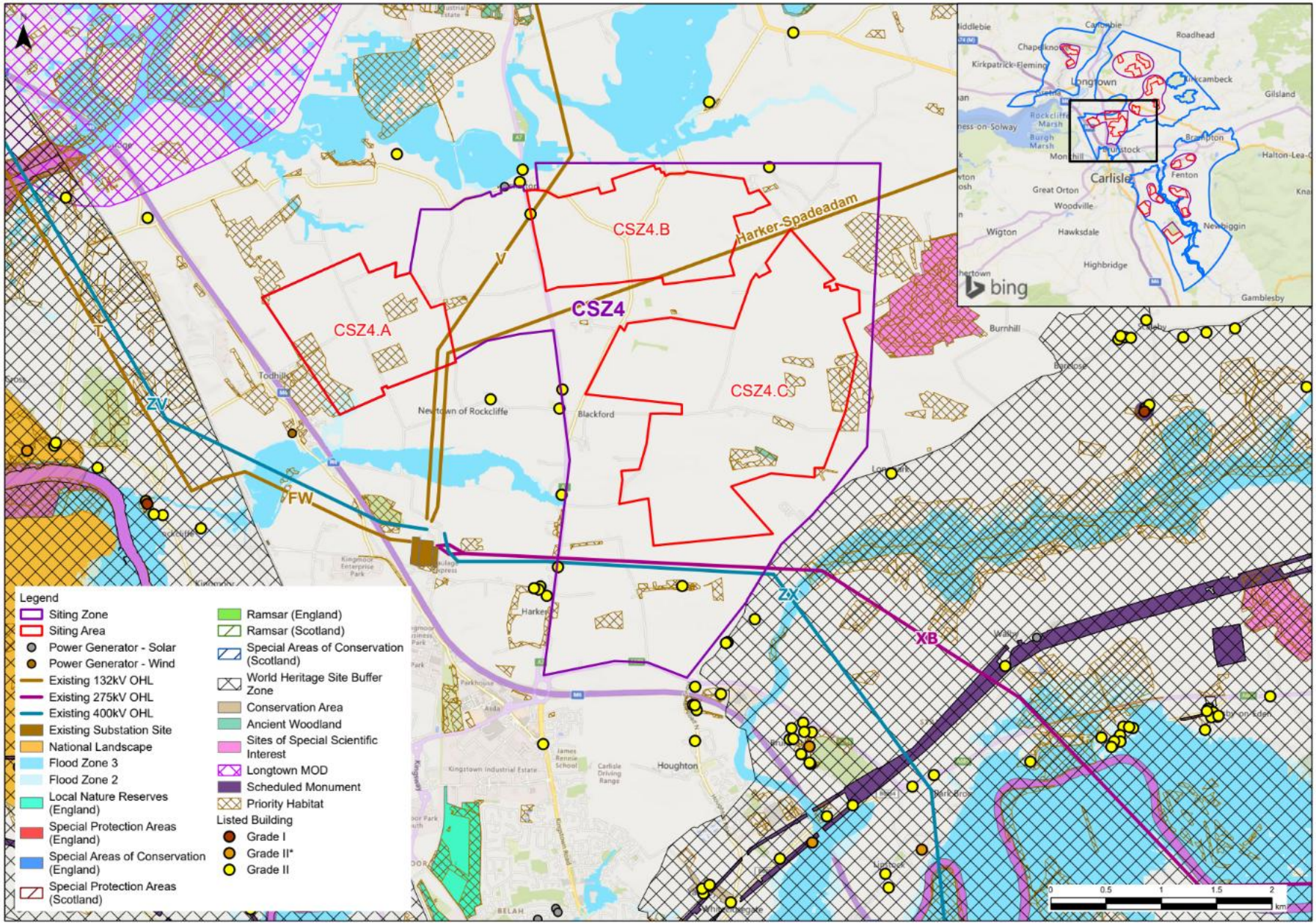
6.5.1 CSZ4 is a substation Siting Zone located to the north of Carlisle (Option A).

6.5.2 CSZ4 occupies an area of 1,384ha located immediately north of Carlisle and adjacent to Westlinton village. There are various clusters of residential and agricultural properties throughout CSZ4, the River Lyne is also adjacent to the north and Well Sike bisects the north-western corner. The A7 road intersects the zone from north to south, the A689 road is adjacent to the south of the zone, and the M6 is located within 300m to the west at its closest point. There are also multiple unclassified roads throughout CSZ4 and the West Coast Main Line (WCML) is located approximately 1km to the western boundary. Hadrian's Wall WHS is located 4.5km south-west and 2.2km south-east of CSZ4, and Scaleby Moss SSSI is located adjacent to the north-east. There are multiple existing DNO overhead lines throughout CSZ4, each Siting Area is intersected by at least one of these lines. Additionally, there are two National Grid existing overhead lines, 275 kV and 400 kV, which cross the south of the zone, and a 132 kV overhead line crossing the north-western corner.

6.5.3 CSZ4 is described in **paragraph 5.6.21** and shown in **Figure 6-4.** The Siting Zone contains three Siting Areas described below:

- Siting Area CSZ4.A: a site 1.3km by 1.3km, approximately 150ha, located immediately east of Todhills village, 300m east of the M6, and 300m south of Well Sike. The existing National Grid 132 kV overhead line intersects the south-eastern corner of the Siting Area. The area is intersected by two unclassified roads.
- Siting Area CSZ4.B: a site 2km by 1km, approximately 172ha. The A7 is adjacent to the west boundary of this Siting Area. The existing National Grid 132 kV overhead line intersects the north-western corner of the Siting Area. The area is intersected by two unclassified roads.
- Siting Area CSZ4.C: a site 2.3km by 2.7km, approximately 388ha, located 200m east of the A7. Scaleby Moss SSSI is located directly east of this Siting Area. There are multiple unclassified roads within the Siting Area and adjacent to the boundary.

Figure 6-4 – New Carlisle Substation Siting Zone 4 (CSZ4) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.5.4 CSZ4 lies within two LCTs as defined by the Cumbria Landscape Character Assessment. The western part of the zone falls within LCT 2c Coastal Plain, which is characterised by a flat to gently undulating pastoral landscape with some arable land, defined by hedgerows and influenced by vertical infrastructure near Harker. The eastern part lies within LCT 5b Low Farmland, an undulating, intensively farmed pastoral landscape with patchy woodland and large, rectangular fields. Pylons are a common feature in this area. There are no designated landscape sites within CSZ4. Although Solway Coast National Landscape is 2km to the west, CSZ4 is not considered to fall within the setting and lies within an area in which existing overhead line and urban fringe development including Harker substation form part of the baseline.

6.5.5 CSZ4.A benefits from the presence of mature vegetation and proximity to existing infrastructure, including the M6 and Harker substation. These features reduce the landscape's susceptibility to change. However, potential impacts include the loss of localised hedgerows and trees, particularly around Boundary Plantation, and visual impacts on nearby residential properties and PRoW. Approximately eight residential properties are located adjacent or within CSZ4.A and would likely experience foreground views towards it.

6.5.6 CSZ4.B is more visually exposed due to limited vegetation and smaller-scale field patterns, and the presence of residential properties and PRoW increases the likelihood of significant visual impacts. Approximately nine residential properties are located adjacent or within CSZ4.B and would likely experience views towards it. Although proximity to existing infrastructure (e.g. Harker substation and overhead lines) slightly reduces susceptibility, the limited containment and mitigation opportunities result in a higher risk of long-term landscape and visual impacts.

6.5.7 CSZ4.C presents a mixed scenario, with mature vegetation and tree belts in the north and centre that offer a degree of containment and opportunities for mitigation. These areas are better suited for careful siting to reduce visual and landscape impacts. However, the southern part of CSZ4.C is more open and rolling, with fewer opportunities for visual integration, increasing the likelihood of impacts. Approximately fourteen residential properties are located adjacent to or within this Siting Area. These are predominantly isolated residences typically associated with farm buildings and would likely experience foreground views towards it, dependent on where the substation is located. The presence of pylons and overhead lines in the wider landscape helps reduce susceptibility to change, but the variation in landscape character across CSZ4.C means impacts would differ depending on the substation's location.

6.5.8 Overall, CSZ4.B presents the greatest constraint due to its limited potential for mitigation and its smaller-scale landscape, which is less accommodating to development. CSZ4.C offers a mixed scenario; while the northern and central areas provide opportunities for mitigation, the southern area remains challenging, therefore substation design would be important. CSZ4.A emerges as the most favourable option from a landscape and visual perspective, benefiting from a large-scale field pattern, mature vegetation, and proximity to existing infrastructure, all of which support effective mitigation.

Historic Environment

6.5.9 Three designated assets have been identified within CSZ4. All Grade II listed buildings, these include a milestone on the A7, the Gill farmhouse in the north-eastern corner of the Siting Zone, and Houghton House in the southern extent of the Siting Zone. None of these designated assets are within any of the Siting Areas. There would be no physical impacts on designated assets throughout the Siting Areas, while any impacts on non-designated archaeological assets are assumed to be mitigable through standard archaeological mitigation measures.

6.5.10 The nearest designated assets within 1km from CSZ4.A are Grade II listed buildings, with Newton Farmhouse to the southeast and Firbank Farmhouse to the northeast, although both are well screened from the Siting Area by later farm buildings as well as woodland. CSZ4.A lies approximately 800m from the Hadrian's Wall WHS buffer and over 4km from the scheduled monuments that define the WHS. The M6 and West Coast Main Line provide substantial separation and visual screening between the WHS and the CSZ4.A, and as such no physical impacts or impact on setting of the WHS are expected.

6.5.11 The nearest designated asset to CSZ4.B is a Grade II listed milestone on the A7, which forms the western boundary of the Siting Area. This asset would not be physically impacted unless road improvements were required in its immediate vicinity. Other designated assets within 1km are also Grade II listed and include a small grouping in Westlinton to the northwest, and more isolated buildings on the A7 to the south, and the rural landscape to the northeast. Impacts on the setting of these assets is expected to be reduced as a result of existing screening, although a full assessment would be required if the Siting Area was progressed. The WHS buffer is approximately 1km to the south-east, and the scheduled components are approximately 4.1km away. As such, there would be no physical impacts on the WHS, and a substation in this location would not result in impacts to attributes of OUV.

6.5.12 There are a limited number of designated assets within 1km of CSZ4.C, all of which are Grade II listed buildings. These include small groupings in nearby settlements such as Blackford and Brunstock, as well as Houghton Hall to the south. Houghton Hall would appear to have been constructed in a relatively prominent position, however, it appears to have been designed to exploit views south, and therefore away from the Siting Areas. While the WHS buffer is 100m to the south, the scheduled components are at least 2.2km away and screened by a ridge and vegetation. As such, impacts on the attributes of OUV of the monument are not predicted. However, locating a substation in the north end would increase the distance between the WHS buffer and any development, and would also provide a greater distance between development and Houghton Hall.

6.5.13 None of the three Siting Areas would be subject to significant historic environment constraints. CSZ4.A and CSZ4.B would be preferable due to their greater distance from the WHS buffer and designated assets. Locating a substation in the northern end of CSZ4.C would also remove any potential impacts on the attributes of OUV associated with the WHS, as well as potential impacts on the setting of the Grade II listed Houghton House.

Ecology

6.5.14 Siting Zone CSZ4 is characterised by predominantly arable land interspersed with hedgerows, grassland, and scattered trees. There are water features with potential

ecological value and lies within the IRZ of nationally and internationally designated sites, including the Solway Firth Ramsar Site, SAC, SPA, and SSSI, and Scaleby Moss SSSI.

6.5.15 CSZ4.A, CSZ4.B, and CSZ4.C are all located east of the Solway Firth SSSI, at approximate distances of 2.1km, 4.1km, and 7km respectively. CSZ4.B and CSZ4.C also lie west of Scaleby Moss SSSI, at distances of approximately 1.2km and 140m. Priority habitats such as deciduous woodland and ancient woodland are present in CSZ4.A and CSZ4.C, with CSZ4.C also containing Mampus Woods, a parcel of ancient woodland. The ancient woodland would be avoidable with careful siting. CSZ4.B is moderately constrained by the watercourses that may support notable and protected species, particularly riparian mammals, amphibians, and invertebrates.

6.5.16 Overall, CSZ4.B would be the most suitable of the three Siting Areas due to the absence of ancient woodland and its relatively lower proximity to designated sites. CSZ4.A would present significant constraints, particularly due to the scattered priority woodland and potential impacts on protected species and designated sites. CSZ4.C would also be potentially constrained by the presence of ancient woodland and its proximity to Scaleby Moss SSSI. However, the northern half of CSZ4.C may offer flexibility when siting to avoid the ancient woodland. While all three areas are constrained, CSZ4.B may offer the greatest scope for mitigation and design flexibility, due to the absence of priority habitats (deciduous woodland) and ancient woodland.

Other Environmental Considerations

6.5.17 Water, geology and soils were also considered as part of the options appraisal.

6.5.18 From a water environment perspective, none of the three Siting Areas present a significant constraint. However, CSZ4.A includes a section of Flood Zone 2 associated with the Rockcliffe Beck, and CSZ4.C is intersected by the Rockcliffe Beck itself along with the presence of surface water pooling. Potential impacts to the three watercourses/drains present in CSZ4.B are considered mitigatable and or avoidable through design. These factors make these two Siting Areas marginally less preferable than CSZ4.B from a water environment perspective. Nonetheless, implementation of standard mitigation measures would be able to manage surface water runoff and protect water quality in Siting Area CSZ4.

6.5.19 Geology and soil conditions do not present a constraint to development in CSZ4.B. However, the presence of peat in CSZ4.A and CSZ4.C introduces a need for careful consideration during siting and design to minimise potential impacts.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.5.20 There are various sections of CSZ4 which are identified as MSAs, including the entirety of CSZ4.A and smaller sections of both CSZ4.B and CSZ4.C. These sections are also within an MCA[40]. It is anticipated that careful siting within CSZ4.B and CSZ4.C would be sufficient to avoid the MSA, although this would need to be confirmed by further survey and design work. For CSZ4.A, it is not possible to avoid the MSA through design, but it is considered that the minerals in this area may have already been sterilised by existing infrastructure.

6.5.21 All of the agricultural land within this Siting Zone is designated as ALC Grade 3, the extent of BMV (Grade 3a) is not known at this stage and ALC or BMV are therefore not key differentiating factors.

6.5.22 Harker Substation is located outside of CSZ4, east of the M6 and west of the A7, approximately 1.4km to the south of CSZ4.A and 1.4km to the west of CSZ4.C, where there is an approved extension currently under construction. There are also a number of approved energy applications adjacent to Harker Substation, including three BESS, with another approved BESS application adjacent to the north-east of CSZ4.A. There is the potential for cumulative impacts but none of these developments would be considered differentiating factors in the siting of a new substation in CSZ4.

Aviation and Defence

6.5.23 Due to distance of the Siting Areas from key aviation and defence constraints, no impacts are anticipated.

Traffic and Transport

6.5.24 CSZ4 is bisected by the A7 which forms the western boundary of CSZ4.B, is 200m to the west of CSZ4.C and 1km east of CSZ4.A. Overall, CSZ4.A was least preferred, with a preference for CSZ4.B or CSZ4.C. As access to any of the Siting Areas in CSZ4 would be via the A7 or from the unnamed C road to the south, temporary standard mitigation measures for construction traffic may be necessary to maintain access to Blackford Church of England Primary School and St. John the Baptist Church.

6.5.25 CSZ4.A includes the Moor House farm complex with a farmhouse fronting onto the road which bisects the Siting Area, and which may also require consideration when siting.

6.5.26 Five Public Footpaths intersect the Siting Areas and NCN10 bisects CSZ4.A. Whilst there would be some impacts on users of the PRoW and NCN10, these are considered to be mitigable and would not be differentiating factors for the siting a new substation within CSZ4.

Engineering and Systems Appraisal Summary

6.5.27 Existing infrastructure located in CSZ4.A, CSZ4.B and CSZ4.C comprises of DNO overhead lines running through each of the Siting Areas. Diversions would likely be required to facilitate any future substation construction in these Siting Areas. It is noted that two existing 132 kV overhead lines run through CSZ4.A and CSZ4.B. However, it is likely that the substation footprints could be positioned to avoid these assets. The existing NWEP runs through CSZ4.B and CSZ4.C, but it is anticipated that exclusion / easement zones could be achieved, meaning there would be no direct interface between the pipeline and substation infrastructure. However, construction crossings for Siting Area access routes would be subject to further engagement with the asset owner. A DNO Substation is located immediately to the northwest of CSZ4.B. This would have associated overhead lines and cables that would need to be considered if this Siting Area is progressed.

6.5.28 CSZ4 is largely covered by glacial deposits, predominantly glacial till with some localised areas of glaciofluvial deposits to the north and some more notable extents of alluvium through the Siting Zone and particularly in CSZ4.C. Glacial materials may

require treatment or removal and replacement. Alluvium is present locally and may present softer and less favourable ground conditions.

6.5.29 A former brick and tile works (Todhills Brick and Tile Works) is identified to the north of CSZ4.A and could have unidentified clay pits associated with it. Similarly, a former Brick Works (Blackford) is identified within the centre of CSZ4.C and this may also include some associated and additional components such as clay pits which may present areas of backfill or made ground that may require additional treatment and consideration. These features are likely small and, if encountered as part of the siting of a substation within the Siting Area, could likely be readily addressed through careful siting.

Horlock Rules

6.5.30 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.5.31 At this early stage of development **Horlock Rules 7**, **9**, **10** and **11** are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.5.32 The appraisal of CSZ4 and the Siting Areas within it (CSZ4.A, CSZ4.B, and CSZ4.C) has been undertaken with reference to the Horlock Rules, as outlined below:

- Consideration of Environmental Features (**Horlock Rule 1**): The Siting Areas have been defined with consideration of environmental features including designated heritage assets, ecological designations (e.g. Solway Firth and Scaleby Moss SSSIs), ancient woodland, and landscape character. The appraisal identifies potential impacts on these features and highlights opportunities for mitigation through siting and design.
- Avoidance of Areas of Highest Amenity Value (**Horlock Rules 2** and **3**): All Siting Areas avoid designated landscapes such as National Parks or Areas of Outstanding Natural Beauty. While CSZ4.C lies closest to the Hadrian's Wall WHS buffer, the scheduled components are screened by topography and vegetation. CSZ4.A and CSZ4.B are more distant from the WHS and designated assets, reducing the potential for setting impacts.
- Opportunities for Siting and Impact Reduction (**Horlock Rules 4** and **5**): Each Siting Area offers sufficient space to allow for siting of substation infrastructure. This facilitates avoidance of specific environmental and socio-economic constraints, such as proximity to residential receptors or sensitive habitats, and allows for the incorporation of mitigation measures such as planting and screening. For example, the northern part of CSZ4.C offers greater flexibility for mitigation than the southern part.
- Use of Existing Screening Features (**Horlock Rule 4**): CSZ4.A and the northern and central parts of CSZ4.C benefit from mature vegetation and landform that provide natural screening, reducing visual prominence. CSZ4.B is more visually exposed, with limited containment and fewer opportunities for effective visual mitigation.
- Minimising Effects on Agricultural Land and Drainage (**Horlock Rule 6**): All Siting Areas are predominantly located on agricultural land and all land is ALC Grade 3. The impact on BMV agricultural land is considered using publicly available provisional data on ALC (no subgrades or survey data) only, and will be assessed at later project stages. All siting areas intersect with MSA. While CSZ4.A lies entirely

within an MSA, it is considered that minerals may already be sterilised by existing infrastructure. CSZ4.B and CSZ4.C offer greater flexibility for micrositing to avoid MSAs. Peat is present in CSZ4.A and CSZ4.C, requiring careful design to avoid or mitigate ground stability and drainage issues.

Summary of Appraisal of Siting Zone 4

Environmental

6.5.33 The key environmental factors influencing the appraisal of CSZ4 are predominantly ecological as well as landscape and visual amenity and historic environment considerations. The north-eastern extent of CSZ4 benefits from the proximity to existing infrastructure reducing the landscape's susceptibility to change. CSZ4.A is well screened from designated heritage assets within 1km, although it presents ecological constraints due to the distance to the SSSIs and the scattered priority woodland. The north of CSZ4 (CSZ4.B) although furthest from the SSSI and designated heritage assets (including the WHS buffer) offers limited opportunity to mitigate landscape and visual impacts due to the open and rolling landscape in the southern half. To the north-east of CSZ4 (northern half of CSZ4.C), the increased distance from designated ecological sites and heritage assets (including the WHS and its buffer) and the mixed landscape character offer the best opportunity to site a substation in CSZ4. While other factors were considered these did not highlight any major siting constraints or impacts.

Socio-economic

6.5.34 The socio-economic appraisal did not identify any constraints that were differentiating factors and potential impacts are considered to be mitigable.

Engineering and Systems

6.5.35 The main engineering factors influencing the appraisal of CSZ4 include existing utilities and former brick and tile factory infrastructure. The utilities include DNO overhead lines and the NWEP which intersects CSZ4.B and CSZ4.C, two existing 132 kV overhead lines through CSZ4.A and CSZ4.B, and a DNO Substation immediately to the northwest of CSZ4.B. The DNO overhead lines would need to be accounted for if siting the substation within the CSZ4 Siting Areas with potential solutions including diversion or crossing of these lines for the associated transmission line connections being required. Exclusion / easement zones can be achieved for the NWEP. The former brick and tile works features located within CSZ4.C can likely be readily addressed at later project stages if this option is selected as preferred.

6.6 New Carlisle Substation Siting Zone 5

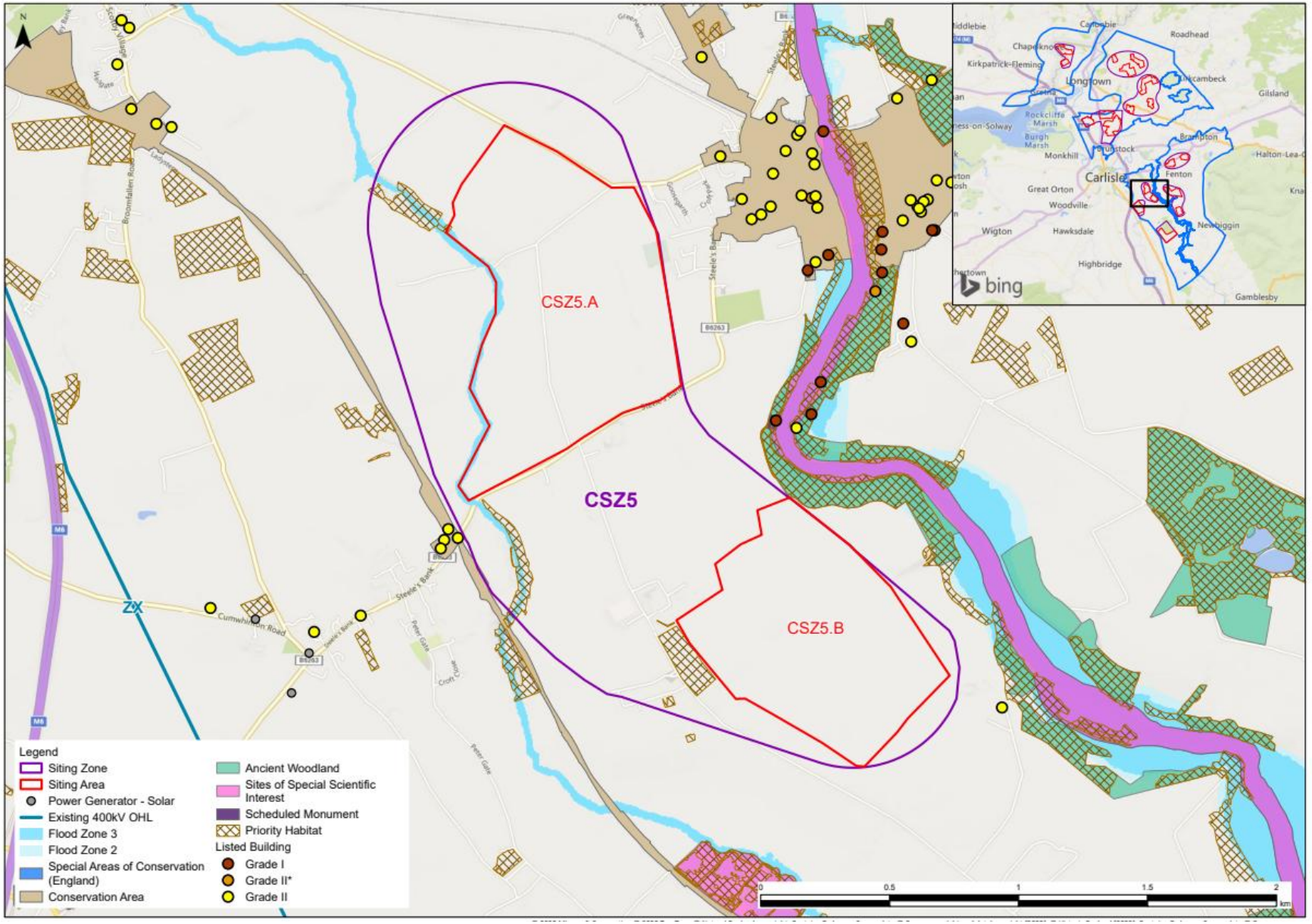
6.6.1 CSZ5 is a substation Siting Zone located to the south of Carlisle (Option B).

6.6.2 CSZ5 occupies an area of approximately 304ha located approximately located 1.5km east of Carlisle. The village of Wetheral (also a conservation area) is adjacent to the eastern boundary of the Siting Zone, the village of Cumwhinton is adjacent to the west, and the village of Scotby is 600m north-east. The B6263 road intersects the middle of CSZ5, with the Newcastle-Carlisle Railway to the north and the Settle-Carlisle Railway (also a conservation area) to the west and south. The M6 is 1.5km west of the Siting Zone boundary. The River Eden and Tributaries SSSI is adjacent to the eastern boundary of the Siting Zone. The existing 400 kV Harker-Hutton overhead line is located 1.5km to the west.

6.6.3 CSZ5 is described in **paragraph 5.6.22** and shown in **Figure 6-5**. The Siting Zone contains two Siting Areas described below:

- Siting Area CSZ5.A: a site 0.7km by 1.2km, approximately 81ha. Scotby Road runs immediately along the northern boundary and the B6263 to the south. There are two unclassified roads within the Siting Area.
- Siting Area CSZ5.B: a site 0.7km by 1km, approximately 60ha, located 200m south-west of the River Eden SSSI.

Figure 6-5 – New Carlisle Substation Siting Zone 5 (CSZ5) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.6.4 CSZ5 lies within a predominantly rural landscape characterised by undulating lowland topography and pastoral land use. It spans two National Character Areas: the Eden Valley to the south and centre, and the Solway Basin to the northwest. It also includes areas classified under the Cumbria Landscape Character Assessment as LCT Sub-type 5c (Rolling Lowland) and, to a lesser extent, 5b (Low Farmland). There are no designated landscape sites within CSZ5. The North Pennines National Landscape is located approximately 6.5km to the east and the Solway Coast National Landscape is 11km to the north-west, CSZ5 is not considered to fall within the setting of either. Corby Castle Registered Park and Garden lies approximately 500m and 200m from CSZ5.A and CSZ5.B respectively. The landscape is generally open, with limited existing energy infrastructure and a small-scale field pattern in parts, particularly near Wetheral.

6.6.5 Both CSZ5.A and CSZ5.B are likely to result in impacts on landscape character and visual amenity. CSZ5.A is more enclosed but lies in proximity to the settlement edge of Wetheral and sensitive features such as Wetheral Memorial Garden and Cemetery. CSZ5.B is more elevated and open, with wider visibility across the surrounding landscape. Both areas are susceptible to change due to the limited presence of existing infrastructure and the rural character of the setting. Visual receptors include numerous residential properties, recreational users, and PRoW.

6.6.6 Landscape and visual impacts are considered highly likely at CSZ5 due to its existing landscape character and proximity to a range of visual receptors, including numerous properties on the residential edge of Wetheral. The Siting Zone is within a more characteristically rural area which would be highly sensitive to the development of a new substation.

Historic Environment

6.6.7 There are no designated assets within CSZ5.A or CSZ5.B, although a number of high value designated assets have been recorded within 1km of both Siting Areas. Designated assets within 1km of CSZ5.A include Wetheral Priory Gatehouse and walls (Scheduled and Grade I listed), the Grade II* Church of the Holy Trinity, and the Grade I listed Corby Bridge. A small grouping of Grade II listed buildings have also been recorded less than 200m to the southwest at Cumwhitton Station, while the Carlisle to Settle Railway is also located near the western limits of CSZ5.A. While most assets are largely screened by the built environment, topography, and tree cover, the proximity of the Grade I Corby Castle Registered Park and Garden (approximately 500m south-east) raises the potential for impacts on key views, though these are likely limited by intervening woodland and topography.

6.6.8 There are also a number of designated assets within 1km of CSZ5.B including Wetheral Priory Gatehouse and walls (Scheduled and Grade I listed), as well as the Grade I Corby Castle Registered Park and Garden approximately 200m to the northeast. While a number of the designated assets are relatively well screened by topography, the built environment, and woodland, the open nature of views towards (and from) the Grade I Corby Castle Registered Park and Garden means there is the potential for impacts on the setting of the asset.

6.6.9 Neither Siting Area is expected to result in direct physical impacts on designated heritage assets, and standard archaeological mitigation measures are anticipated to manage risks to non-designated or previously unrecorded assets. However, both Siting Areas would require further assessment to fully understand and mitigate potential impacts on the setting of designated heritage assets, particularly in relation to the setting of Corby Castle which could be impacted by a substation in either Siting Area, but particularly within CSZ5.B.

6.6.10 No physical impacts or impact on setting are expected on the Hadrian's Wall WHS or attributes of its OUV due to the distance between the sting areas and the WHS (the WHS buffer is at least 2km to the north, while the nearest scheduled components are at least 5.5km to the north), as well as screening from intervening topography, the built environment, and vegetation.

6.6.11 There is little to differentiate between CSZ5.A and CSZ5.B in terms of historic environment constraints; both options are considered to have similar levels of sensitivity and would require further assessment to inform design and mitigation.

Ecology

6.6.12 CSZ5 is situated in proximity to both nationally and internationally designated ecological sites. Specifically, CSZ5.A is approximately 200m west of the River Eden and Tributaries SSSI and SAC, while CSZ5.B lies approximately 100m west of the SSSI and SAC. Both Siting Areas are located within the IRZ of the SSSI. The Solway Firth SAC, SSSI and Ramsar site is over 12km to the west of the CSZ5.A, but it is hydrologically connected to the River Eden. Ecological features within CSZ5 include arable land with field margins, grassland, intact hedgerows, individual trees, and small parcels of priority deciduous woodland. Ancient woodland lies directly adjacent to CSZ5.B.

6.6.13 Both Siting Areas could result in ecological impacts due to habitat loss, fragmentation, and degradation. Potential impacts include waterborne and airborne pollution, disturbance to otters, salmon, wintering birds, and loss of functionally linked land. CSZ5.A is approximately 200m from the River Eden SAC/SSSI, which is designated for its populations of otter, protected fish, alluvial woodland, and oligotrophic-mesotrophic standing water habitat. It is assumed that there are no habitats of principal importance, ancient or veteran trees within the Siting Area. It is considered likely that ecological impacts can be mitigated due to the habitat types considered to be present. CSZ5.B is particularly sensitive as it is within 10m of ancient and priority woodland that is functionally linked to the SAC. The proximity of both Siting Areas to designated sites, means that mitigation alone may not be sufficient to address all risks, and additional assessments and engagement with Natural England will be required if this option is taken forward.

6.6.14 Both CSZ5.A and CSZ5.B present ecological sensitivities due to their proximity to designated habitats. However, CSZ5.B would be less favourable given its proximity to ancient woodland and the River Eden SAC/SSSI. While CSZ5.A is also within the River Eden SSSI IRZ and would require engagement with Natural England, it is located further from designated features and does not contain ancient woodland As such, impacts at CSZ5.A are considered more likely to be capable of mitigation. Nevertheless, for both sites, standard mitigation may not be sufficient, and additional assessments and Natural England assent may be required.

Other Environmental Considerations

6.6.15 Water, geology and soils were also considered as part of the options appraisal. No specific geological or soil-related constraints were identified at this stage within CSZ5.

6.6.16 Both CSZ5.A and CSZ5.B are underlain by permeable ground and a principal aquifer, though no public water supply abstractions are present. While surface water management would be required in both areas, the risk to groundwater is considered low. CSZ5.A presents greater flood risk due to its partial location within Flood Zone 3, proximity to a main watercourse, and areas of surface water ponding. In contrast, CSZ5.B lies entirely within Flood Zone 1 and has fewer water-related constraints. From a water environment perspective, CSZ5.B is the more favourable option.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.6.17 There are various parts of CSZ5 which are identified as MSAs including areas within CSZ5.A and CSZ5.B. While it is preferable to avoid these areas as far as possible, they would not be considered differentiating factors for the development of a new substation in CSZ5. It is expected that careful siting of the infrastructure within the Siting Areas would be sufficient to avoid the MSA.

6.6.18 The majority of the land within this Siting Zone is designated as ALC Grade 3, with one area of Grade 2. All of CSZ5.A is Grade 3 and a small section in the north of CSZ5.A is shown as Grade 2. Further analysis at later project stages would be required to determine the potential loss of BMV (Grade 2 and 3a).

6.6.19 A small part of CSZ5.A is designated as open space (Policy GI 4), although careful siting may reduce any impacts.

Aviation and Defence

6.6.20 Due to the distance of the Siting Areas from key aviation and defence constraints, no impacts are anticipated.

Traffic and Transport

6.6.21 There are no A roads within CSZ5. The B6263 (Steele's Bank) forms the southern boundary of CSZ5.A and is approximately 700m north of CSZ5.B. The Settle to Carlisle railway is located immediately to the west of the CSZ5 boundary and the Tyne Valley Line railway to the north of Wetheral. The B6263 features a narrow bridge over the Tyne Valley Line railway rail track, and another crossing over Pow Maugham, which would constrain HGV movements without temporary traffic management.

6.6.22 There are four transport receptors that cross CSZ5.A, three PRoWs (footpaths 138007 and 138033 and bridleway 138012) and a C road (Wetheral Pastures). Dependent upon the siting of the substation, the PRoWs and the C road may require a temporary diversion during construction and permanent diversion for the operational phase.

6.6.23 CSZ5.B is crossed by one transport receptor, Public Footpath 13803, which may also require a temporary diversion during construction and permanent diversion for the operational phase. As CSZ5.B is not next to a public highway, an access road would be

required to connect to the C road to the west (additional land required) for onward connectivity to the B6263 to the north.

6.6.24 Whilst there would be some impacts on users of PRoW and the C road (Wetheral Pastures), these are considered to be mitigable.

Engineering and Systems Appraisal Summary

6.6.25 DNO overhead lines run through both the CSZ5.A and CSZ5.B, diversions are likely to be required to facilitate any future substation construction on these sites. The NWEP runs through the extreme north-west corner of CSZ5.A, however, it is likely that the substation could be carefully sited to avoid this. Additionally, an existing water pipeline runs through CSZ5.A and a diversion of this would likely be required.

6.6.26 CSZ5 is largely covered by glacial deposits, predominantly glacial till with some localised areas of glaciofluvial deposits and some more smaller extents of alluvium along the western boundary of CSZ5.A, potentially requiring treatment or removal and replacement. Alluvium is locally present and may present softer and less favourable ground conditions.

Horlock Rules

6.6.27 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.6.28 At this early stage of development **Horlock Rules 7, 9, 10** and **11** are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.6.29 The appraisal of CSZ5 and the Siting Areas within it (CSZ5.A and CSZ5.B) has been undertaken with reference to the Horlock Rules, as outlined below:

- Consideration of Environmental Features (**Horlock Rule 1**): The Siting Areas have been defined with consideration of environmental features including designated heritage assets (e.g. Corby Castle Registered Park and Garden), ecological designations (e.g. River Eden SAC/SSSI), and landscape character. The appraisal identifies potential impacts on these features and highlights opportunities for mitigation through siting and design.
- Avoidance of Areas of Highest Amenity Value (**Horlock Rules 2** and **3**): Both Siting Areas avoid designated landscapes such as National Parks or National Landscapes. However, they are located in close proximity to high-value heritage assets and sensitive receptors, including the Grade I Corby Castle Registered Park and Garden and Wetheral Priory. While these assets are partially screened, their proximity increases the potential for setting impacts, particularly for CSZ5.B.
- Opportunities for Siting and Impact Reduction (**Horlock Rules 4** and **5**): Sufficient space is available within both Siting Areas to enable careful siting of the substation infrastructure. This facilitates avoidance of specific environmental and socio-economic constraints, such as such as PRoWs, watercourses, and areas of flood risk. CSZ5.A, while partially within Flood Zone 3, includes areas that could accommodate infrastructure outside of flood-prone zones. CSZ5.B is more constrained in terms of ecological sensitivity but benefits from being entirely within Flood Zone 1.

- Use of Existing Screening Features (**Horlock Rule 4**): CSZ5.A is more enclosed and benefits from some screening by topography and vegetation, offering greater potential for visual mitigation. CSZ5.B is more elevated and open, with wider visibility and fewer opportunities for containment, increasing the likelihood of visual impacts.
- Minimising Effects on Agricultural Land and Drainage (**Horlock Rule 6**): Both Siting Areas are predominantly located on agricultural land Grade 3, however CSZ5.A includes areas of Grade 2 land and may be impacted to achieve the area required whilst avoiding other constraints. Both areas intersect MSAs, though micrositing may allow avoidance. Surface water and drainage considerations are more significant in CSZ5.A due to its proximity to watercourses and flood zones.

Summary of Appraisal of Siting Zone 5

Environmental

6.6.30 The key environmental factors influencing the appraisal of CSZ5 are predominantly landscape and visual amenity as well as ecological considerations. To the north of CSZ5 (CSZ5.A), the increased distance from designated sites and absence of ancient woodland combined with an enclosed landscape provide opportunities to site a substation. While other factors were considered these did not highlight any major siting constraints or impacts.

Socio-economic

6.6.31 The socio-economic appraisal did not identify any constraints that were differentiating factors and potential impacts are considered to be mitigable.

Engineering and Systems

6.6.32 The main engineering factors influencing the appraisal of CSZ5 relate to existing utilities. The existing utilities include existing DNO overhead lines and the NWEP, both are considered to be mitigatable with careful siting of the new substation.

6.7 New Carlisle Substation Siting Zone 6

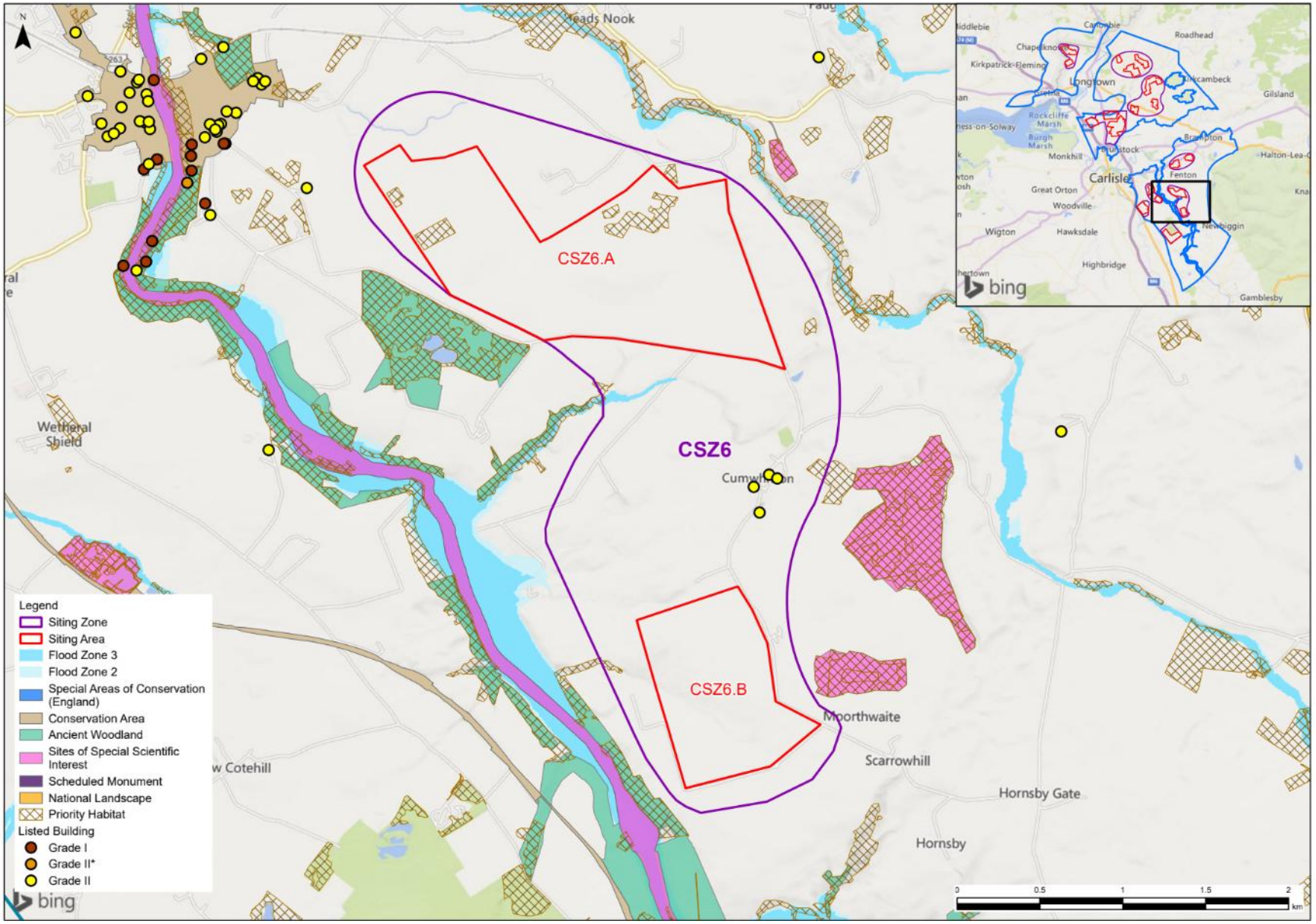
6.7.1 CSZ6 is a substation Siting Zone located to the south Carlisle (Option B).

6.7.2 CSZ6 occupies an area of approximately 663ha located 700m south-east of the village of Wetheral and 4.6km east of Carlisle. The village of Cumwhitton is located within the Siting Zone. There are few agricultural properties scattered throughout the area. There are no A or B roads within CSZ6, the nearest B road being the B6263 located 1.6km west. The River Eden and Tributaries SSSI and SAC is 1km west of the Siting Zone, and the Cumwhitton Moss and Moorthwaite Moss SSSIs are adjacent to the east, with Cairnbridge Sand Pit SSSI adjacent to the north-east. Corby Castle Registered Park and Garden is located within 350m to the north-west of CSZ6.

6.7.3 CSZ6 is described in **paragraph 5.6.23** and shown in **Figure 6-6.** The Siting Zone contains two Siting Areas described below:

- Siting Area CSZ6.A: a site 1.5km by 1.8km, approximately 183ha, located 200m south-east of Clints Roads, with unclassified roads to the north, east and south.
- Siting Area CSZ6.B: a site 0.7km by 1.1km, approximately 77ha, located 900m south of Randlaw Lane with an unclassified road immediately to the east.

Figure 6-6 – New Carlisle Substation Siting Zone 6 (CSZ6) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.7.4 CSZ6 is located within National Character Area 9: Eden Valley, a well-wooded, undulating valley landscape supporting mixed agriculture. It predominantly falls within Cumbria Landscape Character Assessment LCT Sub-type 5c (Rolling Lowland), with a small portion in the southwest within LCT Sub-type 8a (Gorges). The area is rural in character, with limited existing energy infrastructure and a mix of open farmland and mature vegetation blocks. No designated landscape sites are located within CSZ5. The North Pennines National Landscape is located approximately 2.8km to the east and the Solway Coast National Landscape is 14.4km to the north-west. CSZ5 is not considered to fall within the setting of the Solway Coast and is likely to fall outside of the setting of the North Pennines. Corby Castle Registered Park and Garden lies nearby, within 500m to the west of CSZ6.A at its closest point. There is the potential for effects on its setting although the intervening woodland around the River Eden may limit potential effects.

6.7.5 CSZ6.A is likely to result in adverse direct landscape effects from localised hedgerow and tree loss and on the pattern of the landscape, which is relatively small-scale in the western part of the Siting Area. Indirect effects on perceptual and scenic quality would likely extend beyond the Siting Area. These indirect effects would likely be limited to a degree by the presence of mature trees within field boundaries and mature blocks of vegetation within the Siting Area and the surrounding landscape. The limited presence of energy infrastructure in the landscape means that there is limited context for the siting of a substation which increases the susceptibility of the landscape character to the type of change proposed. Approximately four residential properties are located within 500m of CSZ6.A and would likely experience foreground to middle ground views of it. Some of these would be partially screened by vegetation or farm buildings but there is the potential for significant adverse visual effects. The scattered nature of properties within the immediate and wider landscape also means that there is the potential for adverse visual effects from medium to longer range views, however some of these views may be limited by landform or mature vegetation. Dependant on the location of the substation within CSZ6.A, there would also be potential visibility and adverse effects on the visual amenity of recreational users of the PRoW to the north and south-east.

6.7.6 CSZ6.B is located on relatively elevated, rising land associated with the gorge landscape to the west. Indirect effects on the perceptual and scenic would be likely within the rising land to the west of the gorge and likely compromise the setting of the gorge landscape. The limited presence of energy infrastructure in the surrounding landscape means that there is limited context for the siting of a substation which increases the susceptibility of the landscape character to the type of change proposed. Approximately five residential properties are located within 150m of the Siting Area and would likely experience foreground views of it. Some of these would be partially screened by vegetation or farm buildings but there is the potential for significant adverse visual effects. The scattered nature of properties within the immediate and wider landscape, including to the west of the gorge landscape, also means that there is the potential for adverse visual effects from medium to longer range views, however, some of these views may be limited by landform or mature vegetation. There would also likely be potential visibility and adverse effects on the visual amenity of recreational users of the PRoW on the southern boundary of CSZ6.B.

Historic Environment

6.7.7 There are no designated heritage assets located within CSZ6.A or CSZ6.B. However, a number of high-value designated assets have been recorded within the surrounding landscape, particularly to the north and west of CSZ6. These include the Grade I listed Corby Castle and associated structures within the Grade I Registered Park and Garden, located approximately 500m west of CSZ6.A. The Conservation Areas of Wetheral and Great Corby, located over 1km to the north and northwest respectively, also contain multiple Grade I, Grade II*, and Grade II listed buildings.

6.7.8 A small concentration of Grade II listed buildings is located within the settlement of Cumwhitton near the centre of CSZ6 and within 250m of both CSZ6.A and CSZ6.B. The Settle to Carlisle Railway Conservation Area runs along the western side of the River Eden, approximately 500m from the southern end of CSZ6.

6.7.9 While there are a number of high value designated assets in the surrounding landscape of CSZ6.A, most are located in settlements, while the topography and mature woodland in the area also would provide a degree of natural screening. If CSZ6.A was selected for the siting of a new substation, further work would be required to better understand potential impacts to the Grade I Corby Castle Registered Park and Garden. At this stage, the initial assessment suggests key views are towards the River Eden and therefore away from the Siting Area.

6.7.10 There may be views of the CSZ6.B from the Settle to Carlisle Railway Conservation Area, which is located on the western side of the River Eden. If CSZ6.B was selected for the siting of a new substation, further work would be required to better understand if views from the railway towards the Siting Area contribute to the asset's significance.

6.7.11 No physical impacts or impact on setting are expected on the Hadrian's Wall WHS or attributes of its OUV due to the distance between the Siting Areas and the WHS (the WHS buffer is at least 3.6km to the north, while the nearest scheduled components are at least 7.2km to the north), as well as screening from intervening topography, the built environment, and vegetation.

6.7.12 There will be no physical impacts on designated assets as a result of a development in either Siting Area. There is also limited potential for a substation in either Siting Areas to result in impacts on the setting of any designed assets. Potential impacts on non-designated or previously unrecorded archaeological remains could be addressed through standard archaeological mitigation.

6.7.13 Overall, CSZ6.B may be preferable to CSZ6.A from a historic environment perspective due to its greater distance from high value designated assets and lower overall sensitivity.

Ecology

6.7.14 CSZ6 is located within a predominantly arable landscape that includes hedgerows, grassland, scattered trees, and several small parcels of priority deciduous woodland. Both CSZ6.A and CSZ6.B are hydrologically connected to the River Eden SSSI and SAC.

6.7.15 CSZ6.A contains a drainage ditch that connects to Cumwhitton Beck and ultimately the River Eden. This hydrological link introduces the potential for indirect impacts on downstream habitats and species, particularly through pollution or habitat fragmentation. CSZ6.A lies within the IRZ of the Cairnbridge Sand Pit SSSI, located

approximately 300m to the east, and the River Eden SSSI, approximately 1km to the west. While CSZ6.A contains four parcels of priority woodland, these are relatively limited in extent and may be avoidable through design. There is potential for impacts on protected species, hedgerows, and watercourses, particularly during construction.

6.7.16 CSZ6.B presents a higher level of ecological constraint due to the presence of a centrally located unnamed watercourse that is directly connected to the River Eden, increasing the likelihood of impacts on aquatic habitats and species. CSZ6.B is also within the IRZs of Moorthwaite Moss SSSI and Cumwhitton Moss SSSI, located approximately 300m and 700m to the east respectively. These designations increase the potential for impacts, particularly from pollution, disturbance, and hydrological changes.

6.7.17 Both Siting Areas are considered to have potential for impacts on ecology due to their proximity to designated sites and the presence of sensitive habitats. CSZ6.B is more constrained due to its closer proximity to multiple SSSIs and a direct hydrological connection to the River Eden SAC/SSSI, which is likely to require further assessment and mitigation if this option is taken forward. CSZ6.A, is also constrained by ecologically sensitive sites, although there could be greater flexibility to avoid key features through careful design and siting.

Other Environmental Considerations

6.7.18 Water, geology and soils were also considered as part of the options appraisal. No specific geological or soil-related constraints were identified at this stage within CSZ6.

6.7.19 From a water environment perspective, neither CSZ6.A nor CSZ6.B present a significant constraint to development. Both Siting Areas are located within Flood Zone 1, indicating a low probability of fluvial flooding. However, each is intersected by minor watercourses or drainage ditches, which introduce localised surface water flood risk, particularly during extreme rainfall events. CSZ6.B also contains springs, which may indicate groundwater–surface water interaction. These features would require careful consideration during design, but it is anticipated that any impacts could be mitigated.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.7.20 Sections of CSZ6 are identified as MSAs, including areas within CSZ6.A and CSZ6.B, which are also within a MCA[40]. While it is preferable to avoid these areas as far as possible, they would not be considered differentiating factors for the development of a new substation in CSZ6.

6.7.21 The majority of the land within this Siting Zone is designated as ALC Grade 3, with one area of Grade 2. All of CSZ6.B is Grade 3 and a large section in the east of CSZ6.A is shown as Grade 2. Further analysis at later project stages would be required to determine the potential loss of BMV (Grade 2 and 3a).

Aviation and Defence

6.7.22 Due to distance of the Siting Areas from key aviation and defence constraints, no impacts are anticipated.

Traffic and Transport

6.7.23 There are two PRoWs which intersect CSZ6: Public Bridleway 138028 crosses the northern corner of CSZ6.A; and Public Bridleway 113014 runs close to the southern boundary of CSZ6.B.

6.7.24 CSZ6.A is bounded by three unnamed C-roads. A C-road (Allen Grove) which runs south-east from the A69 towards Allenwood forms part of NCN 72, and there would be potential impact on users if used for HGV access. The nearest A road to CSZ6.A is the A69, located 3.7km north-west. There are four potential access routes to the CSZ6.A from the A69 via Great Corby, Burnrigg, Allenwood / Broadwath and Heads Nook, however, none would be suitable for HGV access, with no opportunity for mitigation on existing roads due to substantive constraints including proximity of the roads to residential frontages and bends which restrict visibility. One of the unnamed C roads also includes a railway level crossing which could not be widened and has long vehicle restrictions.

6.7.25 CSZ6.B is bounded by two unnamed roads, with a C-road to the east and an unnamed road to the south. The nearest A road to CSZ6.B is the A6, located 5km west, and connects to the M6 at the northern extent. The A69 is located 6km north-west. As with CSZ6.A, the routes leading to the A6 and A69 from CSZ6.B are not considered suitable for HGV access with no opportunity for mitigation on existing roads.

6.7.26 Overall, constraints to possible access routes include isolated residential properties and frontage, the presence of narrow rail bridges, and visibility restrictions. This would mean new and lengthy haul roads would need to be provided. Therefore, access issues are a determining factor when considering the development of a new substation in CSZ6.

Engineering and Systems Appraisal Summary

6.7.27 DNO overhead lines run through both Siting Areas, diversions may be required in CSZ6.A and are likely to be required in CSZ6.B to facilitate the construction of substations on these sites. When compared to CSZ6.A, CSZ6.B has a smaller area and therefore would have less flexibility to avoid potential constraints through careful siting.

6.7.28 CSZ6 is largely covered by glacial deposits, predominantly glacial till with some localised areas of glaciofluvial deposits near the northern boundary of CSZ6.B and along the eastern boundary of CSZ6.A that may require treatment or removal and replacement.

Horlock Rules

6.7.29 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.7.30 At this early stage of development **Horlock Rules 7, 9, 10** and **11** are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.7.31 The appraisal of CSZ6 and the Siting Areas within it (CSZ6.A and CSZ6.B) has been undertaken with reference to the Horlock Rules, as outlined below:

- Consideration of Environmental Features (**Horlock Rule 1**): The Siting Areas have been defined with consideration of environmental features including designated

heritage assets (e.g. Corby Castle Registered Park and Garden), ecological designations (e.g. River Eden SAC/SSSI), and landscape character. The appraisal identifies potential impacts on these features and highlights some opportunities for mitigation through siting and design.

- Avoidance of Areas of Highest Amenity Value (**Horlock Rules 2** and **3**): Both Siting Areas avoid designated landscapes such as National Parks or National Landscapes. However, CSZ6.A lies closer to Corby Castle and a cluster of designated assets, increasing the potential for setting impacts. CSZ6.B is more distant from high-value heritage assets and is therefore less constrained in this regard.
- Opportunities for Siting and Impact Reduction (**Horlock Rules 4** and **5**): CSZ6.A offers flexibility for siting to facilitate avoidance of sensitive features such as watercourses, woodland, and PRoWs. CSZ6.A includes mature vegetation that could support visual containment and ecological mitigation. CSZ6.B, while more open and topographically complex, may require more extensive earthworks and mitigation to address ecological and visual constraints.
- Use of Existing Screening Features (**Horlock Rule 4**): CSZ6.A benefits from mature vegetation and woodland that could provide natural screening and reduce visual prominence. In contrast, CSZ6.B is more elevated and open, with fewer opportunities for visual containment, particularly in relation to the gorge landscape to the west.
- Minimising Effects on Agricultural Land and Drainage (**Horlock Rule 6**): Both Siting Areas are predominantly located on agricultural land Grade 3, however CSZ6.A includes areas of Grade 2 land and may be impacted to achieve the area required whilst avoiding other constraints. Both Siting Areas intersect with MSAs. CSZ6.A is underlain by a highly productive aquifer, increasing the need for careful design to avoid impacts on soil and water resources. CSZ6.B includes springs and is underlain by the Eden Shales Formation, which may require additional geotechnical mitigation due to potential for heave and subsidence.

Summary of Appraisal of Siting Zone 6

Environmental

6.7.32 The key environmental factors influencing the appraisal of CSZ6 are predominantly landscape and visual amenity as well as ecological considerations. There are conflicting opportunities and constraints across CSZ6, for example, the topography of CSZ6.A has limited opportunity to mitigate landscape and visual impacts, particularly to, residential properties and PRoWs. The ecological constraints associated with CSZ6.B would require further detailed assessment if this option was progressed further. While other factors were considered these did not highlight any major siting constraints or impacts.

Socio-economic

6.7.33 The key socio-economic factors influencing the appraisal of CSZ6 are predominantly traffic and transport considerations. The possible construction routes to the A69 and A6 would not be suitable for HGV access due to isolated residential properties and frontage, the presence of narrow rail bridges, and visibility restrictions. This would mean provision of new and lengthy haul road would need to be provided. Therefore, access is considered a determining factor to the development of a new substation within CSZ6.

Engineering and Systems

6.7.34 The main engineering factors influencing the appraisal of CSZ6 relate to existing DNO overhead lines. These constraints are likely to be avoidable within CSZ6.A, although less likely to be avoided within CSZ6.B. While other factors were considered these did not highlight any major siting constraints or impacts.

6.8 New Carlisle Substation Siting Zone 7

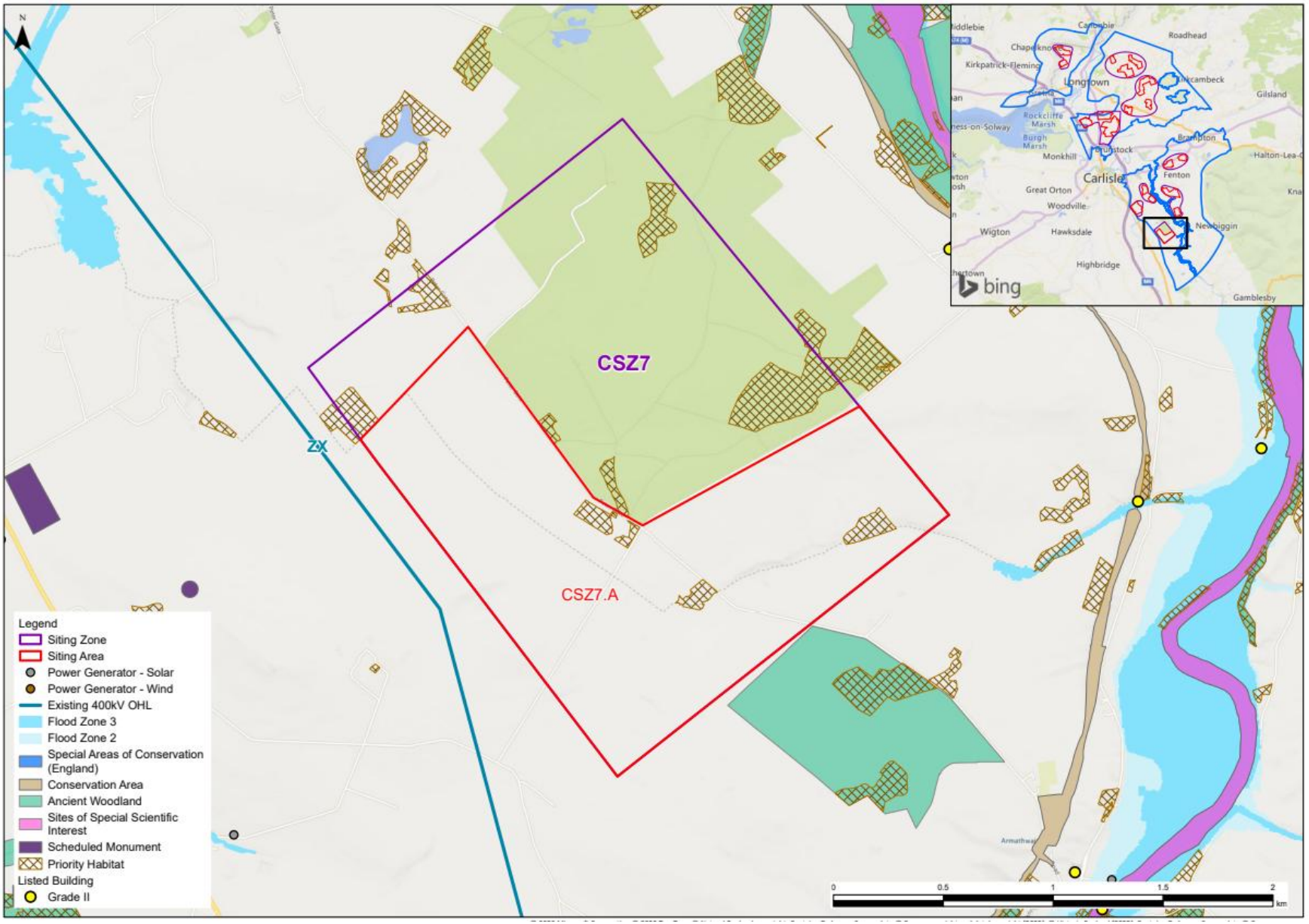
6.8.1 CSZ7 is a substation Siting Zone located to the south of Carlisle (Option B).

CSZ7 occupies an area of approximately 431ha, located 1.6km south-east of the village of Cotehill and 6.3km south-east of Carlisle. The majority of CSZ7 is forestry and agricultural land with few residential properties. The River Eden and Tributaries SSSI is 1km north-east of the Siting Zone. The existing National Grid 400 kV Harker-Hutton overhead line is located 183m west of CSZ7.

6.8.2 CSZ7 is described in **paragraph 5.6.24** and shown in **Figure 6-7**. The Siting zone contains one Siting Area described below:

- Siting Area CSZ7.A: a site 1.9km by 1.9km, approximately 226ha. Various unclassified roads intersect the middle of this Siting Area. The existing National Grid 400 kV Harker-Hutton overhead line is located 183m to the west.

Figure 6-7 – New Carlisle Substation Siting Zone 7 (CSZ7) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.8.3 CSZ7 is located within National Character Area 9: Eden Valley, a well-wooded, undulating valley landscape supporting mixed agriculture. Falling within Cumbria Landscape Character Assessment LCT Sub-type 10 (Sandstone Ridge), CSZ7 is characterised by improved pasture, a mosaic field pattern, and blocks of conifer plantation and mixed woodland. The Siting Zone offers expansive views and includes some existing overhead line infrastructure. Approximately 5.3km from the North Pennines National Landscape at its closest CSZ7 is sufficiently distant to be unlikely to fall within its setting.

6.8.4 CSZ7.A is situated on a prominent north south ridge with a mix of open farmland and mature vegetation. Likely direct landscape impacts include localised hedgerow and tree loss and disruption to the pattern of the landscape, including loss of mature vegetation and shelterbelts. Indirect impacts on perceptual and scenic quality may extend beyond the CSZ7.A but are likely to be limited by surrounding commercial mature vegetation. The presence of overhead lines reduces the susceptibility of the landscape character to change. One residential property adjacent to CSZ7.A would likely experience foreground views, with potential for impacts in medium to longer range residential views. Visual containment from vegetation and landform may screen some views. There is also potential for impacts on the visual amenity of recreational users of PRoW, though visibility may be limited.

6.8.5 Overall, the existing overhead line and presence of blocks of commercial forestry plantation provide a degree of visual containment for CSZ7.A, along with limited visual receptors in the surroundings, these characteristics would reduce longer-term impacts on landscape character and visual amenity.

Historic Environment

6.8.6 There are no designated assets within CSZ7.A. There are however three designated assets within 1km of CSZ7.A, all Grade II listed buildings to the north-east, and elements of the Settle to Carlisle Railway approximately 800m to the south-east and east. The rolling landscape and mature woodland provide screening, limiting potential impacts on their setting. The scheduled hillfort on Barrock Fell (NHLE 1007874) is located about 1km west on high ground. While its setting is currently not fully understood, and further assessment is required for understating the contribution that setting makes to its significance, key views would appear to be over the routeways that existed to the west, and it does not appear to have been designed to be intervisible with other similar monuments to the east. Woodland planting and arable cultivation have also reduced its visual dominance, and the position of the asset on the northern slope might suggest key views were to the north, making views to the east and CSZ7.A were less significant.

6.8.7 No physical impacts or impact on setting are expected on the Hadrian's Wall WHS or attributes of its OUV due to the distance between CSZ7.A and the WHS (the WHS buffer is at least 8.3km to the north-west, while the nearest scheduled components are at least 11km to the north-west), as well as screening from intervening topography, the built environment, and vegetation.

6.8.8 Potential physical impacts on non-designated assets within the footprint of CSZ7.A may occur during construction but could be mitigated through standard archaeological measures.

6.8.9 Overall, CSZ7.A may be less suitable from a historic environment perspective due to its proximity to the scheduled hillfort on Barrock Fell (NHLE 1007874), which is located on high ground and partially overlooks the Siting Area. While other designated assets are present, they are well screened and at greater distances, resulting in lower sensitivity.

Ecology

6.8.10 CSZ7 lies within a predominantly arable landscape interspersed with hedgerows, grassland, individual trees, and a small area of priority deciduous woodland. The Pow Maughan watercourse enters the western edge of the Siting Area and may support protected species. CSZ7.A is located approximately 1.2km west of the River Eden and Tributaries SSSI and within its associated IRZ. It is also hydrologically connected to the Solway Firth SAC, SPA, SSSI, and Ramsar site, located over 12km to the west.

6.8.11 Potential ecological sensitivities include habitat loss and fragmentation, particularly of hedgerows and woodland, and disturbance to protected species. The proximity to the River Eden and its tributaries raises the potential for indirect impacts such as pollution, dust deposition, and disturbance from construction activities. There is also potential for indirect impacts on the Solway Firth, particularly in relation to functionally linked land and bird strike risk from overhead lines associated with the connection to the substation.

6.8.12 CSZ7 may be less suitable due to its proximity to the River Eden SSSI and SAC. The presence of sensitive habitats and species within the designated site would require detailed assessment and mitigation if this Siting Zone was progressed for the development of a new substation. The potential for indirect impacts on the Solway Firth further increases the ecological risk of CSZ7.A.

Other Environmental Considerations

6.8.13 Water, geology and soils were also considered as part of the options appraisal. No specific geological or soil-related constraints are identified at this stage within CSZ7.

6.8.14 CSZ7 contains several watercourses and drainage ditches, including tributaries of the River Eden and Pow Maughan, as well as a locally important waterbody, Blackmoss Pool. CSZ7 is not in within Flood Zone 2 or 3, although development could increase flood risk through surface water runoff, loss of flood storage, and impeded flow paths. These risks are considered manageable through standard mitigation, including surface water management, pollution control, and avoiding works near watercourses and Blackmoss Pool.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.8.15 Sections of CSZ7.A are located within a MSA for sand and gravel, sections are also within a MCA[40]. While it is preferable to avoid these areas as far as possible, they would not be considered differentiating factors for the development of a new substation in CSZ7. It is expected that careful siting of the infrastructure within CSZ7.A could be sufficient to avoid the MSA.

6.8.16 All of the agricultural land within this Siting Zone is designated as ALC Grade 3, the extent of BMV (Grade 3a) is not known at this stage and ALC or BMV are therefore not key differentiating factors.

Aviation and Defence

6.8.17 Due to the distance of CSZ7.A from key aviation and defence constraints, no impacts are anticipated.

Traffic and Transport

6.8.18 There is a railway approximately 1km to the east, and approximately six footpaths to the north of Armathwaite which pass near to the south-east corner of CSZ7.A. Armathwaite railway station is approximately 1.5km south of CSZ7. There are no NCNs or navigable waterways close to CSZ7.A.

6.8.19 There are no major or A roads within CSZ7, CSZ7.A is traversed by an unnamed C road and an unclassified road. The C road has no footways in the rural sections (along the frontage of CSZ7 and within CSZ7.A) but there are footways along one or both sides of the road in the built-up area of Cotehill to the north of CSZ7.

6.8.20 The nearest A road is the A6, located approximately 1.7km to the west of CSZ7.A. Vehicular access could potentially be from the A6 via a C road to the west of CSZ7.A, or the unclassified road that crosses CSZ7.A. To enable access to the site via the C road and the unclassified road, mitigation would be required, including temporary diversion during construction and permanently diverted for the operational phase. It is expected that the potential impacts could be managed with mitigation.

Engineering and Systems Appraisal Summary

6.8.21 There are DNO overhead lines running through the southeast of the CSZ7.A. These may require diversions to facilitate the construction of a new substation. The NWEP runs through CSZ7.A, however, it is likely that the substation could be located to avoid this. Additionally, two gas pipelines run through CSZ7.A which likely could be avoided with careful siting. However, engagement with the relevant asset owner would be required to confirm any exclusion zones.

6.8.22 CSZ7 is largely covered by glacial deposits, predominantly glacial till with Glaciolacustrine deposits present in the north-west corner of CSZ7.A. These glaciolacustrine deposits can often contain laminated silts and clays, perched water tables and very soft and compressible deposits. They may also be susceptible to differential settlement and compaction but can be avoided through careful siting. Glacial materials have the potential to be variable in terms of composition, thickness and strength and may include localised soft spots and less favourable ground that may require treatment or removal and replacement. Some very localised, of limited extent, alluvium deposits are also identified towards the eastern side of CSZ7.A.

Horlock Rules

6.8.23 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.8.24 At this early stage of development **Horlock Rules 7, 9, 10** and **11** are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.8.25 The appraisal of CSZ7 and the Siting Area within it (CSZ7.A) has been undertaken with reference to the Horlock Rules, as outlined below:

- Consideration of Environmental Features (**Horlock Rule 1**): CSZ7.A has been defined with consideration of environmental features including designated heritage assets (e.g. Barrock Fell hillfort and nearby listed buildings), ecological designations (e.g. River Eden SSSI/SAC and Solway Firth SPA/SAC), and landscape character. The appraisal identifies potential impacts on these features and highlights opportunities for mitigation through siting and design.
- Avoidance of Areas of Highest Amenity Value (**Horlock Rules 2** and **3**): CSZ7.A avoids designated landscapes such as National Parks or National Landscapes. While it is located near a scheduled monument and several listed buildings, the presence of topography and mature woodland provides screening that would reduce potential setting impacts. CSZ7.A is also distant from the Hadrian's Wall WHS to avoid direct or indirect impacts.
- Opportunities for Siting and Impact Reduction (**Horlock Rules 4** and **5**): CSZ7.A offers flexibility for siting to facilitate avoidance of sensitive features such as watercourses, woodland, and infrastructure (e.g. gas pipelines and NWEP). While the topography is variable, flatter areas in the west offer opportunities to reduce the need for extensive earthworks. Mitigation measures such as planting and careful layout could reduce visual and ecological impacts.
- Use of Existing Screening Features (**Horlock Rule 4**): CSZ7.A benefits from mature commercial forestry and shelterbelts that provide visual containment. These features, along with the undulating landform, help reduce the prominence of new infrastructure in the wider landscape and limit views from nearby receptors.
- Minimising Effects on Agricultural Land and Drainage (**Horlock Rule 6**): All Siting Areas are predominantly located on agricultural land and all land is ALC Grade 3. The impact on BMV agricultural land is considered using publicly available provisional data on ALC (no subgrades or survey data) only, and will be assessed at later project stages. CSZ7.A intersects a MSA, however, micrositing could allow avoidance of the most sensitive areas. The presence of glaciolacustrine deposits and soft ground conditions may require ground treatment, but these are not considered prohibitive. CSZ7 is not within Flood Zone 2 or 3, surface water risks are considered manageable through standard design and drainage measures.

Summary of Appraisal of Siting Zone 7

Environmental

6.8.26 The key environmental factors influencing the appraisal of CSZ7 are predominantly ecological and historic environment considerations. The proximity to designated ecological and historical sites are likely to require further detailed assessment and mitigation if this option is progressed for the development of a new substation. While other factors were considered, these did not highlight any major siting constraints or impacts which would be a determining factor in the development of a new substation in CSZ7.

Socio-economic

6.8.27 The socio-economic appraisal did not identify any constraints or impacts. While some potential impacts would be unavoidable, including temporary or permanent diversions of the C road and unclassified road, these are considered to be mitigable.

Engineering and Systems

6.8.28 The main engineering factors influencing the appraisal of CSZ7 relate to existing utilities. These include existing DNO overhead lines running through the south-east of CSZ7.A, two gas pipelines, and the NWEP. The existing DNO overhead lines are likely to be an unavoidable constraint for any substation siting in the southern and eastern parts of CSZ7. A diversion of these existing overhead lines would be required to facilitate siting a substation here. Engagement with the relevant asset owner would be required to confirm any exclusion zones for the gas pipelines.

6.9 New Carlisle Substation Siting Zone 8

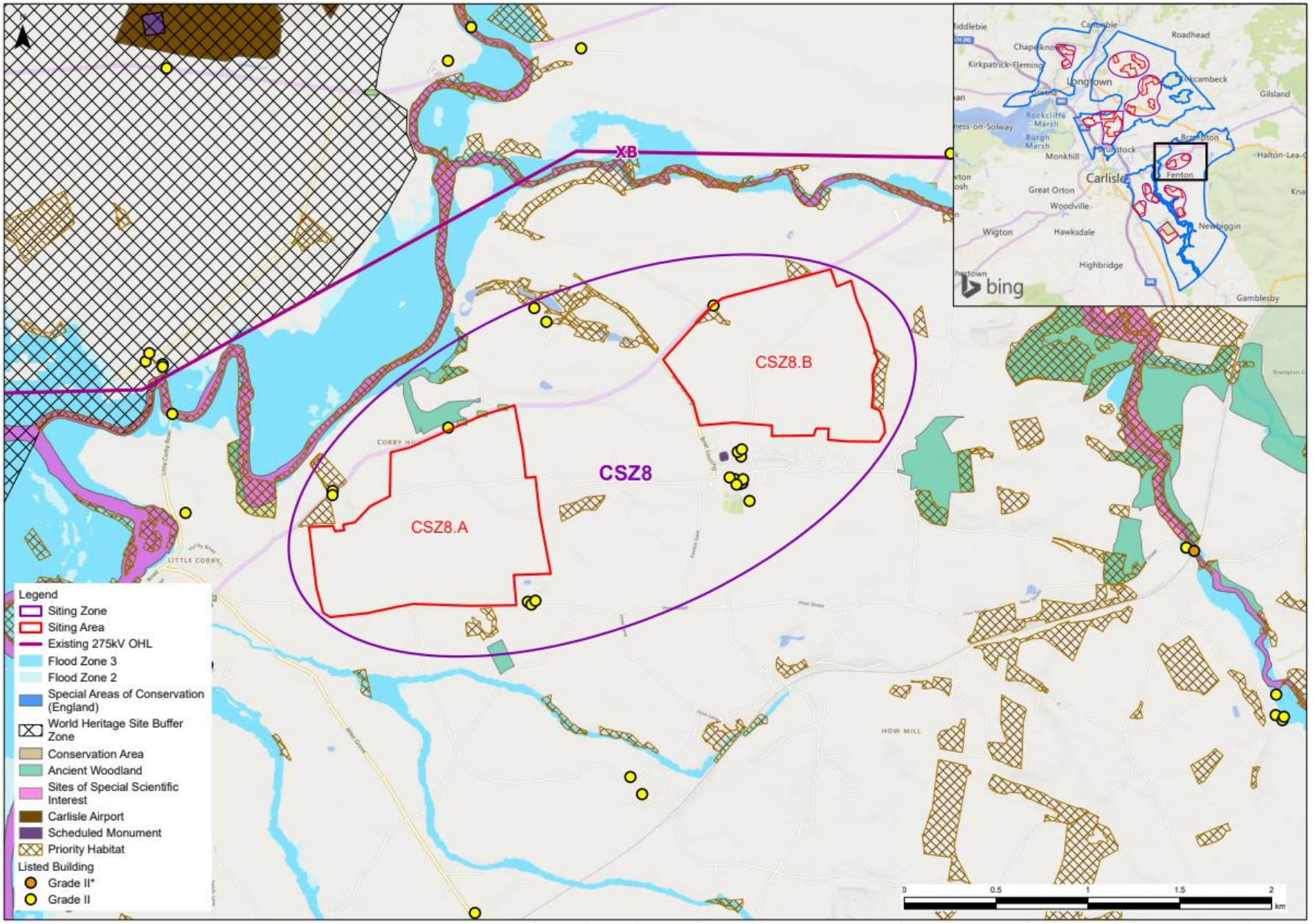
6.9.1 CSZ8 is a substation Siting Zone located to the south of Carlisle (Option B).

6.9.2 CSZ8 occupies an area of approximately 515ha located 200m east of the village of Little Corby and 5.3km east of Carlisle. CSZ8 includes the village of Hayton, within which the majority of the residential properties are located, the rest of the Siting Zone is mostly agricultural. The A69 road bisects the northern section of CSZ8, with various unclassified roads throughout. The River Irthing SAC is adjacent to the northern boundary, and the Hadrian's Wall WHS buffer zone is 700m north (2.3km from the nearest scheduled component).

6.9.3 CSZ8 is described in **paragraph 5.6.25** and shown in **Figure 6-8.** The Siting Zone contains two Siting Areas described below:

- Siting Area CSZ8.A: a site 1.3km by 0.9km, approximately 97ha, located adjacent to the south of the A69 road, with unclassified roads intersecting in the northern half of the Siting Area and one more to the south.
- Siting Area CSZ8.B: a site 1km by 0.8km, approximately 79ha. The A69 is adjacent to the northern boundary of this Siting Area.

Figure 6-8 – New Carlisle Substation Siting Zone 8 (CSZ8) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.9.4 CSZ8 lies within National Character Area 9: Eden Valley, a well-wooded, undulating valley landscape supporting mixed agriculture. Located within Cumbria Landscape Character Assessment LCT Sub-type 5c (Rolling Lowland), CSZ8 is characterised by open, rolling topography, pasture-dominated land use, and a network of hedgerows and mature trees. No designated landscape sites are present within CSZ8, the North Pennines National Landscape lies approximately 2.6km to the south-east at its closest point, but CSZ8 is considered likely to lie outside of the setting.

6.9.5 Both CSZ8.A and CSZ8.B are located in a relatively intact, small-scale landscape with mature vegetation. CSZ8.A is adjacent to Greenholme Beck and near Warwick Bridge, while CSZ8.B lies close to the settlement edge of Hayton and Pottlebog Beck. Both areas are likely to experience impacts on landscape character due to potential loss of mature trees and hedgerows, and on visual amenity due to the presence of nearby residential receptors and PRoW. In both locations, the introduction of a substation would result in direct landscape impacts due to the loss of hedgerows and mature trees, and indirect impacts on perceptual and scenic quality extending beyond the Siting Areas. The presence of mature vegetation in the surrounding landscape provides some containment and context for landscape mitigation, but the potential for significant impacts on both landscape character and visual amenity remains high in both cases.

6.9.6 CSZ8.A is characterised by a relatively small-scale landscape pattern of narrow, linear fields, which is less able to accommodate development without impacts. The loss of mature vegetation associated with Greenholme Beck would result in impacts to landscape character. Approximately eight residential properties within 350m of CSZ8.A would likely experience foreground views, some are partially screened by vegetation or buildings. CSZ8.A is also close to Warwick Bridge and the PRoW present in the surrounding landscape and is likely to result significant visual impacts. The small-scale landscape pattern and proximity to residential receptors limit opportunities to reduce impact through mitigation.

6.9.7 CSZ8.B borders the settlement of Hayton, a substation here would likely compromise its approach and character. The presence of scattered mature specimen trees within the Siting Area limits the ability to site the substation in a way that reduces impacts. Residential properties on the northern edge of Hayton are either adjacent to or in close proximity to CSZ8.B, with direct and midground views. PRoWs cross CSZ8.B and are located to the south-west, increasing the potential for visual impacts. The proximity to the settlement and elevated viewpoints from higher ground make significant long-term impacts on landscape character and visual amenity unavoidable.

6.9.8 Both Siting Areas are subject to significant landscape and visual constraints. However, CSZ8.B is more constrained due to its proximity to the settlement of Hayton, the presence of specimen trees, and the unavoidable visual impacts on multiple residential receptors and PRoW. In contrast, CSZ8.A, while still constrained, offers slightly more opportunity for mitigation due to its more rural setting and less immediate proximity to dense residential areas. Therefore, CSZ8.A is preferred within CSZ8 from a landscape and visual perspective.

Historic Environment

6.9.9 There are no designated heritage assets located within CSZ8. However, a number of designated heritage assets are present in the surrounding landscape. These include Grade II listed Toppin Castle and associated structures, located immediately adjacent to CSZ8.A, and the scheduled Castle Hill monument, located approximately 150m south of CSZ8.B in the village of Hayton. Other designated assets, including Grade II* listed churches and scheduled monuments, are located at greater distances and are generally screened by topography, mature woodland, and the built environment.

6.9.10 The Hadrian's Wall WHS buffer is located approximately 900m north of CSZ8.A and at least 1.6km north of CSZ8.B. The nearest scheduled monuments that are components of the WHS are located over 2km north, and the Wall itself is situated more than 3.6km to the north of both Siting Areas. The A69, which is tree-lined, and the valley of the River Irthing provide a degree of physical and visual separation between the WHS and the Siting Areas, further reducing the potential for intervisibility or impacts on the OUV of the WHS. Standard archaeological mitigation measures are assumed to be sufficient to address potential impacts on non-designated or previously unrecorded assets.

6.9.11 For CSZ8.A, the primary constraint is the proximity of the Grade II listed Toppin Castle (NHLE 1051105) and its associated barn and gate piers (NHLE 1335589 and 1087554), which are located immediately adjacent to the Siting Area. A substation in this location could reduce the prominence of the castle in the landscape, diminishing its significance. While careful design and screening through planting may help reduce setting impacts on other assets, the close proximity of Toppin Castle limits the potential for full mitigation. No physical impacts to designated assets are anticipated.

6.9.12 CSZ8.B lies approximately 150m north of the scheduled Castle Hill monument (NHLE 1004591) and 350m north of the Grade II* listed Church of St Mary Magdalen (NHLE 1335622). Although these are high value assets, existing screening from topography, mature woodland and the built environment is expected to limit impacts on their setting and significance. The prominence of Castle Hill has already been diminished by surrounding development of the settlement of Hayton. Physical impacts on the milestone on the A69 (NHLE 1087553) would be avoided if access is required in that area.

6.9.13 While both Siting Areas are near designated heritage assets, CSZ8.A is more constrained due to the immediate adjacency of Toppin Castle and its associated structures, which are sensitive to changes in their setting. In contrast, CSZ8.B, despite being closer to higher-value assets, benefits from natural and built screening that reduces the likelihood of significant impacts. Therefore, CSZ8.B would be preferable compared to CSZ8.A from a historic environment perspective.

Ecology

6.9.14 CSZ8 is characterised by arable land with field margins, hedgerows, grassland, individual trees, and small areas of priority deciduous woodland. The River Eden Tributaries and Estuaries SAC and SSSI is located approximately 300m north-west of CSZ8.A and 350m north of CSZ8.B. Both Siting Areas fall within the SSSI IRZ. CSZ8 contains unnamed watercourses that are tributaries of the River Eden, and are hydrologically connected to the Solway Firth Ramsar site, SAC, SPA and SSSI, approximately 14–15km to the west of both CSZ8.A and CSZ8.B.

6.9.15 Both CSZ8.A and CSZ8.B could result in ecological impacts due to habitat loss, fragmentation, and disturbance to protected species. The proximity to the River Eden SAC and SSSI raises the potential for indirect impacts such as pollution, dust deposition, and disturbance from construction activities. The presence of watercourses within the Siting Areas increases the risk of downstream impacts on sensitive habitats.

6.9.16 In conclusion, both CSZ8.A and CSZ8.B are considered to present a high level of ecological constraints as they are located within close proximity to the River Eden SAC/SSSI and contain tributary watercourses which connect them hydrologically to the River Eden SAC/SSSI.

Other Environmental Considerations

6.9.17 Water, geology and soils were also considered as part of the options appraisal. No specific geological or soil-related constraints were identified at this stage within CSZ8.

6.9.18 Both CSZ8.A and CSZ8.B contain watercourses and are underlain by a highly productive principal aquifer. Development in both Siting Areas could increase flood risk due to surface water runoff, loss of flood storage, and impeded overland flow paths. CSZ8.A is intersected by the Greenholme Beck, a Water Framework Directive (WFD) designated waterbody with a “Good” ecological status, while CSZ8.B contains the headwaters of the Pottlebog Beck, which is not WFD-designated but drains into a sensitive catchment. Both sites also contain springs, which may influence local groundwater regimes. While there would be potential impacts on water quality, hydro-geomorphology, and aquatic ecology, particularly during construction, these impacts are considered manageable through standard mitigation measures, including surface water management, pollution control, and avoidance of works near watercourses and springs. CSZ8.B is less constrained than CSZ8.A in relation to water environment considerations and is therefore the preferred option within CSZ8.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.9.19 Sections of CSZ8 are located within a MSA (almost the entirety of Siting Area CSZ8.B), these sections are also within an MCA[40]. For CSZ8.A, development south of the unclassified road south of the A69 would avoid the majority of the MSA. For CSZ8.B, it is not possible to avoid the MSA through design, although it is considered that the minerals in this area may have already been sterilised by existing infrastructure. It is also not known at this stage whether any minerals at risk of sterilisation in this area have any commercial viability or not.

6.9.20 All of the agricultural land within CSZ8 is designated as ALC Grade 3, the extent of BMV (Grade 3a) is not known at this stage and ALC or BMV are therefore not key differentiating factors.

Aviation and Defence

6.9.21 Due to the distance of the Siting Areas from key aviation and defence constraints, no impacts are anticipated.

Traffic and Transport

6.9.22 There is one unclassified road which crosses CSZ8.A, south of the A69. CSZ8 is bisected by an unclassified, unnamed road which crosses CSZ8.B in a south west to north east direction as well as Public Footpath 117025 which bisects the Siting Area in a north to south direction between that road and the A69. Both Siting Areas allow flexibility to position the substations in the southern part of the Siting Areas where it is unlikely to encroach on either road. If this is not possible, this road may need to be closed or diverted, with the potential for delay on road users and pedestrians.

6.9.23 The A69 runs across the north of CSZ8, along the northern boundary of CSZ8.A and CSZ8.B. Access could be off the A69 as it is an A classification road and forms part of the HGV Cumbria Routes for timber haulage. The A69 has narrow footways in the built-up areas including on approach to and through Corby Hill and Warwick Bridge to the east. The A69 is also a bus route, and the nearest bus stops are in Byegill Farm which serve bus route 685 and a school bus service, the S96. It is not considered that traffic and transport impacts would constrain the development of a new substation within CSZ8.

Engineering and Systems Appraisal Summary

6.9.24 There are DNO overhead lines running through CSZ8.A and CSZ8.B. It may be possible to avoid these when siting the substations within the Siting Areas. Otherwise a diversion of the overhead lines may be required to facilitate construction of a new substation here.

6.9.25 CSZ8 is largely covered by glacial deposits, predominantly glacial till. There are also localised areas of glaciofluvial deposits to the east of the Siting Zone and along the eastern boundary of CSZ8.B which may require treatment or removal and replacement.

Horlock Rules

6.9.26 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.9.27 At this early stage of development **Horlock Rules 7, 9, 10** and **11** are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.9.28 The appraisal of CSZ8 and the Siting Areas within it (CSZ8.A and CSZ8.B) has been undertaken with reference to the Horlock Rules, as outlined below:

- Consideration of Environmental Features (**Horlock Rule 1**): The Siting Areas have been defined with consideration of environmental features including designated heritage assets (e.g. Toppin Castle, Castle Hill, and the Church of St Mary Magdalen), ecological designations (e.g. River Eden SAC/SSSI), and landscape character. The appraisal identifies potential impacts on these features and highlights opportunities for mitigation through siting and design.
- Avoidance of Areas of Highest Amenity Value (**Horlock Rules 2** and **3**): Both Siting Areas avoid designated landscapes such as National Parks or National Landscapes. However, CSZ8.A lies immediately adjacent to Toppin Castle and its associated listed structures, increasing the potential for setting impacts. Siting Area CSZ8.B,

while closer to higher-value assets, benefits from screening and is situated in a developed area, reducing the likelihood of significant impacts.

- Opportunities for Siting and Impact Reduction (**Horlock Rules 4** and **5**): Both Siting Areas offer some flexibility for siting to facilitate avoidance of sensitive features such as watercourses, PRoWs, and infrastructure. CSZ8.A, while constrained by its small-scale landscape and proximity to residential receptors, may allow for more rural integration. CSZ8.B is more constrained due to its proximity to Hayton, specimen trees, and limited space for mitigation.
- Use of Existing Screening Features (**Horlock Rule 4**): Both Siting Areas benefit from mature vegetation and topography that provide some visual containment. However, CSZ8.A offers slightly more opportunity for mitigation due to its more rural setting and less immediate proximity to dense residential areas, whereas CSZ8.B is more exposed to visual receptors and elevated viewpoints.
- Minimising Effects on Agricultural Land and Drainage (**Horlock Rule 6**): Both Siting Areas are predominantly located on agricultural land and all land is ALC Grade 3. The impact on BMV agricultural land is considered using publicly available provisional data on ALC (no subgrades or survey data) only, and will be assessed at later project stages. Both Siting Areas intersect with the MSA. CSZ8.B lies almost entirely within an MSA, which cannot be avoided through design, although the minerals may already be sterilised. CSZ8.A may offer more flexibility to avoid sterilisation. Both areas are underlain by glacial till and principal aquifers, with watercourses and springs present. These introduce potential risks to water quality and hydro-geomorphology, though these are considered manageable through standard mitigation.

Summary of Appraisal of Siting Zone 8

Environmental

6.9.29 The key environmental factors influencing the appraisal of CSZ8 are predominantly ecological as well as landscape and visual amenity and historic environment considerations. CSZ8 presents a high level of ecological constraint due to proximity to the River Eden SAC and SSSI. In regard to landscape and visual amenity, the west of CSZ8 (CSZ8.A) offers mitigation opportunity as well as a rural setting preferable to site a substation, however both Siting Areas are subject to significant landscape and visual constraints. While other factors were considered these did not highlight any major siting constraints or impacts.

Socio-economic

6.9.30 The socio-economic appraisal did not identify any constraints or impacts. While some potential impacts would be unavoidable, such as the MSA within CSZ8.B, it is considered that the minerals in this area may have already been sterilised by existing infrastructure, with CSZ8.A offering greater siting flexibility in respect of the MSA.

Engineering and Systems

The main engineering factors influencing the appraisal of CSZ8 are the existing DNO overhead lines. These constraints are likely to be avoidable in siting a new substation,

however, the existing DNO overhead line is likely to constrain new overhead lines connecting to a substation in CSZ8.

6.10 New Carlisle Substation Siting Zone 9

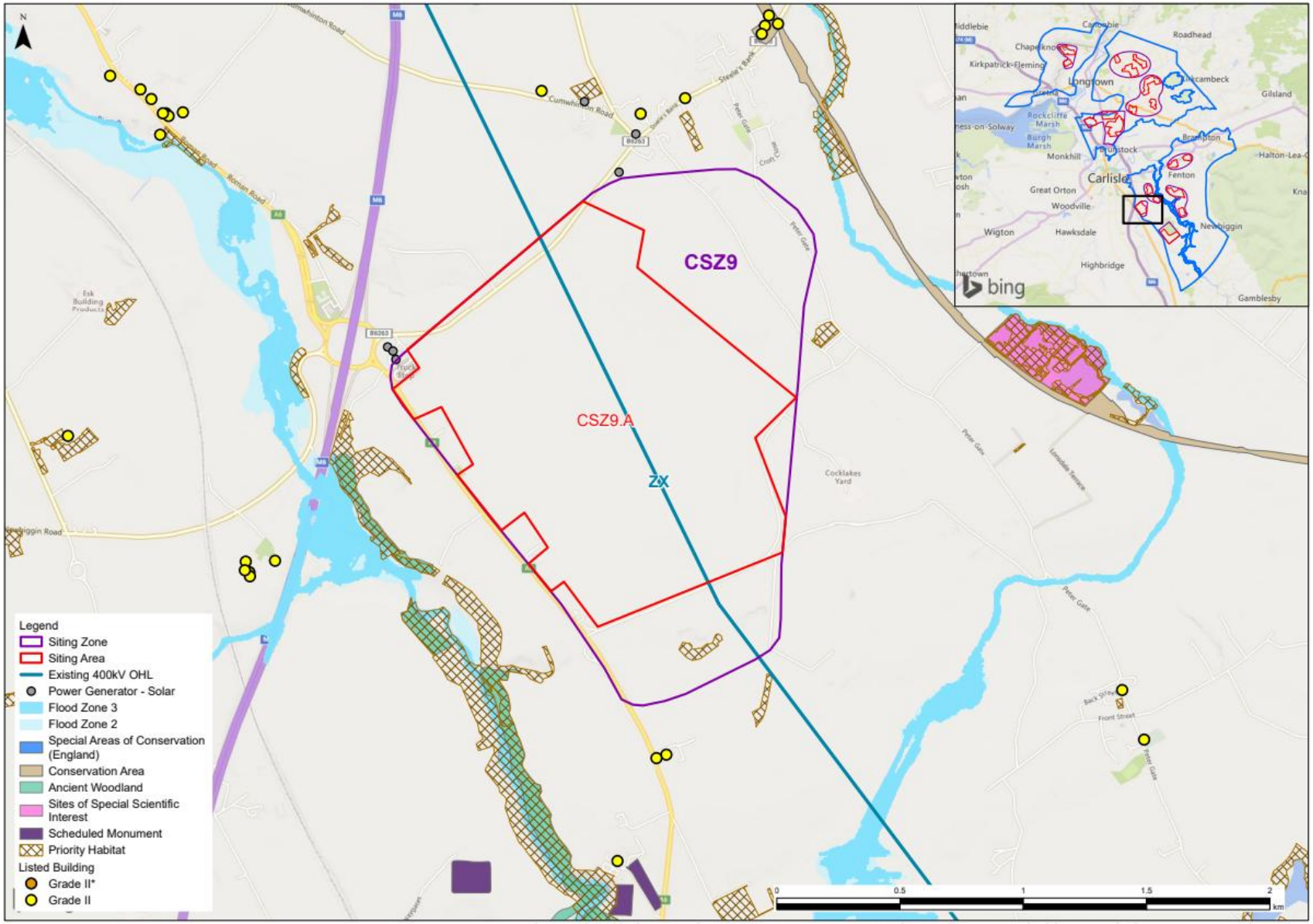
6.10.1 CSZ9 is a substation Siting Zone located to the south of Carlisle (Option B).

6.10.2 CSZ9 occupies an area of approximately 246ha located immediately to the south of the village of Cumwhinton and 1.8km south-east of Carlisle. CSZ9 is predominantly agricultural fields with few residential properties scattered throughout. The A6 is adjacent to the north-west boundary of the Siting Zone, the B6263 is adjacent to the north, and the M6 is located 200m west. The Siting Zone is located 260m west of the Settle-Carlisle railway and 1.2km east of the WCML. The existing 400 kV Harker-Hutton line bisects the Siting Zone.

6.10.3 CSZ9 is described in **paragraph 5.6.26** and shown in **Figure 6-9**. The Siting Zone contains one Siting Area described below:

- Siting Area CSZ9.A: a site 1.2km by 1.4km, approximately 160ha. The A6 is adjacent to the south-west boundary of this area and the B6263 is adjacent to the northern boundary of this area. The M6 is approximately 150m from the western boundary of the Siting Area at its closest point. The existing 400 kV Harker-Hutton overhead line bisects the middle of this Siting Area.

Figure 6-9 – New Carlisle Substation Siting Zone 9 (CSZ9) with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

6.10.4 CSZ9 lies within the National Character Area 6: Solway Basin, a low-lying, gently undulating landscape framed by uplands. It is entirely within Cumbria Landscape Character Assessment LCT Sub-type 5b: Low Farmland, characterised by intensively farmed pastoral land, patchy woodland, and a rectilinear field pattern defined by hedgerows and trees. No designated landscape sites are present within CSZ9, the North Pennines National Landscape lies approximately 8.3km to the east at its closest point, but the Siting Zone is not considered to lie within its setting.

6.10.5 CSZ9.A could result in localised impacts on landscape character, particularly through the loss of hedgerows and mature vegetation, especially in the northern part where the field pattern is more irregular. The undulating landform may require modification to accommodate development. Visual impacts are likely for receptors along the A6 and a PRoW that crosses the Siting Area. The total number of potential visual residential receptors is limited and properties often have existing boundary vegetation filtering views towards the site. Where properties have open views to the north-east these are across fields of pasture with existing overhead line visible in the distance. However, the surrounding landform, vegetation, and existing infrastructure (including the M6 and existing overhead lines) provide a degree of visual containment and reduce wider landscape susceptibility. The village of Cumwhinton is located to the north of the Siting Area boundary, there are a limited unquantifiable number of properties at the southern edge of the village that could experience views of the north of CSZ9.A.

6.10.6 CSZ9.A presents moderate landscape and visual constraints, primarily due to localised impacts on vegetation and views from nearby receptors, particularly from the southern edge of Cumwhinton within 250m. However, the presence of existing infrastructure and natural screening features offers opportunities for effective mitigation. Overall, there are no determining factors which would constrain the development of a new substation in CSZ9.A.

Historic Environment

6.10.7 There are no designated heritage assets located within CSZ9. A small number of designated assets are present in the surrounding landscape, including two scheduled monuments of high value, Scalesceugh Roman kilns and Park House Roman Fort, both are located approximately 1km to the south-west of CSZ9.A. Views from these assets towards CSZ9.A are expected to be limited due to screening from topography, woodland, and built structures. Cringles Farm, a Grade II listed building approximately 400m to the north, may have partial views toward the Siting Area, although these are likely filtered by mature vegetation and terrain. Other nearby listed buildings, including those in Cumwhinton and Carleton Farm, are similarly screened by intervening development or orientated away from CSZ9.A.

6.10.8 The Hadrian's Wall WHS buffer is over 3.9km to the north of CSZ9.A and the nearest scheduled components of the WHS are over 6.4km to the north-west. Given this distance and the presence of screening from elements such as topography, impacts on the setting on the WHS, or attributes of its OUV, are not anticipated.

6.10.9 While there is potential for physical impacts on non-designated or previously unrecorded archaeological assets within the footprint of the Siting Area, these can be mitigated through standard archaeological measures.

6.10.10 Overall, CSZ9.A presents low historic environment constraints. Designated assets are sufficiently distant and visually screened, and potential archaeological impacts are manageable. The Siting Area is therefore considered acceptable from a historic environment perspective.

Ecology

6.10.11 CSZ9 is located in a predominantly arable landscape with field margins, hedgerows, grassland, and scattered trees. The River Eden SAC and SSSI is located around 2.3km east of the CSZ9.A. CSZ9.A also lies within the IRZ of both the Cotehill Pastures and Ponds SSSI (approximately 0.8km east of CSZ9.A) and the River Eden and Tributaries SSSI (approximately 2.5km east of CSZ9.A), and the Solway Firth SAC, SPA, SSSI and Ramsar site lies over 13km to the west of CSZ9.A. Whilst CSZ9.A may be hydrologically connected to the Solway Firth via the River Eden, or via the River Petteril, located 400m west of CSZ9.A, the likelihood of indirect impacts is low.

6.10.12 Potential ecological sensitivities include habitat loss, fragmentation, and disturbance to protected species. The proximity to multiple designated sites raises the potential for indirect impacts such as pollution, noise, and disturbance during construction.

6.10.13 Overall, while the CSZ9.A is ecologically sensitive due to proximity to designated sites and potential for habitat disruption, impacts are considered manageable with appropriate mitigation.

Other Environmental Considerations

6.10.14 Water, geology and soils were also considered as part of the options appraisal.

6.10.15 CSZ9.A is located within Flood Zone 1, indicating a low probability of fluvial flooding. CSZ9 is intersected by a tributary of the River Petteril and contains areas of surface water flood risk. The tributary forms part of a WFD-designated waterbody with a “Moderate” ecological status, suggesting some sensitivity to water quality and hydro-geomorphological changes. It is likely that the tributary would be avoided with careful design. Therefore the hydrological sensitivities within CSZ9.A are considered manageable through standard design and mitigation measures.

6.10.16 Geology and soil receptors do not present a constraint to this option at this stage. Whilst peat or peaty soils are not identified at present, some wet and marshy areas were noted during the site visit and further investigation would be required to confirm presence and extent, which would help shape the implementation of any required soil management measures.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

6.10.17 All of the agricultural land within CSZ9 is designated as ALC Grade 3, the extent of BMV (Grade 3a) is not known at this stage and ALC or BMV are therefore not key differentiating factors.

6.10.18 Whilst there do not appear to be any planning constraints within CSZ9, the Siting Zone was previously included within an early draft Local Plan allocation for St Cuthbert's Garden Village. St Cuthbert's Garden Village is now identified in the adopted Carlisle District Local Plan 2015-2030 (2016) under Policy SP3: 'Broad location for growth: Carlisle South'. If this option was selected as preferred, consideration would need to be given to the draft Local Plan. To the north of the Golden Fleece roundabout, the Regulation 19 draft Plan shows a strategic employment allocation as part of the St Cuthbert's Garden Village, with an area of strategic green infrastructure within the allocation. A proposed "mobility hub" is shown as being located approximately halfway along the B6263 (the southern boundary of the Garden Village allocation in this location and the northern boundary of CSZ9).

Aviation and Defence

6.10.19 Aviation and defence receptors do not present a constraint to this option.

Traffic and Transport

6.10.20 There are four transport receptors that intersect CSZ9.A; Public Footpath 138040, the A6, the B6263, and an un-named road. The footpath crosses the Siting Zone in a north to south direction from the B6263 to the unnamed road. The development of a substation close to or crossing recreational routes has the potential to impact on users, in particular during construction. However, these are considered to be mitigable and would not constrain the development of a substation in Siting Area CSZ9.A.

6.10.21 The nearest public highways are the A6 and the B6263 which run along the boundaries of CSZ9. The B6263 forms the northern Siting Zone boundary and has no footways in the rural sections (along the frontage of CSZ9) but there are footways in the adjacent village of Cumwhinton. The A6 between the Siting Area and the M6 would be suitable for regular two-way construction HGV access in its current form. A narrow footway runs along the eastern side of the A6 carriageway and the A6 is also a bus route with bus stops adjacent to the Golden Fleece motorway services which are served by bus route 104, operating a half hourly service to Carlisle. Alternative vehicular access could be taken from the B6263 but widening may be required and temporary or permanent suspension of the weight restriction would be required. Overall, it is expected that temporary construction impacts could be reduced by mitigation to enable access to CSZ9.

Engineering and Systems Appraisal Summary

6.10.22 There are DNO overhead lines running through CSZ9.A that may require a diversion to facilitate construction of a new substation within this Siting Area. Furthermore, the existing 400 kV Harker-Hutton line runs through CSZ9.A, careful consideration would need to be given to the substation siting, and the 400 kV overhead line route, to facilitate corridors for future overhead lines and avoid 400 kV overhead line crossings.

6.10.23 The former Cocklakes Gypsum Mine is located to the east/south-east of CSZ9.A. It is reported to include both surface and underground workings. Former surface workings, now shown as ponds, 200m south-east of CSZ9.A are identified and a mine plan for Cocklakes is understood to be held by the Mining Remediation Authority, formerly the Coal Authority. At this stage, it is not known how extensive any underground workings may be or the condition of any workings and what the relative proximity of these

workings is in relation to CSZ9.A. It is understood that British Gypsum operated the mine/workings before closure circa 1960's. If CSZ9.A was selected as the preferred option, further investigations would be carried out at the next stage to develop a better understanding of the extent, presence, and condition of any workings, and the potential need for mitigation of these former workings in proximity to the Siting Area if they are confirmed to be present beneath CSZ9.

Horlock Rules

6.10.24 The following paragraphs provide commentary on the extent to which the Siting Zone (or where relevant the Siting Areas) accord with the Horlock Rules.

6.10.25 At this early stage of development **Horlock Rules 7, 9, 10** and **11** are not considered applicable as they are primarily concerned with the detailed design of substations following Siting Area selection.

6.10.26 The appraisal of CSZ9 and the Siting Area within it (CSZ9.A) has been undertaken with reference to the Horlock Rules, as outlined below:

- Consideration of Environmental Features (**Horlock Rule 1**): CSZ9.A has been defined with consideration of environmental features including designated heritage assets (e.g. Scalesceugh Roman kilns, Park House Roman Fort), ecological designations (e.g. River Eden SAC/SSSI), and landscape character. The appraisal identifies potential impacts on these features and highlights opportunities for mitigation through siting and design.
- Avoidance of Areas of Highest Amenity Value (**Horlock Rules 2** and **3**): CSZ9.A avoids designated landscapes such as National Parks or National Landscapes and is sufficiently distant from the Hadrian's Wall WHS and its buffer to avoid setting impacts. Designated heritage assets are screened by topography and vegetation, and CSZ9.A is not located within a conservation area or other high-amenity designation.
- Opportunities for Siting and Impact Reduction (**Horlock Rules 4** and **5**): CSZ9.A offers flexibility for siting to facilitate avoidance of sensitive features such as watercourses, PRoWs, and infrastructure. While there are some localised visual and ecological sensitivities, the presence of existing infrastructure, mature vegetation, and undulating landform provides opportunities for visual containment and mitigation. The position of the substation relative to the existing 400 kV Harker–Hutton line would influence the routing of future overhead line connections, and careful consideration would be required to avoid routing conflicts.
- Minimising Effects on Agricultural Land and Drainage (**Horlock Rule 6**): CSZ9.A is located on agricultural land and all land is ALC Grade 3. The impact on BMV agricultural land is considered using publicly available provisional data on ALC (no subgrades or survey data) only, and will be assessed at later project stages. CSZ9 intersects a tributary of the River Petteril, a WFD-designated waterbody. While it is not confirmed, wet and marshy areas suggest peat may be present. CSZ9 is within Flood Zone 1, and surface water risks are considered manageable through standard design and drainage measures. The presence of historical landfills are considered manageable as they are located outside of the Siting Zone. Further assessment would be required to determine the extent, presence, and condition of the former nearby gypsum workings.

Summary of Appraisal of Siting Zone 9

Environmental

6.10.27 The environmental appraisal did not identify any constraints or impacts. While some potential impacts would be unavoidable, such as habitat disruption to ecological designated sites, these are considered to be mitigable.

Socio-economic

6.10.28 The socio-economic appraisal did not identify any constraints that were differentiating factors and potential impacts are considered to be mitigable.

Engineering and Systems

6.10.29 The main engineering factors influencing the appraisal of CSZ9 relate to existing utilities and historical infrastructure. These include the 400 kV Harker-Hutton line intersecting CSZ9.A, the DNO overhead lines throughout CSZ9, and the former Cocklakes Gypsum Mine located to the east of the Siting Area boundary. These constraints are likely to be avoidable in siting a new substation. Due to the presence of the Harker-Hutton 400 kV overhead line, careful consideration would need to be given to the substation siting, and the 400 kV overhead line route, to facilitate corridors for future overhead lines and avoid 400 kV overhead line crossings.

7. Options Appraisal – Route Corridors

7.1 Introduction

7.1.1 This chapter details the outcomes of the Option Appraisal (Step 7), as described in **Chapter 4**, for the Route Corridors. The Route Corridors have been developed through the definition of a study area (Step 1), mapping and weighting of features (Step 2 and 3), and an iterative identification, review and refinement process (Steps 4, 5 and 6).

7.1.2 As described in **paragraph 5.6.48**, there are five Core Route Corridor options (namely Core Route Corridor 1 to Core Route Corridor 5) located north of Carlisle which would provide an end-to end overhead line connection between the new Carlisle substation and the England-Scotland border, as well as an end-to-end overhead line connection between the new Carlisle substation and the existing Harker substation. These options would provide a route corridor wholly to the north of the Hadrian's Wall WHS (Option A). However as set out in **paragraph 3.8.1**, other projects would inevitably be required to cross Hadrian's Wall WHS to meet the overall regional need.

7.1.3 These Core Route Corridor options are comprised of segments as described below:

- Core Route Corridor 1 (segments 1e, 1d, 1c, 1b and 1a);
- Core Route Corridor 2 (segments 1e, 1d, 1c, 2e, 4d, 2d, 2f, 2c, 2a and 2b);
- Core Route Corridor 3 (segments 1e, 1d, 1c, 2e, 2d, 3);
- Core Route Corridor 4 (segments 1e, 1d, 1c, 2e, 4d, 4c, 4a and 4b); and
- Core Route Corridor 5 (segments 1e, 4f, 4e, 4d, 4c, 4b, 4b).

7.1.4 Core Route Corridor 1 to 5 are shown in **Figure 5-12** of **Chapter 5**.

7.1.5 In each of the Core Route Corridors, some of the segments extend across the border into Scotland or fall wholly within Scotland. Any infrastructure within these segments in Scotland would not be delivered as part of the Proposed Development, but would be delivered as part of the wider Project. The approach to the appraisal of the route corridors is described in **Section 4.8.** Where relevant, the options appraisal in this chapter identifies where any key environmental and technical constraints or potential impacts fall in Scotland.

7.1.6 There are also additional segments that cross the WHS buffer and extend to the south-east of Carlisle. These form two route corridors to the south-east of Carlisle which, when combined with the Core Route Corridor options, provide ten route corridor options. These are described as:

- Core Route Corridor 1 to 5 plus segment 5a and 5b, as described in **paragraphs 5.6.58** to **5.6.62**; and
- Core Route Corridor 1 to 5 plus segment 5a, 5c, 5d, as described in **paragraph 5.6.63** to **5.6.68.**

7.1.7 These options would provide a route corridor crossing Hadrian's Wall WHS (Option B). Therefore, these options contribute to meeting the regional need described in **paragraph 3.8.1.**

7.1.8 This chapter describes each of the Core Route Corridors (Option A) and provides an appraisal of their constraints. It then describes and appraises the additional segment options, which (when combined with a Core Route Corridor) would provide the Option B route corridors to the south of Carlisle.

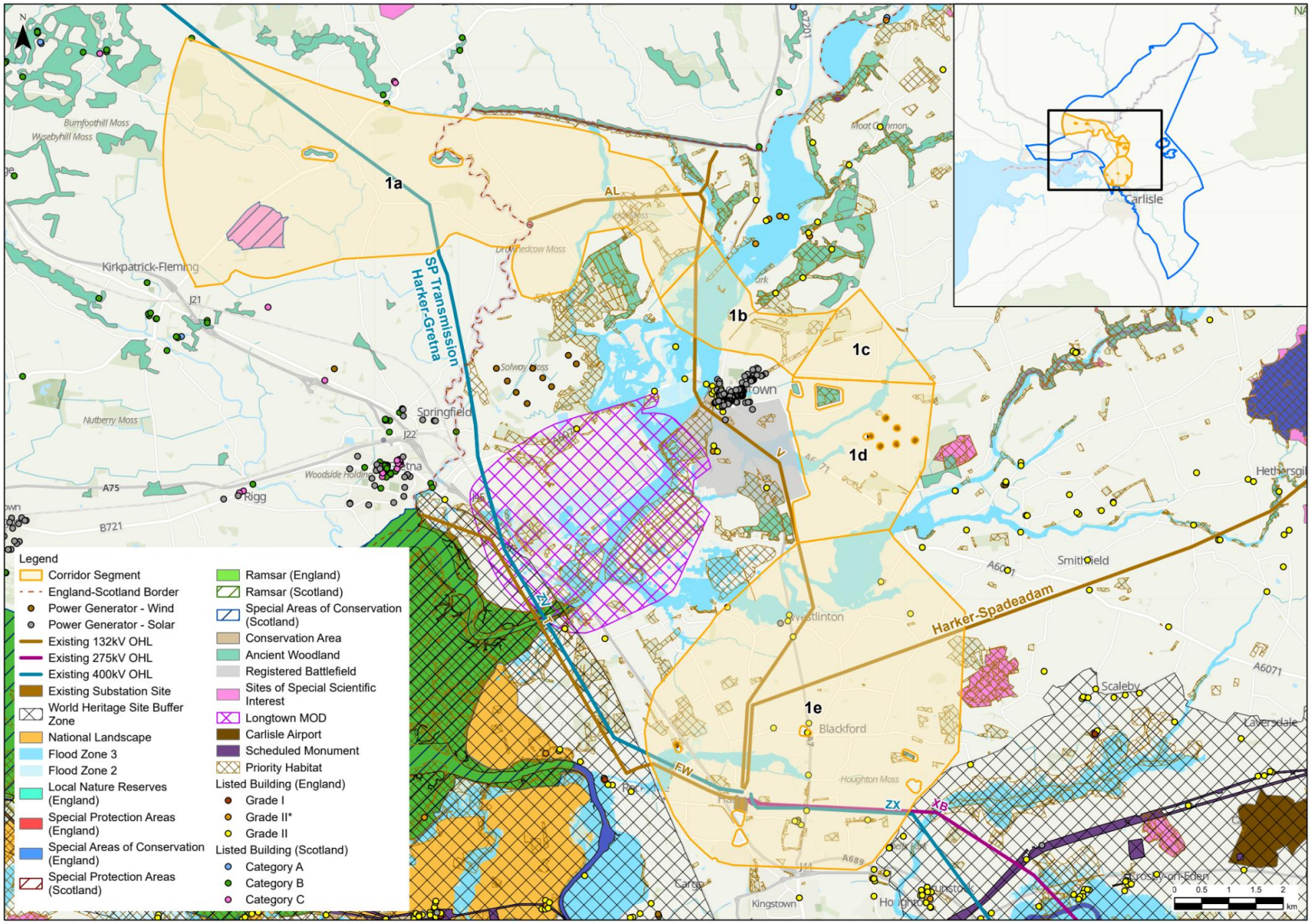
7.1.9 **Chapter 2** provides details of the typical infrastructure, including pylons and overhead lines that would be provided within the route corridors.

7.2 Core Route Corridor 1

7.2.1 Core Route Corridor 1 is formed by segments 1e, 1d, 1c, 1b, and 1a (see **Figure 7-1**). It is routed north from the existing Harker substation (segment 1e and 1d) for approximately 9.7km and is crossed by the existing National Grid 400 kV Harker-Hutton overhead line, an existing National Grid 275 kV overhead line and an existing 132 kV overhead line. The corridor is then routed in a north-west direction to the north of Longtown, crossing the A7 road. The corridor continues north-west until it reaches the Scotland-England Border approximately 1.6km east of the village of Chapelknowe. The corridor extends by 5km beyond the England-Scotland border, crossing the existing 400 kV overhead line between Gretna and Moffat; the licence holder for which is SP Energy Network. Subject to detailed route design, Core Route Corridor 1 would result in the development of an overhead line connection of up to 17.9km long within England.

7.2.2 The width of Core Route Corridor 1 has been narrowed around constraints such as the settlement of Longtown and various areas of ancient woodland including Hopesike Woods, Sawmill Wood, Silverhill Wood, Cistern Wood, Blackroots Wood. Furthermore, the corridor has been designed to avoid the Scaleby Moss SSSI, Black Snib SSSI, Raeburn Flow SSSI, Hadrian's Wall WHS and associated buffer zone, the Battle of Solway Moss Registered Battlefield, the Scots' Dike Scheduled Monument, and the MoD Longtown hazard zone.

Figure 7-1 – Core Route Corridor 1 with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

7.2.3 Core Route Corridor 1 avoids crossing statutory landscape designations. At its closest point it lies approximately 1.1km east of the Solway Coast National Landscape and approximately 4.4km south of the Langholm Hills Regional Scenic Area, a local landscape designation to the north of the England-Scotland border. To the extent that Core Route Corridor 1 could be considered to form part of the setting of the Solway Coast National Landscape, it would be located in association with Harker substation and overhead lines which already form the baseline. The Northumberland National Park and North Pennines National Landscape are approximately 20km and 12.9km to the east respectively at the closest point. The Hadrian's Wall Path National Trail is located outside the corridor, approximately 2.6km to the south (of segment 1e) at its closest point.

7.2.4 Core Route Corridor 1 traverses a varied landscape, beginning in the north-west with a low lying, mostly flat and gently rolling landscape with long views over the Solway Firth and towards the Lakeland Fells, and transitioning southwards into areas characterised by a mixture of arable and pastoral land with notable blocks of woodland and increasing infrastructure presence. The central part of the corridor is defined by a broad valley that is medium in scale and dominated by woodland, which provides some enclosure and reduces sensitivity to overhead line infrastructure.

7.2.5 Segment 1a falls within Scotland and passes through the LCT 171 Flow Plateau in the western section of segment 1a before entering NCA 6 Solway Basin in England, predominantly within LCT sub type 5b Low Farmland defined within the Cumbria Landscape Character Guidance and Toolkit. A smaller section of the Core Route Corridor in segment 1a also occupies LCT sub type 2b Coastal Mosses and LCT sub type 8b Broad Valleys in England. Within segment 1a there is the potential for impacts on this landscape character as a result of the Proposed Development in England as well as the infrastructure within Scotland (which would not be part of the Proposed Development but part of the wider Project), noting that 1a straddles the border but also includes existing overhead lines as baseline elements. There is potential for effects on the locally designated Langholm Hills Regional Scenic Area from the Proposed Development in segment 1a and 1b, although due to distance and baseline characteristics these are likely to be limited in magnitude and localised.

7.2.6 Segments 1b,1c and 1d fall almost entirely within LCT sub type 5b Low Farmland. Segment 1b includes existing overhead lines. The western extent of segment 1e includes LCT 02c Coastal Plain and the southern extent of segment 1e includes LCT 13 Urban Fringe. LCT sub-type 5b, which covers the majority of Core Route Corridor 1 (in England) has large scale fields, undulating topography and dispersed vegetation, as well as existing overhead line as key characteristics, which reduce sensitivity.

7.2.7 In the southern part of the corridor (segments 1d and 1e), the presence of existing energy infrastructure and major road corridors lower the susceptibility of the landscape to overhead line infrastructure. In the north-western part of the corridor (segment 1a), overhead line pylons would appear prominent in this open, mostly flat landscape. The open and uninterrupted views to the Solway Firth and Lakeland Fells beyond are particularly susceptible to tall infrastructure.

7.2.8 The corridor mainly avoids areas of settlement but contains a dispersed pattern of properties and farmsteads scattered across the landscape. The settlement of Longtown lies to the south-west of the corridor where there is a concentration of residential properties. The settlement pattern becomes more concentrated in the south of the corridor (segment 1d and 1e) with residential properties clustered along road corridors on the northern edge of Carlisle. There is a sparse PRoW network in the north-western part of the corridor, which becomes denser in the south of the corridor. NCN routes pass through a small area in the west and cross through the southern part of the corridor.

7.2.9 Although Mitigation measures would be incorporated, including careful routeing to avoid loss of existing features, use of existing trees and woodland to provide partial screening, and increasing the distance of the overhead line from residential receptors where possible, localised impacts, including potential cumulative effects with existing overhead lines, are likely to remain.

Historic Environment

7.2.10 Core Route Corridor 1 avoids designated heritage assets where practicable, however, the location and distribution of the assets means that some are either within or are in closer proximity to the corridor. The setting of the notable designated heritage assets that could be affected by an overhead line in Core Route Corridor 1 include:

- The Grade II listed Alstonby Hall (NHLE 1335568), located in the north-east section of Segment 1e, which may have been designed to have views across the valley of the River Lyne.
- The Solway Moss Registered Battlefield, located approximately 70m to the west of Segment 1d. Although Core Route Corridor 1 does not encroach on this asset, the Proposed Development might result in an impact on the wider setting of the battlefield.
- The Grade II* Netherby Hall (NHLE 1204948), located approximately 1.5km northeast of Segment 1b, in a slightly elevated position overlooking the River Esk.
- The Scots' Dike scheduled monument (NHLE 1016860 and HES ID SM660), located approximately 130m north of Segment 1a in Scotland. While the introduction of an overhead line within the eastern section of segment 1a in England and within the western section of segment 1a in Scotland would not completely detract from the asset's setting, which is primarily the border itself, it could reduce the asset's prominence in the landscape.

7.2.11 Based on the assessment to date, there is limited potential for an overhead line in Core Route Corridor 1 to impact the setting of Hadrian's Wall WHS and its OUV. This is largely a result of the distance between the asset and Core Route Corridor 1, as well as screening from topography and tree cover. Furthermore, while the south-eastern boundary of Core Route Corridor 1 is adjacent to Hadrian's Wall WHS buffer, the nearest scheduled monument that forms a component of the WHS is at 1.8km from this boundary. As set out in the WHS Capacity Assessment Technical Note (included in **Appendix A** of this CPRSS), the section of Hadrian's Wall WHS buffer adjacent to the south-east boundary of Core Route Corridor 1 is considered less sensitive to change as a result of existing infrastructure including the M6 and two overhead lines, degrading the setting of the WHS, as well as aspects such as condition/survival. A Heritage Impact Assessment (HIA) to identify potential impacts on the WHS may be required if the

overhead line were sited in proximity to the south-eastern boundary of Core Route Corridor 1.

7.2.12 In summary, there is potential for an overhead line in Core Route Corridor 1 to impact the settings of some designated heritage assets within or in close proximity to the corridor. Potential impacts would be mitigated through careful routeing, as well utilising existing screening such as the local topography, the built environment and mature woodland, reducing the potential for impacts on the setting of assets.

Ecology

7.2.13 Core Route Corridor 1 has been designed to avoid designated ecological areas where possible, however, there remains a range of ecological sensitivities, including designated sites, priority habitats, areas of ancient woodland and protected species present within or close to the corridor. Potential impacts on ecological interests resulting from the construction of an overhead line within Core Route Corridor 1 include habitat loss or degradation and disturbance or displacement of protected species.

7.2.14 The corridor intersects or lies near several statutory and non-statutory designations, including SAC, SPA, SSSI, LNCS, and areas of priority habitat and of ancient woodland. Notable designations which may be affected by an overhead line in Core Route Corridor 1 include:

- The River Eden SAC, located within 1km of segment 1e at its closest point, and designated for riparian habitats and fauna. Potential impacts to the River Eden SAC include water pollution, to which its designated features are particularly sensitive, and loss or fragmentation of functionally linked habitat.
- The Solway Firth SAC, SPA, Ramsar Site and SSSI, located 1.3km west of the corridor at its closest point. Qualifying features of the Solway Firth, particularly wintering birds, may be present within the corridor and could be impacted by activities associated with construction or routine operation of the overhead lines in England (within segments 1e, 1d, 1c, 1b and within the eastern part of segment 1a), and of the overhead lines in Scotland (within the western part of segment 1a) which would not be part of the Proposed Development but would be part of the Scottish section of the Project. Potential impacts include waterborne pollution, disturbance impacts to birds that are a qualifying feature of the Solway Firth through noise, vibration, lighting or human presence during the construction phase leading to displacement and impacts on population; habitat loss of functionally linked land for foraging or roosting during construction and operation phases; and mortality or injury due to bird strike into overhead lines. A stage 1 Habitat Regulations Assessment (HRA) would likely be required at the later stages of the Proposed Development to assess potential impacts on the Solway Firth SAC, SPA, Ramsar and SSSI. Should the HRA identify impacts on the integrity of these designated sites, further assessment would be undertaken. The HRA would also assess any indirect impacts associated with the loss of functionally linked land used by the SPA species.
- The Scaleby Moss SSSI, located in segment 1e and Black Snib SSSI located 150m east of segment 1d. Direct and indirect impacts to its qualifying features may include by habitat loss, water pollution, dust deposition, and injury of birds including as a result of collision with overhead lines. Given the small footprint of Scaleby Moss SSSI relative to the size of the corridor it is considered that direct impacts could be avoided by careful routing.

- The Raeburn Flow SAC and SSSI, located within the western part of segment 1a in Scotland, designated for its active raised bog habitat. There is potential for direct and indirect impacts on this site arising from the overhead lines within the western part of segment 1a in Scotland (which would not be part of the Scottish section of the Project). Impacts may include disturbance or habitat loss, or pollution of surface water or watercourses which are connected to the SAC. Given the small footprint of this site relative to the size of the corridor it is considered that direct impacts could be avoided by careful routeing.
- The Greenwrae Flow, Cowgarth Flow, and Cadgill Flow LNCS, located within the western part of segment 1a in Scotland. There is potential for direct and indirect impacts to these sites arising from the overhead lines within eastern part of segment 1a in England and the western part of segment 1a in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). Impacts may include disturbance or habitat loss, or pollution of surface water or watercourses connected to these sites or dust deposition.
- Priority deciduous woodland, scattered throughout the corridor, which may be impacted by tree removal, root damage, or dust deposition.
- Parcels of ancient woodland, located within close proximity (within 50m-100m) from the corridor boundary. As these parcels are excluded from the corridor, direct impacts on ancient woodland are not anticipated. If the overhead line runs within 50m of a parcel of ancient woodland, the indirect negative impacts such as dust pollution or surface water pollution could be managed through precautionary working method.

7.2.15 In summary, most impacts on protected and notable habitats and species are expected to be avoided or reduced through careful design. However, due to the proximity of Core Route Corridor 1 to the Solway Firth SAC, SPA, Ramsar Site and SSSI, it is likely that qualifying features of the Solway Firth may be present within the corridor. It is expected that the impact of an overhead line within the corridor on habitats used by protected species would be difficult to mitigate and would have implications for species populations. Detailed assessment would be required at the later stages of the Proposed Development to further understand potential impacts and inform design development.

Other Environmental Considerations

7.2.16 Other environmental aspects were considered as part of the options appraisal including water, geology and soils.

7.2.17 There are a number of surface and groundwater constraints or features within or close to Core Route Corridor 1. This includes surface water bodies such as rivers, burns or ponds, Flood Zone 3 floodplain (associated with the River Esk, spanning approximately 1.2km and covering the western section of 1b and associated with the River Lyne, spanning approximately 1km and covering the northern section of 1e) and ecological interests which are dependent on or linked to surface and groundwater. Overall, there are no constraints which are considered to have potential to experience impacts to the extent that they would prevent routeing an overhead line within Core Route Corridor 1, however, there are areas which would be avoided if possible or crossed by direct a route as possible and would require the implementation of standard mitigation measures.

7.2.18 Geology and soils are not considered to be a significant constraint to the development of an overhead line route within Core Route Corridor 1. While there are some areas of

peat or peaty soils present, the extent and distribution of these is such that they are considered to be avoidable with careful routeing.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

7.2.19 All of Core Route Corridor 1, except segment 1c, contains large areas identified as MSAs due to the sand and gravel deposits which are present. Development within these areas has the potential to impact mineral resources. While it preferable to avoid MSAs, none of the MSAs are a determining factor in the appraisal of the development of an overhead line.

7.2.20 Segment 1b includes areas of Best and Most Versatile (BMV) Grade 2 land. It could be possible to avoid this land in this segment and crops can still be grown under overhead line. Areas with BMV Grade 2 could incorporate mitigation measures such as optimising the space used for temporary construction sites wherever practicable and prioritising the use of Grade 3 or lower quality land for permanent development to avoid permanent impact on good quality soils.

7.2.21 There are a number of recreational interests within or close to the route corridor including PRoWs and NCN 7 and 10. The development of an overhead line close to or crossing recreational routes has the potential to impact on users, in particular during construction. Overall, while it is preferable to avoid routeing close to recreational interests, these are not considered as determining factors in the appraisal of development of an overhead line within Core Route Corridor 1.

7.2.22 There are a number of approved major planning applications associated with the Harker substation, which is within segment 1e, including the substation expansion (20/0082, 22/0981) and three BESS applications (23/0833, 23/0444 and 24/0093) that are adjacent to Harker Substation. Segments 1e and 1d also include a number of approved major non-energy related applications, including warehousing and logistics (refs: 22/0909, 19/0859, 22/0836 and 23/0580). None of these are considered as determining factors in the appraisal of development of a new overhead line, however, there is the potential for cumulative impacts.

7.2.23 There are no Nationally Significant Infrastructure Project applications within Core Route Corridor 1. There is one application under sections 36 and 37 of the Electricity Act located in Scotland within or in very close proximity to segment 1a, ref: ECU00004999 (3 Phase Upgrade of Existing Overhead Line Spur – consented), which overlaps with segment 1a, although only to a small extent which could be avoided through careful routing. While it is not considered as determining factor in the appraisal of the development of a new overhead line, however, there is potential for cumulative impacts.

7.2.24 Policy HO11 (Gypsy, Traveller and Travelling Showpeople Provision) of the Carlisle District Local Plan (2015-2030), designated land at Low Harker Dene for the accommodation needs of Gypsies, Travellers and Travelling Showpeople. This designated land has been excluded from segment 1e to avoid direct impacts. All Route Corridors are similarly constrained by this allocation.

Aviation and Defence

7.2.25 Segments 1a, 1b and 1c are entirely within the MoD TTA 20T which is used for low flying training between 100 and 250 feet (30 and 76m). Overhead line pylons carrying 400 kV circuits are expected to be between 40m and 60m tall. As a result, pylons could pose a hazard and/or restrict flying activities. National Grid would engage with the MoD should this option be taken forward to ensure that impacts are appropriately mitigated.

7.2.26 The entirety of Core Route Corridor 1 is located outside the defined 2km hazard area for MoD Longtown[42] (900m north-west from segment 1e at its closest point), impacts on MoD Longtown are therefore considered unlikely.

7.2.27 Overhead line development should generally be avoided within 4km from military airfields and possible issues may arise where overhead line development is within 10km from military airfields. The proximity of Core Route Corridor 2 to Carlisle Airport, approximately 5.3km from segment 1e (at its closest point), may introduce aviation safeguarding considerations. Where avoidance of aviation constraints cannot be achieved, stringent design and construction measures would be required to mitigate potential impacts. These may include height restrictions on pylons, installation of aviation warning lights, and engagement with relevant authorities such as the MoD and the CAA to ensure compliance with aviation safety regulations. These measures would be confirmed through further assessment at the next stage of development.

Traffic and Transport

7.2.28 Core Route Corridor 1 is intersected by the M6 in segment 1e in proximity to the Harker substation. The corridor is also crossed by the four A and B roads that are managed by local highway authorities—A7 (segment 1b and 1e), A689 (segment 1e), A6071 (segment 1d), and B6357 (segment 1a). These roads would require temporary structures such as scaffolding to enable cable crossing during construction.

7.2.29 The corridor is crossed by the M6, four A roads and two B roads, which could potentially be used as construction routes, albeit there are some constraints such as bridges and narrow roads on the A6071 and B6357 in particular. It is also likely that the use of some minor roads would be required to access the construction works along the corridor in some locations. Overall, it is expected that access routes could be improved by mitigation if required such as footpath diversion, removal of vegetation, junction improvements and widening. Impacts would largely be temporary during construction.

7.2.30 There are two NCN routes that cross the corridor, Route 7 in segment 1a and 1e and Route 10 in segment 1e as well as several PRoW that cross Core Route Corridor 1. Whilst there would be some impacts on users of the NCN and other recreational routes, these are considered to be mitigable and would not be a determining factor in the appraisal of the construction of the overhead line within Core Route Corridor 1.

7.2.31 Bus routes operate on various roads in the corridor, temporary construction impacts for bus users could occur if road closures and diversions are required but would not prevent the construction of the overhead line within Core Route Corridor 1.

[42] Guidance prepared by Cumberland Council (available at: https://www.cumberland.gov.uk/sites/default/files/2025-03/mod_longtown_warning_and_informing_leaflet.pdf) identifies a hazard area around the MoD Longtown, which extends by 2km from the centre of the site.

7.2.32 A number of constraints within Core Route Corridor 1 have been identified, which are likely to reduce routeing flexibility and/or increase the technical complexity of potential overhead line routes. These constraints are outlined in **paragraphs 7.2.33** to **7.2.38** below.

7.2.33 There are a number of existing high voltage overhead lines within the Core Route Corridor which may require the new overhead line to cross them or be routed in their vicinity. These include:

- The existing 400 kV overhead line in Scotland (operated by SPT) is routed through segment 1a and lies wholly within Scotland. While this line would not interact with the Proposed Development as it is outside the scope of works in England, it would require crossing as part of the Scottish section of the Project should the overhead line route be developed within Core Route Corridor 1.
- The existing 400 kV Harker–Hutton overhead line, which is owned by National Grid and routed through segment 1e, is not anticipated to require crossing, as the proposed overhead line can be routed to avoid the existing overhead line.
- The existing 275 kV overhead line, which is owned by National Grid and routed through segment 1e, is not anticipated to require crossing, as the proposed overhead line can be routed to avoid it.

7.2.34 Proposed overhead line infrastructure within this corridor would be routed to avoid the existing 400 kV lines as far as practicable, as crossings of these would be highly complex and carry the potential for significant cost and programme implications. A crossing of the existing SPT overhead line in Scotland as part of the Scottish section of the Project would be unavoidable if Core Route Corridor 1 were selected as the emerging preferred option for the Proposed Development, as the line lies entirely within segment 1a (within Scotland). In contrast, a crossing of the Harker–Hutton 400 kV line in segment 1e could be avoided through appropriate route alignment.

7.2.35 There are a number of DNO overhead lines within Core Route Corridor 1 that may need to be crossed, including the existing 132 kV lines through segments 1a, 1b, 1e, and the connection to Ewe Hill Wind Farm. These crossings are expected to be achievable through appropriate route alignment and standard clearance design considerations during detailed design.

7.2.36 The NWEP pipeline runs through segments 1a, 1b, 1d, and 1e. Sufficient space is available within the corridor to route the proposed overhead line to avoid the pipeline, taking into account other constraints.

7.2.37 Underlying ground conditions vary across the corridor comprising Glacial Till/Diamicton deposits (clay, sand and gravel), with localised areas of Glaciofluvial Deposits (predominantly sands and gravels and Alluvium i.e. clay, silt and sand). Peat and peaty soils are identified in localised areas in segments 1a, 1d and 1e but may be present as unmapped deposits given the regional setting. The distribution of mapped peat deposits suggest that they can likely be avoided in the development of an overhead line route within the corridor.

7.2.38 The superficial geology comprises of glacial material which has the potential to be variable in terms of composition, thickness and strength and may include localised soft spots. Other less favourable ground including peat, alluvium and alluvial materials that may require treatment or removal and replacement are also locally present. While this

would be a design consideration, it does not prevent development of an overhead line. Small areas of identified mines and quarries are identified on the western extent of segment 1a and within segment 1e. In addition to those identified in segments 1a and 1b, some small areas of historical landfill are also identified on the western edge of segment 1e, but these are likely avoidable.

Holford Rules

7.2.39 Core Route Corridor 1 has been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.

7.2.40 Core Route Corridor 1 has generally avoided smaller areas of high amenity value which have been specifically excluded from the corridor. The smaller areas of high amenity value which exist within the boundaries of the corridor comprise:

- Listed buildings within segments 1e and 1e.
- Priority habitats within segments 1e, 1c, 1b and 1a.

7.2.41 Where there are smaller areas of high amenity value, sufficient space has been included within the corridor to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.

7.2.42 Core Route Corridor 1 was defined to provide a largely direct route from Harker to the England-Scotland border (in line with Holford Rule 3) and is shorter compared to other corridors.

7.2.43 Core Route Corridor 1 was developed to avoid highly constrained areas, and specific constraints including settlements such as Longtown (Holford Rule Supplementary Note 1). The width of the corridor reflects the constraints in a given area, with narrow sections where constraints are present such as in proximity to areas of ancient woodland (Foulton Wood, Cistern Wood, Silverhill Wood).

7.2.44 Generally, Core Route Corridor 1, particularly segment 1e, includes more land than is needed for construction of an overhead line which provides flexibility and options when considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with Holford Rule 3.

7.2.45 Core Route Corridor 1 offers partial opportunities to identify a line route aligned with Holford Rules 4 and 5. The central part of the corridor (segment 1b) includes broad valleys and a medium-scale landscape dominated by woodland, which can provide screening and reduce visual prominence of pylons (Landscape and Visual appraisal). In the southern segments (1d and 1e), the presence of existing infrastructure such as overhead lines and substations provides context that lowers the susceptibility to new overhead line development, allowing better integration. However, the northern section (segment 1a) is characterised by an open, low-lying landscape with long views, which limits the ability to avoid sky-lining and makes pylons appear prominent (Landscape and Visual appraisal). Overall, while careful routeing and siting can help reduce visual impact in central and southern areas, the ability to achieve full alignment with Holford Rules 4 and 5 across the entire corridor is more constrained in the northern part.

7.2.46 Core Route Corridor 1 could potentially require the crossing of existing overhead lines. While this could result in landscape and visual impacts, further assessment would be required during the next design phase. In accordance with Holford Rule 6, mitigation

(re-routeing, removal or undergrounding) would be considered to minimise visual and landscape effects.

7.2.47 While the Holford Rules have been used to guide the definition of the Core Route Corridor, it is important to note that not all aspects of the rules can be fully applied at this stage of the project. Specifically, Holford Rules 4, 5, 6 and 7 which relate to proximity to residential areas, visual intrusion, special areas, and skyline impacts, require detailed alignment and tower positioning to be meaningfully assessed. These considerations depend on further design development, including visual impact assessments, ecological surveys, and topographic modelling, which will be undertaken during the next phase of route refinement. The current application of the Holford Rules is therefore strategic and high-level, with more detailed compliance to be demonstrated as the design progresses.

Summary of Appraisal of Core Route Corridor 1

Environmental

7.2.48 The key environmental considerations influencing the appraisal of Core Route Corridor 1 are predominantly landscape and visual amenity as well as historic environment and ecology considerations. The corridor avoids statutory landscape designations but lies near the Solway Coast National Landscape and Langholm Hills Regional Scenic Area. It includes scattered visual receptors, such as residential properties and users of BCRD41 and NCN7. While mitigation measures such as careful routeing, use of existing woodland for screening, and avoidance of key views are proposed, impacts on landscape character and visual amenity are likely to remain. There is potential for an overhead line within the corridor to reduce the significance of the Scots' Dike scheduled monument in the landscape due to the proximity of the corridor to this asset (approximately 130m at its closest point). Additionally, there is potential for qualifying features of the Solway Firth (such of wintering birds) to be present within the corridor due proximity of the corridor to this designation (approximately 1.3km at its closest point). These qualifying features could be impacted by activities associated with construction and routine operation of the Proposed Development. Further assessment would be required at the later stages of the Proposed Development to further understand impacts and guide the design of the overhead line.

Socio-economic

7.2.49 The socio-economic appraisal did not identify any constraints or impacts which would be a determining factor in the appraisal of the development of an overhead line within Core Route Corridor 1. While some impacts would be unavoidable, including, subject to routing the potential use of Grade 2 ALC and temporary diversion of PRoWs, these are considered to be mitigatable. The proximity of the corridor to Carlisle Airport (approximately 5.3km at its closest point) may introduce aviation safeguarding considerations; National Grid would engage with the MoD and the CAA should this option be taken forward to ensure that impacts are appropriately identified and mitigated.

Engineering and Systems

7.2.50 The main engineering factors influencing the appraisal of Core Route Corridor 1 relate to existing utilities. These include existing overhead lines (132 kV, 275 kV and 400 kV)

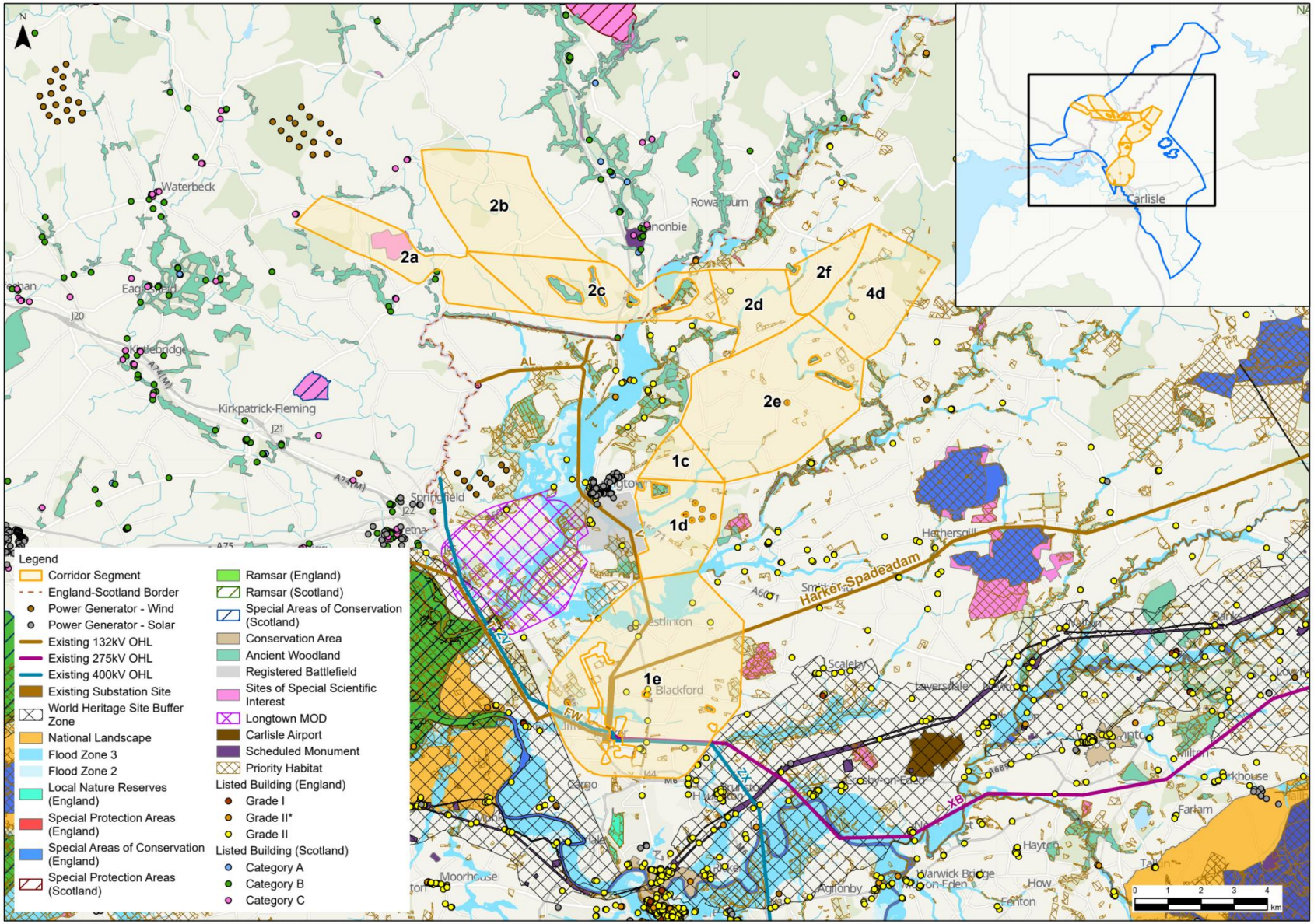
which would require the new overhead line to cross them or be routed in their vicinity. Crossings of 400 kV overhead lines would be highly complex and carry significant cost and programme implications. In addition, the NWEP pipeline runs through segments 1a, 1b, 1d and 1e. While ground conditions within the corridor would influence the design and construction of an overhead line within the corridor, they are not considered to prevent development of an overhead line.

7.3 Core Route Corridor 2

7.3.1 Core Route Corridor 2 is formed by segments 1e, 1d, 1c, 2e, 4d, 2f, 2d, and 2c with the option for either segment 2a or 2b located in Scotland, at the north-west extent of the corridor (see **Figure 7-2**). It is routed north from the existing Harker substation (segment 1e and 1d) for approximately 9.7km, being crossed by the existing National Grid 400 kV Harker-Hutton overhead line, an existing National Grid 275 kV overhead line and an existing 132 kV overhead line. The corridor is then routed in a north-east direction for approximately 9.5km through mixed farmland interspersed with small sections of woodland until it approaches the Rae Burn. The corridor then continues in a west direction for approximately 4.4.km until it crosses the River Liddel, the England-Scotland border and the River Esk (immediately west of the border). The corridor (segments 2a, 2b and 2c) extends by approximately 5km beyond the England-Scotland border. Subject to detailed route design, Core Route Corridor 2 enables the development of an overhead line route of up to 25km long within England.

7.3.2 The alignment of Core Route Corridor 2 excludes constraints such as the settlement of Longtown and various areas of ancient woodland including Hopesike Woods, Sawmill Wood, Cistern Wood, Blackroots Wood. Furthermore, the corridor has been designed to avoid Scaleby Moss SSSI, Black Snib SSSI, Lyne Woods SSSI, Bell's Flow, Hadrian's Wall WHS and associated buffer zone, the Battle of Solway Moss Registered Battlefield, the Scots' Dike Scheduled Monument, and the MoD Longtown hazard zone.

Figure 7-2 – Core Route Corridor 2 with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

7.3.3 Core Route Corridor 2 avoids crossing statutory landscape designations. At its closest point it lies approximately 1.1km east of the Solway Coast National Landscape and approximately 1km south of the Langholm Hills Regional Scenic Area within Scotland. To the extent that Core Route Corridor 2 could be considered to form part of the setting of the Solway Coast National Landscape, it would be located in association with Harker substation and 400 kV overhead line which already form the baseline. The Northumberland National Park and North Pennines National Landscape are approximately 17.9km and 12.9km to the east respectively at the closest point and Core Route Corridor 2 is considered to lie outside of their setting. The Hadrian's Wall Path National Trail is located outside the corridor, approximately 2.6km to the south (segment 1e) at its closest point.

7.3.4 In Scotland Core Route Corridor 2 occupies LCT 171 Flow Plateau and LCT 163 Middle Dale - Dumfries & Galloway in the western section of segment 1a before entering NCA 6 Solway Basin, predominantly within LCT sub type 5b Low Farmland defined within the Cumbria Landscape Character Guidance and Toolkit. A smaller section of the Core Route Corridor also occupies LCT sub type 2b Coastal Mosses, LCT sub-type 2c Coastal Plain and LCT sub type 8b Broad Valleys. The southern extent of segment 1e includes LCT 13 Urban Fringe.

7.3.5 LCT 171 has decreased sensitivity derived from simple landform, landscape scale, land use and landscape and visual pattern. LCT sub-type 5b has large scale fields, undulating topography and dispersed vegetation, as well as existing overhead line as key characteristics, which reduce sensitivity.

7.3.6 Overall, Core Route Corridor 2 traverses a predominantly rural landscape. In the southern and central parts (segments 2e, 1c, 1d, 1e), the landscape consists of a mixture of arable and pastoral medium to large-scale landscape, where the presence of existing energy infrastructure and major road corridors reduces the landscape's susceptibility to overhead line infrastructure. This transitions into a more transitional farmland landscape between the uplands and lowlands in the northeastern part (segments 2d, 2f, 4d), and further into a gently rolling landscape in the north-western part of the corridor (segments 2a, 2b located in Scotland and 2c partially located in Scotland), with a generally large to medium-scale field pattern comprising rush-infused pastures, bounded by hedgerows, fences, and shelterbelts.

7.3.7 The corridor avoids settlements but includes a dispersed pattern of properties and farmsteads. Views are generally focused on the surrounding rural landscape, with longer-distance views toward the Solway Firth in the central part of the corridor. Segments 2a (located in Scotland), 2c (partially located in Scotland), 2e, and 2f are particularly sensitive due to their undulating and gently rolling landform, long views, and scattered residential visual receptors.

7.3.8 There is the potential for impacts on the setting of the Langholm Hills Regional Scenic Area within Scotland arising from the overhead lines which would be required in segment 2b and 2c in Scotland (which would not be included in the Proposed Development but would be part of the Scottish section of the Project).

7.3.9 The southern segments, particularly 1d and 1e, contain existing energy infrastructure such as wind turbines, substations, and major roads, which reduce the landscape's susceptibility to change. However, there is potential for cumulative visual impacts from the Proposed Development in combination with existing and future infrastructure in these areas.

7.3.10 The corridor includes scattered visual receptors, including residential properties and recreational users of PRoW and the NCN 7. While mitigation measures such as careful routeing, use of existing woodland for screening, and avoidance of key views are proposed, impacts on both landscape character and visual amenity are likely to persist.

Historic Environment

7.3.11 Core Route Corridor 2 has been designed to avoid designated heritage assets where possible, however, the location and distribution of the assets means that some are unavoidable and are either within or are in closer proximity to the corridor. The setting of the notable designated heritage assets that could be affected by an overhead line in Core Route Corridor 2 include:

- The Grade II listed Alstonby Hall (NHLE 1335568), located in the north-east section of segment 1e and which may have been designed to have views across the valley of the River Lyne.
- The Solway Moss Registered Battlefield, located approximately 70m to the west of segment 1d. Although Core Route Corridor 1 does not encroach on this asset, the Proposed Development might result in an impact on the wider setting of the battlefield.
- The Scheduled Liddel Strength motte and bailey castle and fortified tower (NHLE 1007152), located within segment 2c. This asset is located in an elevated position on the English side of the England-Scotland border, overlooking the confluence of the River Esk and Liddel Water. As such, it may have been designed to command views across the border and the rivers in this area, as well as be a prominent feature in the medieval and post-medieval landscape. While this prominence is much diminished as a result of mature woodland in the area, the introduction of an overhead line in this area has the potential to result in impacts on this asset by diminishing its prominence within its setting.
- The Category B listed Woodslee House (HES ID LB3518), located within segment 2c. This asset is positioned above the confluence of the River Esk and Liddel Water on the Scottish side of the England-Scotland border and may have been designed to overlook the watercourses and the valley. There is the potential for impacts on the setting arising from the overhead lines within segment 2d in England and the overhead lines which would be required in segment 2c in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project).
- The Scots' Dike scheduled monument (NHLE 1016860 and HES ID SM660), located approximately 300m south of segments 2a and 2c in Scotland. While the introduction of an overhead line in this area would not completely detract from the asset's setting, which is primarily the border itself, it could reduce the asset's prominence in the landscape. There is the potential for impacts on the setting arising from the overhead lines required in segments 2a and 2c in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project).

7.3.12 While the south-eastern boundary of Core Route Corridor 2 is adjacent to Hadrian's Wall WHS buffer, the nearest scheduled monument that forms a component of the WHS is at 1.8km from this boundary. Based on the assessment to date, there is limited potential for an overhead line in Core Route Corridor 2 to impact the setting of Hadrian's Wall WHS and its OUV. This is largely a result of the distance between the asset and Core Route Corridor 2, as well as screening from topography and tree cover. As set out in the WHS Capacity Assessment Technical Note (included in **Appendix A** of this CPRSS), the section of Hadrian's Wall WHS buffer adjacent to the south-east boundary of Core Route Corridor 2 is considered less sensitive to change as a result of existing infrastructure including the M6 and two overhead lines, which have already had an impact on the setting of the WHS, as well as aspects such as condition/survival. A HIA may be required if the overhead line were sited in proximity to the south-eastern boundary of Core Route Corridor 2.

7.3.13 In summary, there is potential for on overhead line in Core Route Corridor 2 to impact the settings of the designated heritage assets including, Brunstock House, Eden Grove, Edmond Castle and Toppin Castle within or in close proximity to the corridor. Further assessment would be required at the later stages of the Proposed Development to guide the siting of the overhead line.

Ecology

7.3.14 Core Route Corridor 2 has been defined to avoid designated ecological areas where possible, however, there remains a range of ecological sensitivities, including designated sites, priority habitats, areas of ancient woodland and protected species present within or close to the corridor. Potential impacts on ecological interests resulting from the construction of an overhead line within Core Route Corridor 2 include habitat loss or degradation and disturbance or displacement of protected species.

7.3.15 The corridor intersects or lies near several statutory and non-statutory designations, including SAC, SPA, SSSI, and areas of priority habitat and of ancient woodland. Notable designations which may be affected by an overhead line in Core Route Corridor 2 include:

- The River Eden SAC, located within 1km of segment 1e at its closest point, and designated for riparian habitats and fauna. Potential impacts to the River Eden SAC include water pollution, to which its designated features are particularly sensitive, and loss or fragmentation of functionally linked habitat.
- The Solway Firth SAC, SPA, Ramsar Site and SSSI, located 1.3km west of the corridor at its closest point. Qualifying features of the Solway Firth, particularly wintering birds, may be present within the corridor and could be impacted by activities associated with construction or routine operation of overhead lines in England, particularly within segments 1e, 1d, 1c that are located within relatively close proximity (within 1.3, 4.2 and 5.8km respectively) to the Solway Firth at their closest point. Potential impacts include waterborne pollution, disturbance impacts to birds that are a qualifying feature of the Solway Firth through noise, vibration, lighting or human presence during the construction phase leading to displacement and impacts on population; habitat loss of functionally linked land for foraging or roosting during construction and operation phases; and mortality or injury due to bird strike into overhead lines. A Stage 1 HRA would likely be required at the later stages of the Proposed Development to assess the potential impact on the Solway Firth SAC, SPA, Ramsar and SSSI sites. With the implementation of careful routeing and standard construction and design measures, Core Route Corridor 2 provides

opportunities to mitigate potential impacts on identified sites. Should the HRA identify impacts on the integrity of these designated sites, further assessment would be undertaken. The HRA would also assess indirect effects, such as the loss of functionally linked land used by SPA species.

- The Scaleby Moss SSSI located in segment 1e, the Black Snib SSSI located 150m east of segment 1d, the Lyne Woods SSSI located in segment 2e. There is potential for direct and indirect impacts to the qualifying features of these SSSIs may include habitat loss, water pollution, dust deposition, and injury of birds as a result of collision with overhead lines. Given the minimal extent of other SSSIs that enter into the corridor it is considered that direct impacts to these constraints could be avoided by careful routing.
- The Bell's Flow SSSI located within segment 2a in Scotland. There is potential for direct and indirect impacts to the qualifying features of this SSSI from the overhead line within segment 2a in Scotland and within the western part of segment 2c in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project), and from the overhead line within the eastern part of segment 2c in England. As the footprint of Bell's Flow SSSI spans a significant portion of the width of segment 2a, avoiding this constraint would considerably restrict options for an overhead line.
- Priority deciduous woodland along with parcels of other priority habitat, scattered throughout the corridor. These could be directly or indirectly impacted by activities associated with construction, including removal of vegetation or dust deposition.
- Parcels of ancient woodland, located within close proximity (within 50m-100m) from the corridor boundary. As these parcels are excluded from the route corridor, direct impacts on ancient woodland are not anticipated.

7.3.16 Although careful design of an overhead line route within the corridor could mitigate impacts many protected and notable habitats and species, the proximity of Core Route Corridor 2 to internationally designated sites such as the Solway Firth would require thorough assessment in parallel with design development.

7.3.17 Routing through segment 2b would be preferential to routing through segment 2a, as segment 2b does not contain any designated sites and is further away from the Solway Firth, reducing the likelihood of indirect impacts.

Other Environmental Considerations

7.3.18 Other environmental aspects were considered as part of the options appraisal including water, geology and soils.

7.3.19 There are a number of surface and groundwater constraints or features within or close to Core Route Corridor 2. This includes surface water bodies such as rivers, burns or ponds, sections of Flood Zone 3 floodplain and ecological interests which are dependent on or linked to surface and groundwater. Notable features include designated Principal Salmon Rivers (River Esk and River Lyne) in England, which are sensitive to changes in water quality and flow regime, and WFD waterbodies of Bad, Poor and Moderate ecological status, which may be vulnerable to deterioration during construction.

7.3.20 Groundwater Dependent Terrestrial Ecosystems (GWDTEs) including Scaleby Moss and Lyne Woods, are present within the corridor and may be sensitive to changes in

groundwater levels and quality. The corridor also contains springs and aquifers (Principal, Secondary A and B), which support local groundwater-surface water interaction and may be affected by development. While these constraints are not considered to be a determining factor in the appraisal of the routeing of an overhead line within Core Route Corridor 2, there are areas which would be avoided if possible or crossed by direct a route as possible and would require the implementation of standard mitigation measures.

7.3.21 Geology and soil receptors would pose some constraints to this option due to the presence of some more notable and expansive areas of peat, particularly within segment 2a and towards the northern boundary of segment 2b. These greater extents of peat limit routing options if peat were to be avoided.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

7.3.22 All of Core Route Corridor 2, except segments 1c and 2a, fall within an MSA relating to sand and gravel. Development within these areas has the potential to impact mineral resources but this would not necessarily be a determining factor in the appraisal of the development of an overhead line.

7.3.23 Core Route Corridor 2 entirely avoids areas ALC Grades 1 and 2 which are the most fertile and valuable for agriculture.

7.3.24 There are a number of approved major planning applications associated with Harker substation, which is within segment 1e, including the substation expansion (20/0082, 22/0981) and three BESS applications (23/0833, 23/0444 and 24/0093) that are adjacent to Harker Substation. Segments 1e and 1d also include a number of approved major non-energy related applications, including warehousing and logistics (refs: 22/0909, 19/0859, 22/0836 and 23/0580). None of these are considered as determining factors in the appraisal of development of an overhead line within Core Route Corridor 2.

There are no Nationally Significant Infrastructure Project applications or s36/37 within Core Route Corridor 2, however segment 2a in Scotland is located approximately 2km to the south-east of the proposed Bloch Wind Farm (ECU00003463). While it is not considered as determining factor in the appraisal of the development of a new overhead line, there is potential for cumulative impacts.

7.3.25 Policy HO11 (Gypsy, Traveller and Travelling Showpeople Provision) of the Carlisle District Local Plan (2015-2030), designated land at Low Harker Dene for the accommodation needs of Gypsies, Travellers and Travelling Showpeople. This designated land has been excluded from segment 1e so as to avoid direct impacts. All Route Corridors are similarly constrained by this allocation.

Aviation and Defence

7.3.26 Segments 1c, 2e, 4d, 2f, 2d, 2c, 2b and 2a are entirely within the MoD TTA 20T which is used for low flying training between 100 and 250 feet (30 and 76m). Overhead line pylons carrying 400 kV circuits are expected to be between 40m and 60m tall. As a result, pylons could pose a hazard and/or restrict flying activities. National Grid would

engage with the MoD should this option be taken forward to ensure that impacts are appropriately mitigated.

7.3.27 The entirety of Core Route Corridor 2 is located outside the defined 2km hazard area for MoD Longtown[41] (900m north-west from segment 1e at its closest point), impacts on MoD Longtown are therefore considered unlikely.

7.3.28 Overhead line development should generally be avoided within 4km from military airfields and possible issues may arise where overhead line development is within 10km from military airfields. The proximity of Core Route Corridor 2 to Carlisle Airport, at approximately 5.3km from segment 1e (at its closest point), may introduce aviation safeguarding considerations. Where avoidance of aviation constraints cannot be achieved, stringent design and construction measures would be required to mitigate potential impacts. These may include height restrictions on pylons, installation of aviation warning lights, and engagement with relevant authorities such as the MoD and the CAA to ensure compliance with aviation safety regulations. These measures would be confirmed through further assessment at the next stage of development.

Traffic and Transport

7.3.29 Core Route Corridor 2 is intersected by the M6 in segment 1e. The corridor is also crossed by three A roads and three B roads that are managed by the local highway authorities: A7 (segment 1e and 2c), A689 (segment 1e), A6071 (segment 1d),); B6318 (edge of segment 2f), B7201 (segment 2c), and B6357 (segments 2a and 2b). It is also likely that some minor roads would be required to access the construction works along the corridor in some locations. Overall, it is expected that the impacts could be reduced by mitigation to enable site access, including footpath diversion, removal of vegetation, junction improvements and widening. The impacts would largely be temporary during construction, and traffic management measures may be required.

7.3.30 There are two NCN routes that cross Core Route Corridor 2, Route 7 and Route 10 in segment 1e as well as several PRoWs. Whilst there would be some impacts on users of the NCN and other recreational routes, these are considered to be mitigable and would not be considered as determining factors of the appraisal of the construction of the overhead line. Bus routes operate on various roads in Route Corridor 2, temporary impacts on bus users during construction may occur if road closures and diversions are required, these would not be considered as determining factors of the appraisal of the construction of the overhead line within Core Route Corridor 2.

Engineering and Systems Appraisal Summary

7.3.31 A number of constraints within Core Route Corridor 2 have been identified, which are likely to reduce routeing flexibility and/or increase the technical complexity of potential overhead line routes. These constraints are outlined in **paragraphs 7.3.32** to **7.3.38** below.

7.3.32 There are a number of existing high voltage overhead lines within the Core Route Corridor which may require the new overhead line to cross them or be routed in their vicinity. These include:

- The existing 400 kV Harker–Hutton overhead line, which is owned by National Grid and routed through segment 1e, is not expected to require crossing, as the proposed overhead line can likely be routed to avoid it.

- The existing 275 kV overhead line, which is owned by National Grid and routed through segment 1e, is not anticipated to require crossing, as the proposed overhead line can be routed to avoid it.

7.3.33 There are a number of existing overhead lines within Core Route Corridor 2 that may require crossing. These include two 132 kV lines in segments 1e, another 132 kV line in segment 4e, a 132 kV line towards Hawick substation in segment 2c, and the 132 kV connection to Ewe Hill Wind Farm in segment 2a. These crossings are expected to be achievable through standard clearance and design measures, though it may be possible to avoid some of them through appropriate route alignment depending on the final design.

7.3.34 The NWEP pipeline runs through segments 1d and 1e. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, considering other constraints.

7.3.35 An existing high-pressure gas pipeline runs through the southern part of segment 2c. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

7.3.36 Hallburn Wind Farm is located to the east of segment 1d. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate separation. Sufficient space is available within the corridor to accommodate this, considering other constraints.

7.3.37 Underlying ground conditions vary across the corridor comprising Glacial Till/Diamicton deposits (clay, sand and gravel), with localised areas of Glaciofluvial Deposits (predominantly sands and gravels and Alluvium i.e. clay, silt and sand). Peat and peaty soils are identified in localised areas in segments 2a, 2b and 4d but may be present as unmapped deposits given the regional setting. The distribution of mapped peat deposits suggest that they can likely be avoided in the development of an overhead line route within the corridor.

7.3.38 The superficial geology notably comprises of glacial material which have the potential to be variable in terms of composition, thickness and strength and may include localised soft spots and less favourable ground including peat, alluvium and alluvial materials that may require treatment or removal and replacement. While this would be a design consideration if the route option were to be selected, it is not considered as a determining factor of the appraisal for development of an overhead line. Small areas of identified mines and quarries are within segments 1e, 2e and 2d but these are likely avoidable.

Holford Rules

7.3.39 Core Route Corridor 2 has been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.

7.3.40 Core Route Corridor 2 has generally avoided smaller areas of high amenity value which have specifically excluded from the corridor. The smaller areas of high amenity value which exist within the boundaries of the corridor comprise:

- Individual listed buildings within segments 1e, 4d, 2d, 2c.

- Priority habitats within segments 1e, 1d, 1c, 2e, 2d, 2c.
- Designated sites including Bell's Flow SSSI including:
  - Bell's Flow SSSI (fully within segment 2a);
  - Scaleby Moss SSSI (eastern perimeter of segment 1e); and
  - Lyne Woods SSSI (southeastern perimeter of segment 2e).
- Areas within SSSI IRZ in segments 2a, 2d, 2e, 2f, 4d, 1c, 1d, and 1e.

7.3.41 Where there are smaller areas of high amenity value, sufficient space has been included within the corridor to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.

7.3.42 Core Route Corridor 2 was defined to provide a central route from Harker to the England-Scotland border which follows a largely direct route (in line with **Holford Rule 3**).

7.3.43 Core Route Corridor 2 was defined to avoid highly constrained areas, and specific constraints including settlements such as Longtown and Canonbie (Holford Rule Supplementary Note 1). The width of the corridor reflects the constraints in a given area, with narrow sections where constraints are present such as in proximity to areas of ancient woodland (Foulton Wood, Cistern Wood, Carwinley and Wisk Woods, Blackroots Wood) and the Bell's Flow SSSI.

7.3.44 Core Route Corridor 2, particularly segment 1e, 2e and 2b, includes more land than is needed for construction of an overhead line which provides flexibility and options when considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.

7.3.45 The features of Route Corridor 2 provide opportunities to identify a line route that aligns with **Holford Rules 4** and **5**. In the northern portion (segment 2a and 2c), the gently rolling to undulating landscape includes a patchy network of forests, hedgerows, and tree belts that can provide vegetative screening and backclothing for pylons. However, the open and uninterrupted views to the Solway Firth and Lakeland Fells beyond are particularly susceptible to tall infrastructure (Landscape and Visual appraisal). In the central and southern portions of the corridor, transitional farmland and valley landscapes (segments 2d, 2f, 4d) offer options to reduce sky-lining and apparent tower height. These characteristics, combined with careful routeing and the ability to carefully sited infrastructure and alignment with existing landform and vegetation, allow for a design that minimises visual impact and integrates the line into the surrounding landscape, consistent with Holford guidance.

7.3.46 Core Route Corridor 2 could potentially require the crossing of existing overhead lines. While this could result in landscape and visual impacts, further assessment would be required during the next design phase. In accordance with Holford Rule 6, mitigation (re-routeing, removal or undergrounding) would be considered to minimise visual and landscape effects.

7.3.47 While the Holford Rules have been used to guide the definition of the Core Route Corridor, it is important to note that not all aspects of the rules can be fully applied at this stage of the project. Specifically, **Holford Rules 4, 5, 6** and **7** which relate to proximity to residential areas, visual intrusion, special areas, and skyline impacts,

require detailed alignment and tower positioning to be meaningfully assessed. These considerations depend on further design development, including visual impact assessments, ecological surveys, and topographic modelling, which will be undertaken during the next phase of route refinement. The current application of the Holford Rules is therefore strategic and high-level, with more detailed compliance to be demonstrated as the design progresses.

Summary of Appraisal of Core Route Corridor 2

Environmental

7.3.48 The key environmental considerations influencing the appraisal of Core Route Corridor 2 are predominantly landscape and visual amenity as well as historic environment and ecology considerations. The corridor passes through a predominantly rural landscape, with segments 2a, 2c, 2e, and 2f identified as particularly sensitive due to undulating landform, long views, and the presence of scattered residential and recreational visual receptors. The southern segments, particularly 1d and 1e, contain existing energy infrastructure such as wind turbines, substations, and major roads, which reduce the landscape's susceptibility to change. However, there is potential for cumulative visual impacts from the Proposed Development in combination with existing and future infrastructure in these areas. There is potential for an overhead line within the corridor in Scotland to reduce the prominence of the Scots' Dike scheduled monument in the landscape due to the proximity of the corridor to this asset (approximately 300m at its closest point). Additionally, there is potential for qualifying features of the Solway Firth (such as wintering birds) to be present within the corridor due to proximity of the corridor to this designation (approximately 1.3km at its closest point). These qualifying features could be impacted by activities associated with construction and operation of the Proposed Development. Bell's Flow SSSI spans a significant portion of the width of the corridor (in segment 2a); therefore, avoiding this constraint would considerably restrict options for an overhead line through this segment. Further assessment would be required at the later stages of the Proposed Development to further understand impacts and guide the design of the overhead line.

Socio-economic

7.3.49 The socio-economic appraisal did not identify any constraints or impacts which would be considered as determining factors of the appraisal of development of an overhead line within Core Route Corridor 2. While some impacts would be unavoidable, subject to routeing the temporary diversion of PRoWs, these are considered to be mitigatable. The proximity of the corridor to Carlisle Airport (approximately 5.3km at its closest point), may introduce aviation safeguarding considerations; National Grid would engage with the MoD and the CAA should this option be taken forward to ensure that impacts are appropriately identified and mitigated.

Engineering and Systems

7.3.50 The main engineering factors influencing the appraisal of Core Route Corridor 2 relate to existing utilities. These include existing high voltage overhead lines (132 kV, 275 kV and 400 kV), the NWEP in segments 1d and 1e, and a high-pressure gas pipeline in segment 2c. These would require careful routeing to avoid crossings or ensure safe construction. While ground conditions within the corridor would influence the design of

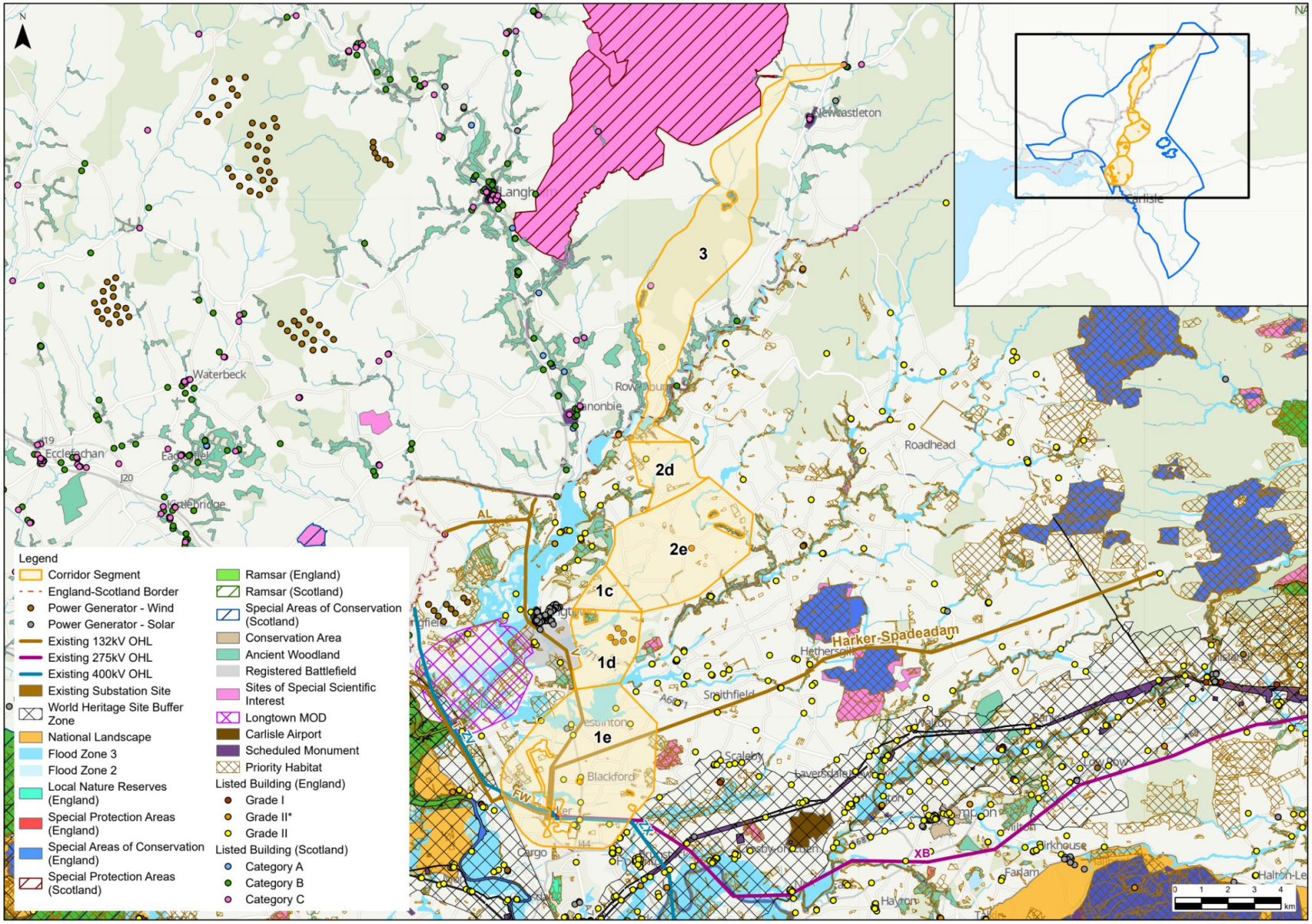
an overhead line within the corridor, they are not considered to be determining factors of the appraisal of the development of an overhead line.

7.4 Core Route Corridor 3

7.4.1 Core Route Corridor 3 is formed by segments 1e, 1d, 1c, 2e, 2d and 3 (see **Figure 7-3**). It is routed north from the existing Harker substation (segment 1e and 1d) for approximately 9.7km, being crossed by the existing National Grid 400 kV Harker-Hutton overhead line), an existing National Grid 275 kV overhead line and an existing 132 kV overhead line. The corridor is then routed in a north-east direction for approximately 5km through mixed farmland interspersed with small sections of woodland until it reaches the Rae Burn and then in a north direction for approximately 3.3km until it reaches the England-Scotland border and the River Liddel in the southern part of segment 3. The corridor extends by approximately 14.5km north of the border and terminates in proximity to the village of Newcastleton. Subject to detailed route design, Core Route Corridor 3 enables the development of an overhead line route of up to 18.6km long within England.

7.4.2 The alignment of Core Route Corridor 3 excludes constraints such as the settlement of Longtown and various areas of ancient woodland including Hopesike Woods, Sawmill Wood, Cistern Wood, Blackroots Wood. Furthermore, the corridor has been designed to avoid Solway Moss Registered Battlefield, Scaleby Moss SSSI, Black Snib SSSI, Lyne Woods SSSI, the Langholm-Newcastleton Hills SPA, Copshaw Holm LNCS, Hadrian's Wall WHS and associated buffer zone, the Battle of Solway Moss Registered Battlefield and the MoD Longtown hazard zone

Figure 7-3 – Core Route Corridor 3 with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

7.4.3 Core Route Corridor 3 avoids crossing statutory landscape designations. At its closest point it lies approximately 1.1km east of the Solway Coast National Landscape in England and approximately 1.3km east of the Langholm Hills Regional Scenic Area local designation in Scotland. To the extent that Core Route Corridor 3 could be considered to form part of the setting of the Solway Coast National Landscape, it would be located in association with Harker substation and overhead lines which already form the baseline. The Northumberland National Park and North Pennines National Landscape are approximately 22km and 12.9km to the east respectively at the closest point. Hadrian's Wall Path National Trail is located outside the corridor, approximately 2.6km to the south (segment 1e) at its closest point.

7.4.4 In Scotland Core Route Corridor 3 segment 3 occupies LCT 113 Upland Valley with Pastoral Floor, LCT 93 Southern Uplands with Scattered Forest – Borders, LCT 160 Narrow Wooded River Valley, LCT 172 Upland Fringe and LCT 176 Foothills with Forest all in Dumfries and Galloway before entering NCA 6 Solway Basin in England in the southernmost part of segment 3.

7.4.5 In England the corridor lies predominantly within LCT sub type 5b Low Farmland. A smaller section of the Core Route Corridor also occupies LCT sub type 8b Broad Valleys and LCT 06 Intermediate Farmland between segment 3 and 2d/2e and LCT 2c Coastal Plain and LCT 13 Urban Fringe within segment 1e.

7.4.6 The majority of the Scottish LCTs are of reduced sensitivity in this context due decreased susceptibility evident in the following characteristics: simple landscape scale, land use with man-made influences, landscape and visual pattern and woodland or forestry to aid integration. Similarly, LCT sub-type 5b has large scale fields, undulating topography and dispersed vegetation, as well as existing overhead line as key characteristics, which reduce sensitivity.

7.4.7 Within the southern part of Core Route Corridor 3, the more widespread nature of potential impacts on landscape character are considered to be limited due to the presence of existing electrical infrastructure which is a prominent feature of the landscape with neutral impacts overall on landscape character. Due to the scattered nature of potential visual receptors negative impacts are anticipated on visual amenity, particularly in relation to residential receptors, although overhead lines are already detracting elements in many of these views.

7.4.8 In the elevated, northern part of the corridor, there is the potential for more limited impacts on landscape character. There is the potential for impacts on the setting of the Langholm Hills Regional Scenic Area within Scotland arising from the overhead lines which would be required in segment 3 in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). However, as the elevated landscape transitions into the valley landscape and the open and gently rolling agricultural landscape in the central part of the corridor, there is potential for direct and more widespread landscape impacts. This would likely result in negative impacts on landscape character. Similarly, due to the scattered nature of potential visual receptors across the corridor, negative impacts are anticipated on visual amenity, particularly in relation to residential receptors.

7.4.9 Key visual constraints within this corridor relate to segments 2d and 2e which are areas of undulating and gently rolling landscape with long views. There are scattered residential visual receptors throughout segment 3 located in Scotland, where the proposed overhead line (which would not be part of the Proposed Development but would be part of the Scottish section of the Project) would be likely to have negative impacts for users of Langholm Hills Regional Scenic Area (subject to the proximity of an overhead line to the locally designated landscape) and direct and widespread impacts to the valley landscape in the southern part of the segment .

Historic Environment

7.4.10 Core Route Corridor 3 has been defined to avoid designated heritage assets where possible, however, the location and distribution of the assets means that some are unavoidable and are either within or are in closer proximity to the corridor. Notable designated heritage assets that could be affected by an overhead line in Core Route Corridor 3 include:

- The Grade II listed Alstonby Hall (NHLE 1335568), located in the north-east section of Segment 1e, and which may have been designed to have views across the valley of the River Lyne.
- The Solway Moss Registered Battlefield, located approximately 70m to the west of Segment 1d. Although Core Route Corridor 3 does not encroach on this asset, the Proposed Development might result in an impact on the wider setting of the battlefield.
- The scheduled Kirk Hill enclosure (HES ID SM2149), located on the eastern boundary of segment 3 in Scotland. This asset is positioned on the summit of Kirk Hill and may have been designed to command views over the surrounding landscape, but especially the valley of the Liddel Water which drops away to the east. There is the potential for impacts on the setting arising from the overhead lines within segment 3 in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project).
- Castleton former church complex (HES ID LB 6624), a Category B Listed Building, located approximately 100m from the north boundary of segment 3 in Scotland, and may have been designed to have views over the confluence of the Liddel Water and the Hermitage Water. There is the potential for impacts on the setting arising from the overhead lines within segment 3 in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project).

7.4.11 Based on the results of the appraisal to date, there is limited potential for an overhead line in Core Route Corridor 3 to impact the setting of Hadrian's Wall WHS and its OUV. This is largely a result of the distance between the asset and Core Route Corridor 3, as well as screening from topography and tree cover. Furthermore, while the south-eastern boundary of Core Route Corridor 3 is adjacent to Hadrian's Wall WHS buffer, the nearest scheduled monument that forms a component of the WHS is at 1.8km from this boundary. As set out in the WHS Capacity Assessment Technical Note (included in **Appendix A** of this CPRSS), the section of Hadrian's Wall WHS buffer adjacent to the south-east boundary of Core Route Corridor 3 is considered less sensitive to change as a result of existing infrastructure including the M6 and two overhead lines which have resulted in impacts to the setting of the WHS, as well as aspects such as the condition/survival of components of the WHS. A HIA may be required if the overhead line were sited in proximity to the south-eastern boundary of Core Route Corridor 3.

7.4.12 In summary, there is potential for on overhead line in Core Route Corridor 3 to impact the settings of some designated heritage assets within or in close proximity to the corridor. Further assessment would be required at the later stages of the Proposed Development to guide the siting of the overhead line.

Ecology

7.4.13 Core Route Corridor 3 has been defined to avoid designated ecological areas where possible, however, there remains a range of ecological sensitivities, including designated sites, priority habitats, and protected species present within or close to the corridor. Potential impacts on ecological interests resulting from the construction of an overhead line within Core Route Corridor 3 include habitat loss or degradation and disturbance or displacement of protected species.

7.4.14 The corridor intersects or lies near several statutory and non-statutory designations, including SAC, SPA, SSSI, and areas of priority habitat. Notable designations which may be affected by an overhead line in Core Route Corridor 3 include:

- The River Eden SAC, located within 1km of segment 1e at its closest point, and designated for riparian habitats and fauna. Potential impacts to the River Eden SAC include water pollution, to which its designated features are particularly sensitive, and loss or fragmentation of functionally linked habitat
- The Solway Firth SAC, SPA, Ramsar Site and SSSI, located 1.3km west of the corridor at its closest point. Qualifying features of the Solway Firth, particularly wintering birds, may be present within the corridor and could be impacted by activities associated with construction or routine operation of overhead lines in England, particularly within segments 1e, 1d and 1c that are located within close proximity (within 1.3, 4.2 and 5.8km respectively) to the Solway Firth at their closest point. Potential impacts include waterborne pollution, disturbance impacts to birds that are a qualifying feature of the Solway Firth through noise, vibration, lighting or human presence during the construction phase leading to displacement and impacts on population; habitat loss of functionally linked land for foraging or roosting during construction and operation phases; and mortality or injury due to bird strike into overhead lines. A stage 1 HRA would likely be required at the later stages of design to assess potential impacts on the Solway Firth SAC, SPA, Ramsar and SSSI. With the implementation of careful routeing and standard construction and design measures, Core Route Corridor 3 provides opportunities to mitigate potential impacts on identified sites. Should the HRA identify impacts on the integrity of these designated sites, further assessment would be undertaken. The HRA would assess any indirect effects, such as the loss of functionally linked land used by SPA species.
- The Langholm-Newcastleton Hills SPA, designated for upland flora and fauna, located 60m to the west of segment 3 (at its closest point) in Scotland, designated for the presence of breeding hen harrier (*Circus cyaneus*) amongst other upland species and habitats. Potential impacts include disturbance to fauna that is a qualifying feature of the SPA through activities associated with construction or routine operation of the overhead lines which would be required within segment 3 in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). The potential impact on the SPA would be considered in detail within a Habitat Regulations Assessment (HRA) at the later stages of the Proposed Development.

- The Scaleby Moss SSSI located in segment 1e, the Black Snib SSSI located 150m east of segment 1d, the Lyne Woods SSSI located in segment 2e. Direct and indirect impacts to the qualifying features of these SSSIs may include habitat loss, water pollution, dust deposition, and injury of protected birds which breed in or are qualifying features of these SSSIs as a result of collision with overhead lines. Given the minimal extent of SSSIs that enter into the corridor it is considered that direct impacts to these constraints could be avoided by careful routing.
- The Langholm-Newcastleton Hills SSSI is located 60m west of segment 3 in Scotland and the Penton Linns SSSI is located 150m from the eastern boundary of segment 3 in Scotland. There is potential for impacts on these sites arising from the overhead lines which would be required within segment 3 in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). Direct and indirect impacts to the qualifying features of these SSSIs may include habitat loss, water pollution, dust deposition, and injury of protected birds which breed in or are qualifying features of these sites as a result of collision with overhead lines. Given that these SSSIs are not located within the corridor, it is considered that direct impacts to these constraints could be avoided by careful routing.
- Areas of deciduous woodland priority habitat, scattered throughout the corridor segments. Other priority habitat present includes an area of traditional orchard in segment 2d, areas of good quality semi-improved grassland in segments 2d, 2e and 4, and a small area of lowland raised bog in the west of segment 1e. These could be directly or indirectly impacted by activities associated with construction, including removal of vegetation or dust deposition.
- Parcels of ancient woodland and semi-natural woodland irreplaceable habitat, located within close proximity (within 50m-100m) from the corridor boundary. As these parcels are excluded from the route corridor, direct impacts on ancient woodland are not anticipated.

7.4.15 Although careful design of an overhead line route within the corridor could mitigate impacts many protected and notable habitats and species, the proximity of Core Route Corridor 3 to internationally designated sites including the Solway Firth and Langholm-Newcastleton Hills SSSIs would require thorough assessment in parallel with design development.

Other Environmental Considerations

7.4.16 Other environmental aspects were considered as part of the options appraisal including water, geology and soils.

7.4.17 There are a number of surface and groundwater constraints or features within or close to Core Route Corridor 3. This includes surface water bodies such as rivers, burns or ponds, sections of Flood Zone 3 floodplain and ecological interests which are dependent on or linked to surface and groundwater. The corridor route contains WFD waterbodies and tributaries of WFD waterbodies of Bad, Poor, Moderate and Good ecological status. The River Lyne, a designated Principal Salmon River, intersects segments 1d and 1e.

7.4.18 Sections of Flood Zone 3 floodplain span approximately 1000m in segment 1e (River Lyne) and 600m in segment 3 (Liddel Water), with potential receptors including the A7, minor roads, residential and industrial properties, and agricultural land. Development in these areas could displace flood volume and increase flood risk elsewhere.

7.4.19 The corridor also includes several GWDTEs, including Scaleby Moss, Lyne Woods, and Jockie's Skye, all of which are also designated SSSIs. Springs and issues indicating ground/surface water interaction are present and may be locally sensitive to disturbance.

7.4.20 Overall, while these constraints are not considered to be determining factors of the appraisal of Core Route Corridor 3, they present a range of sensitivities. Areas should be avoided where possible or crossed by direct a route as practicable, with the implementation of standard mitigation measures.

7.4.21 Geology and soil receptors would pose a constraint to this option, necessitating careful consideration for avoiding or managing peat and peaty soils. Localised peat and peaty soils are prevalent throughout much of the corridor and become increasingly unavoidable towards the north, particularly in segment 3. Within this segment and west of Newcastleton, it is unlikely that the mapped areas of peat can be avoided and therefore this would be a substantive constraint to this route corridor.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

7.4.22 All of Core Route Corridor 3, except segment 1c, contains large segments of MSAs relating to sand and gravel. Development within these areas has the potential to impact mineral resources but this would not be a determining factor in the appraisal of the development of an overhead line.

7.4.23 Core Route Corridor 3 entirely avoids areas ALC Grades 1 and 2 which are the most fertile and valuable for agriculture.

7.4.24 There are no Nationally Significant Infrastructure Project applications within Core Route Corridor 3. However, the site of the Liddesdale Wind Farm (ECU00004833) planning application, which is at the scoping stage (as of July 2025), is approximately 200m east of segment 3 located within Scotland).

7.4.25 There are a number of major planning applications associated with Harker Substation, which is within segment 1e, including the substation expansion (20/0082, 22/0981) and three BESS applications (23/0833, 23/0444 and 24/0093) that are adjacent to Harker Substation. Segments 1d and 1e also include a number of major non-energy related applications, including warehousing and logistics (refs: 22/0909, 19/0859, 22/0836 and 23/0580). None of these are considered as the determining factors of the appraisal of the development of a new overhead line, however, there is the potential for cumulative impacts.

7.4.26 Policy HO11 (Gypsy, Traveller and Travelling Showpeople Provision) of the Carlisle District Local Plan (2015-2030), designated land at Low Harker Dene for the accommodation needs of Gypsies, Travellers and Travelling Showpeople. This designated land has been excluded from segment 1e so as to avoid direct impacts. All Route Corridors are similarly constrained by this allocation.

Aviation and Defence

7.4.27 Segments 1c, 2e, 2d and 3are entirely within the MoD TTA 20T which is used for low flying training between 100 and 250 feet (30 and 76m). overhead line pylons carrying 400 kV circuits are expected to be between 40m and 60m tall. As a result, pylons could

pose a hazard and/or restrict flying activities. National Grid would engage with the MoD should this option be taken forward to ensure that impacts are appropriately mitigated.

7.4.28 The entirety of Core Route Corridor 3 is located outside the defined 2km hazard area for MoD Longtown[41] (900m north-west from segment 1e at its closest point), impacts on MoD Longtown are therefore considered unlikely.

7.4.29 Overhead line development should generally be avoided within 4km from military airfields and possible issues may arise where overhead line development is within 10km from military airfields. The proximity of Core Route Corridor 3 to Carlisle Airport, at approximately 5.3km from segment 1e (at its closest point), may introduce aviation safeguarding considerations. It is considered that impacts could be avoided or reduced to an acceptable level by careful routing and following the implementation of aviation-related design considerations, such as height restrictions on pylons and/or the installation of aviation warning lights to ensure safe operation and compliance with aviation regulations. National Grid would engage with the MoD and the CAA should this option be taken forward to ensure that impacts are appropriately mitigated.

Traffic and Transport

7.4.30 Core Route Corridor 3 is intersected by the M6 in segment 1e. The corridor is also crossed by five A and B roads that are managed by the local highway authorities the A7 and A689 (segment 1e), A6071 (segment 1d), B6318 and B6357 (segment 3). As far as possible, construction traffic would be routed along the A and B roads. To mitigate impacts on drivers, road closures associated with construction access along and across these roads would be kept to a minimum and if possible planned at night times to avoid the peak/busiest times.

7.4.31 There are two NCN routes that cross Core Route Corridor 3, Route 7 and Route 10 in segment 1e, as well as several PRoWs. The development of an overhead line close to or crossing recreational routes has the potential to impact on users. However, these are considered to be mitigable and would not be considered as determining factors of the appraisal of the construction of the overhead line. Bus routes operate on various roads in Core Route Corridor 3, temporary construction delay impacts for bus users could occur if road closures and diversions are required.

7.4.32 For segment 3, the B6357 could potentially be used as a construction route between the corridor and the A7. However, it does have potential constraints including its width and the bridge in Canonbie. It is also likely that some minor roads would be required to access the construction works along the corridor in some locations. Overall, it is expected that the impacts could be reduced by mitigation to enable site access, including footpath diversion, removal of vegetation, junction improvements and widening.

Engineering and Systems Appraisal Summary

7.4.33 A number of constraints within Core Route Corridor 3 have been identified, which are likely to reduce routeing flexibility and/or increase the technical complexity of potential overhead line routes. These constraints are outlined in **paragraphs 7.4.34** to **7.4.40** below.

7.4.34 Segment 3 passes through a Coal Mining Reporting Area, with the entire southern half indicated to be within a high-risk development zone. This segment threads between areas of known former shallow coal mine workings, mine entries, and probable shallow

workings identified at Rowanburn and those immediately east of the River Liddel. These features and areas are regarded as high-risk development areas. Where coal workings are present or suspected, further study and likely additional intrusive investigation would be required to locate and evaluate the potential impact. Additional workings, that are currently unknown or unmapped may also be present, further increasing the potential risk from former coal mine workings such as collapse.

7.4.35 There are a number of existing high voltage overhead lines within the Core Route Corridor which may require the new overhead line to cross them or be routed in their vicinity. These include:

- The existing 400 kV Harker–Hutton overhead line, which is owned by National Grid and routed through segment 1e, is not expected to require crossing, as the proposed overhead line can likely be routed to avoid it.
- The existing 275 kV overhead line, which is owned by National Grid and routed through segment 1e, is not anticipated to require crossing, as the proposed overhead line can be routed to avoid it.

7.4.36 There are a number of overhead lines within Core Route Corridor 3 that will require crossing. These include the 132 kV lines in segment 1e and 2c. Crossings of both lines will be necessary, as they lie within the anticipated alignment. These crossings are expected to be achievable through standard overhead line clearance and design practices.

7.4.37 The NWEP pipeline runs through segments 1d and 1e. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to achieve this, taking into account other constraints.

7.4.38 Hallburn Wind Farm is located to the east of segment 1d. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate separation. Sufficient space is available within the corridor to achieve this, taking into account other constraints.

7.4.39 Underlying ground conditions vary across the corridor comprising Glacial Till/Diamicton deposits (clay, sand and gravel), with localised areas of Glaciofluvial Deposits (predominantly sands and gravels and Alluvium i.e. clay, silt and sand). Peat and peaty soils are mapped locally throughout the corridor, becoming more frequent in the northern half of segment 3. A broad expanse of peaty soil has been identified near the southern boundary of segment 1d. However, the distribution of mapped peat deposits suggest that they can likely be avoided in most areas but towards the north of segment 3, this would not be possible for the development of an overhead line route within the corridor.

7.4.40 The superficial geology notably comprises of glacial material which have the potential to be variable in terms of composition, thickness and strength and may include localised soft spots and less favourable ground including peat, alluvium and alluvial materials that may require treatment or removal and replacement. While this would be a design consideration if the Siting Zone were to be selected, it is not a determining factor in the appraisal of the development of an overhead line within the Siting Zone. In addition to the areas of high risk development relating to coal workings, there are other areas of identified mines and quarries within the segments but these are likely avoidable as relatively small and sporadic.

Holford Rules

7.4.41 Core Route Corridor 3 has been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.

7.4.42 Core Route Corridor 3 has generally avoided smaller areas of high amenity value which have specifically excluded from the corridor. The smaller areas of high amenity value which exist within the boundaries of the corridor comprise:

- Individual listed buildings within segments 1e, 2d, 3
- Priority habitats within segments 1e, 1d, 1c, 2e, 2d, 3.

7.4.43 Where there are smaller areas of high amenity value, sufficient space has been included within the corridor to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.

7.4.44 Core Route Corridor 3 was defined to provide a central route from Harker to the England-Scotland border which follows a largely direct route (in line with **Holford Rule 3**).

7.4.45 Core Route Corridor 3 was designed to avoid highly constrained areas, and specific constraints including settlements such as Longtown and Newcastleton (**Holford Rule Supplementary Note 1**). The width of the corridor reflects the constraints in a given area, with narrow sections where constraints are present such as in proximity to areas of ancient woodland (Foulton Wood, Cistern Wood, Carwinley and Wisk Woods, Rigg Wood, Penton Wood, Archerbeck Wood, Dryslack Wood), the Langholme-Newcastleton Hills SPA and the Copshaw Holme LNCS.

7.4.46 Core Route Corridor 3 includes more land than is needed for construction of an overhead line which provides flexibility and options when considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.

7.4.47 The features of Route Corridor 3 provide opportunities to identify a line route that aligns with **Holford Rules 4** and **5**, particularly in its central and southern segments. The northern segment (segment 3) comprises elevated, rolling upland landscapes where careful routeing along valley sides and use of extensive forestry can partially reduce sky-lining impacts and visual prominence (Landscape and Visual appraisal). The central segments (2d, 2e, 1c) contain undulating landscapes with patchy woodland and larger field patterns, providing opportunities for screening and following landform, consistent with Holford guidance. In the southern segments (1d and 1e), the presence of existing energy infrastructure and major transport corridors reduces the landscape's susceptibility to new development, supporting integration of an overhead line. While northern upland areas pose greater challenges for full compliance with **Holford Rule 4**, overall, the corridor's features enable careful routeing to achieve reduced visual impact and better landscape integration in accordance with **Holford Rules 4** and **5**.

7.4.48 Core Route Corridor 3 would require the crossing of existing overhead lines. While this could result in landscape and visual impacts, further assessment would be required during the next design phase. In accordance with Holford Rule 6, mitigation (re-routeing, removal or undergrounding) would be considered to minimise visual and landscape effects.

7.4.49 While the Holford Rules have been used to guide the definition of the Core Route Corridor, it is important to note that not all aspects of the rules can be fully applied at this stage of the project. Specifically, **Holford Rules 4, 5, 6** and **7** which relate to proximity to residential areas, visual intrusion, special areas, and skyline impacts, require detailed alignment and tower positioning to be meaningfully assessed. These considerations depend on further design development, including visual impact assessments, ecological surveys, and topographic modelling, which will be undertaken during the next phase of route refinement. The current application of the Holford Rules is therefore strategic and high-level, with more detailed compliance to be demonstrated as the design progresses.

Summary of Appraisal of Core Route Corridor 3

Environmental

7.4.50 The key environmental considerations influencing the appraisal of Core Route Corridor 3 are predominantly landscape and visual amenity, historic environment, ecology and soils and geology considerations. Impacts are anticipated on visual amenity, particularly in relation to scattered residential receptors, and on landscape character in the central part of the corridor where the elevated landscape transitions into open, gently rolling agricultural land. The corridor may also give rise to negative visual effects on the Langholm Hills Regional Scenic Area, subject to the proximity of the proposed overhead lines, and direct and widespread impacts to the valley landscape in the southern part of segment 3. There is potential for qualifying features of the Solway Firth (such as wintering birds) to be present within the corridor due to the proximity of the corridor to this designation; these qualifying features could be impacted by activities associated with construction and operation of the Proposed Development and potential for bird strike into overhead lines. The Langholm-Newcastleton Hills SPA and SSSI is located 60m to the west of the corridor; while the designation lies outside the corridor, potential indirect impacts may include disturbance to fauna that is a qualifying feature of the SPA. In addition, there is potential for impacts on the setting of designated heritage assets located within or near the corridor, including listed buildings, scheduled monuments and registered battlefields. Further assessment would be required at the later stages of the Proposed Development to further understand impacts and guide the design of the overhead line. Localised peat and peaty soils are prevalent throughout much of the corridor and would also require careful consideration as part of design development.

Socio-economic

7.4.51 The socio-economic appraisal did not identify any constraints or impacts which would be a determining factor of the appraisal of the development of an overhead line within Core Route Corridor 3. While some impacts would be unavoidable, subject to routing the temporary diversion of PRoWs, these are considered to be mitigatable. The proximity of the corridor to Carlisle Airport (approximately 5.3km at its closest point), may introduce aviation safeguarding considerations; National Grid would engage with the MoD and the CAA should this option be taken forward to ensure that impacts are appropriately identified and mitigated.

Engineering and Systems

7.4.52 The main engineering factors influencing the appraisal of Core Route Corridor 3 relate to existing utilities. These include existing high-voltage overhead lines (132 kV, 275 kV, and 400 kV), which the proposed overhead line would need to cross or be routed in proximity to. In addition, the NWEP pipeline runs through segments 1d and 1e. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

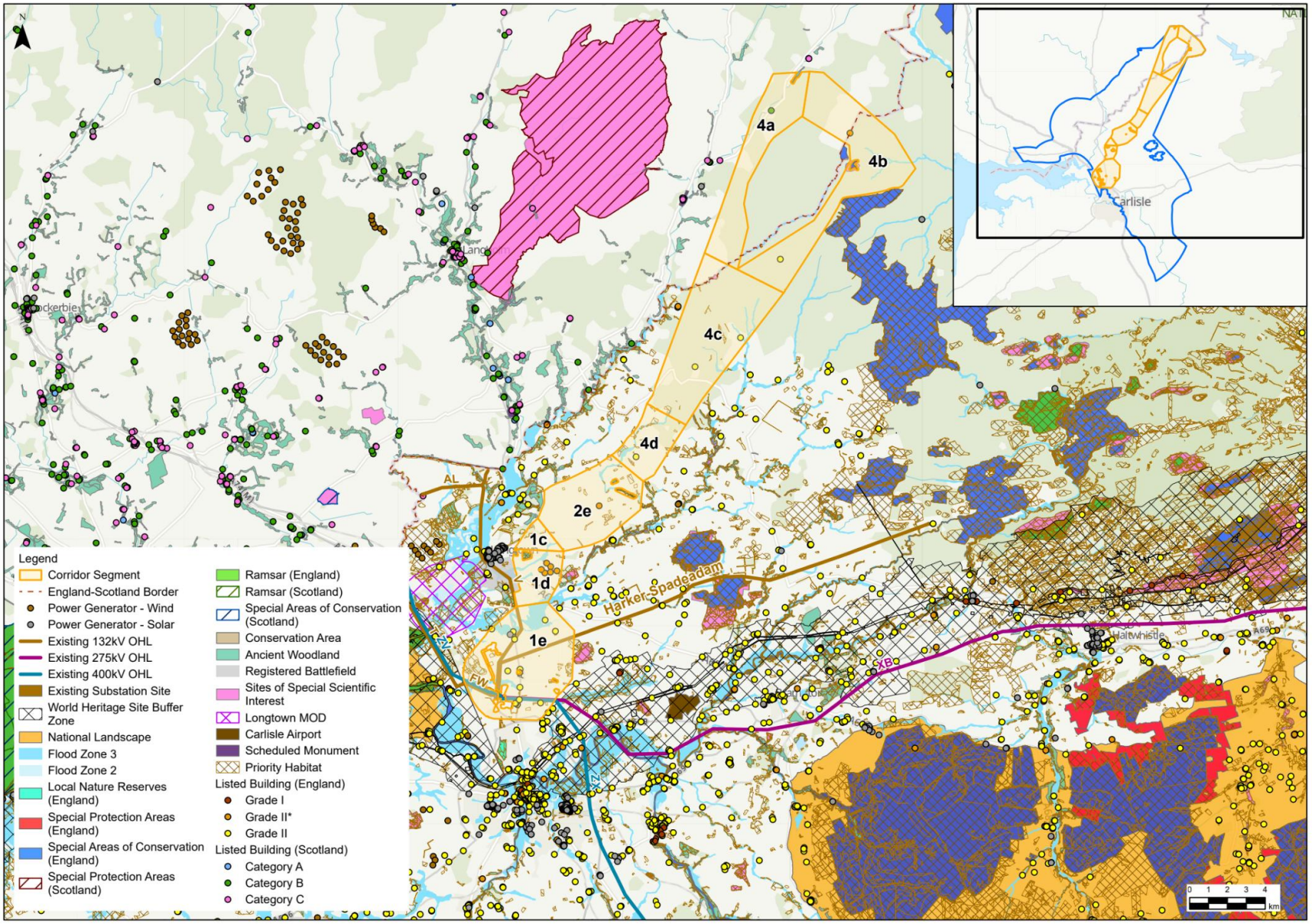
7.4.53 Ground conditions, particularly in relation to the presence of high-risk development area with regards to former coal mining would be a constraint within the corridor and would influence the design of an overhead line within the corridor.

7.5 Core Route Corridor 4

7.5.1 Core Route Corridor 4 is formed by segments 1e, 1d, 1c, 2e, 4d and 4c, with the option for either segment 4a or 4b to be used at the north-eastern extent of the corridor (see **Figure 7-4**). It is routed north from the existing Harker substation (segment 1e and 1d) for approximately 9.7km, being crossed by the existing National Grid 400 kV Harker-Hutton overhead line, an existing National Grid 275 kV overhead line and an existing 132 kV overhead line. The corridor is then routed in a north-east direction for approximately 10km through mixed farmland interspersed with small sections of woodland. The corridor then continues for approximately 8.5km within an area that is largely occupied by Kershope Forest until it reaches the England-Scotland border at the northern extent of segment 4c. The corridor continues into Scotland via either segment 4a (for approximately 10.5km) or segment 4b (approximately 14.3km); segment 4a and 4b provide alternative routing options around the proposed Liddesdale Wind Farm (ECU reference: ECU00004833). Subject to detailed route design, Core Route Corridor 4 enables the development of an overhead line route of up to 28km long (using segment 4a) and up to 39.km long (using segment 4b) respectively within England.

7.5.2 The alignment of Core Route Corridor 4 excludes constraints such as the settlement of Longtown and various areas of ancient woodland including Hopesike Woods, Sawmill Wood, Cistern Wood, Blackroots Wood. Furthermore, the corridor has been designed to avoid the Langholm-Newcastleton Hills SPA, Scaleby Moss SSSI, Black Snib SSSI, Lyne Woods SSSI, Kershope Bridge SSSI, Kielder Mires SAC and SSSI, Hadrian's Wall WHS and associated buffer zone, the Battle of Solway Moss Registered Battlefield and the MoD Longtown hazard zone.

Figure 7-4 – Core Route Corridor 4 with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

7.5.3 Core Route Corridor 4 avoids crossing statutory landscape designations. At its closest point it lies approximately 1.1km east of the Solway Coast National Landscape and approximately 5.5km east of the locally designated Langholm Hills Regional Scenic Area in Scotland. To the extent that Core Route Corridor 4 could be considered to form part of the setting of the Solway Coast National Landscape, it would be located in association with Harker substation and overhead lines which already form the baseline. The Northumberland National Park and North Pennines National Landscape are approximately 17.7km and 12.9km to the east respectively at the closest point and Core Corridor 4 is not considered likely to lie within their setting. Hadrian's Wall Path National Trail is located outside the corridor, approximately 2.6km to the south (segment 1e) at its closest point.

7.5.4 In Scotland Core Route Corridor 4 segment 4b predominantly occupies LCT 96 Southern Uplands with Forest with sections of segment 4a also in LCT 113 Upland Valley with Pastoral Floor. Due to distance and baseline forestry there is only limited potential for impacts on the setting of the Langholm Hills Regional Scenic Area within Scotland arising from the overhead lines which would be required in segment 4a,4b and 4c in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). Overhead lines in England within segments 4b and 4c would be distant and unlikely to impact the Langholm Hills Regional Scenic Area.

7.5.5 At the national landscape scale in England, Core Route Corridor 4 lies within NCA 5 Border Moors and Forests in the north and NCA 6 Solway Basin in the south. At a local scale in England segments 4a-4d of the corridor lie predominantly within LCT 96 Southern Uplands with Forest- Borders with a small area in LCT 19a Kielder and Redesdale Forests with LCT sub type 5b Low Farmland occupying most of the southern extent. A smaller section of the Core Route Corridor also occupies LCT sub-type 9c Forests in segment 4c, LCT sub type 06 Intermediate Farmland between segment 4d and 2e and LCT 2c Coastal Plain and LCT 13 Urban Fringe within segment 1e. LCT 96 Southern Uplands with Forest has key characteristics which reduce sensitivity to overhead line such as large-scale rolling landform, dominant coniferous forest cover and a simple, uniform character. LCT 113 Upland Valley with Pastoral Floor has slightly increased sensitivity as a result of strong enclosure by uplands with intermittent long views along valley corridors which would accentuate overhead line. LCT sub-type 5b has large scale fields, undulating topography and dispersed vegetation, as well as existing overhead line as key characteristics, which reduce sensitivity. Sensitive visual receptors within Core Route Corridor 4 include residential properties, Core Paths, NCN routes, and ProW. In the southern section (segments 1d and 1e), due to the scattered nature of potential visual receptors, negative effects are anticipated on visual amenity, particularly residential receptors, although existing overhead lines are already detracting elements in many views. In the central part of the corridor (segments 1c and 2e), receptors are more scattered across undulating and gently rolling landscapes with long views and wooded watercourses. In the northern part of the corridor (segments 4d, 4c and 4a), receptors are limited to dispersed properties and recreational users. Due to the scattered nature of potential visual receptors, negative impacts are anticipated on visual amenity, particularly in relation to residential receptors.

7.5.6 The southern segments (1d and 1e) of Core Route Corridor 4 are influenced by existing energy infrastructure, including wind turbines, substations, and major roads such as the A7 and M6. The central segments (2e and 1c) feature undulating and gently rolling landscapes with long views, wooded watercourses, and scattered residential receptors. These characteristics increase the potential for visual and landscape impacts. The larger field pattern and patchy woodland offer some integration opportunities for overhead lines. However, the transitional nature of the landscape makes it more susceptible to change. Negative impacts on both landscape character and visual amenity are anticipated.

7.5.7 Segment 4d marks a shift from upland to the north to lowland landscapes to the south, comprising improved pasture and arable farmland with wooded river valleys. The smaller scale and reduced forestry cover increase susceptibility to overhead lines. Avoiding wooded lower slopes and watercourses can help limit impacts. Settlement is dispersed, and visual impacts are likely to be localised but could be significant where receptors are present. Segment 4c has areas of high rolling or undulating moorland and plateau and large areas of coniferous planting which increase potential for integration of overhead line.

7.5.8 Segment 4a, mostly located in Scotland, would introduce pylons into the narrow valley of the Liddel Water, resulting in a more pronounced change to landscape character. However, the segment benefits from a large-scale upland forested setting, allowing better integration of overhead lines, especially when pylons follow contours and avoid ridgelines. Visual impacts would be due to scattered residential receptors and recreational routes, but the limited settlement density reduces the overall concentration of impacts.

7.5.9 Segment 4b, partially located in Scotland, lies within a more expansive upland landscape dominated by coniferous plantations, open grassland, and moorland. It is more capable of accommodating overhead lines with limited effect on key landscape characteristics, although noting that steep terrain in the Larriston Fells may accentuate localised impacts. The segment borders the Dark Sky Park and includes ancient woodland and a Local Wildlife and Geological Site, increasing landscape sensitivity. However, visual impacts are likely to be localised and negative, particularly for isolated properties and recreational users near Kielder Water and Forest Park.

7.5.10 The southern segments (1d and 1e and to a lesser extent 1c) of Core Route Corridor 4 are influenced by existing energy infrastructure, which reduces the landscape's susceptibility to new development but noting that careful routeing would still be required to avoid cumulative visual clutter. The central sections (2e and 4d) are transitional landscapes between the more urbanised southern segments and the upland forestry to the north but are relatively localised and offer potential opportunities for mitigation by use of landform and existing forestry. Whilst segment 4a, mostly located in Scotland, would be within the valley of the Liddel Water, and segment 4b, partially located in Scotland, has steep topography, the northern segments of Core Route Corridor 4 offer mitigation opportunities for integrating overhead lines into forested upland landscapes in a way which would limit and/or localises landscape and visual effects. Overall, taking these baseline characteristics into account Core Route Corridor 4 using segment 4a would be the more preferable option, with the ability to accommodate overhead lines with limited or localised effects.

Historic Environment

7.5.11 Core Route Corridor 4 has been defined to avoid designated heritage assets where possible, however, the location and distribution of the assets means that some are unavoidable and are either within or are in closer proximity to the corridor. Notable designated heritage assets that could be affected by an overhead line in Core Route Corridor 4 include:

- The Grade II listed Alstonby Hall (NHLE 1335568), located in the north-east section of Segment 1e, and which may have been designed to have views across the valley of the River Lyne.
- The Solway Moss Registered Battlefield, located approximately 70m to the west of Segment 1d. Although Core Route Corridor 1 does not encroach on this asset, the Proposed Development might result in an impact on the wider setting of the battlefield.
- The Scheduled Moments Currick Long Cairn (NHLE 1015734) located 60m east of segment 4b and the Long Knowe Long Cairn (HES ID SM2154), located in Scotland 1.1km to the north-west of segment 4b and 3.6km north-northwest of The Currick Long Cairn. There is potential for any intervisibility that was important to the design and setting of both assets to be partially interrupted, although the potential for this is considered to be low as a result of existing vegetation screening as well as the nature of an overhead line, which would only partially interrupt views. If segment 4a was selected for this corridor option, there would be potential for impacts on the setting of these assets in to arise from the overhead lines which would be required in segment 4a in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). If segment 4b was selected, there would be potential for impacts on the setting of these assets in Scotland from the overhead line provided in segment 4b in England..

7.5.12 Based on the assessment to date, there is limited potential for an overhead line in Core Route Corridor 4 to impact the setting of Hadrian's Wall WHS and its OUV. This is largely a result of the distance between the asset and Core Route Corridor 4, as well as screening from topography and tree cover. Furthermore, while the south-eastern boundary of Core Route Corridor 4 is adjacent to Hadrian's Wall WHS buffer, the nearest scheduled monument that forms a component of the WHS is at 1.8km from this boundary. As set out in the WHS Capacity Assessment Technical Note (included in Appendix A of this CPRSS), the section of Hadrian's Wall WHS buffer adjacent to the south-east boundary of Core Route Corridor 4 is considered less sensitive to change as a result of existing infrastructure including the M6 and two overhead lines, degrading the setting of the WHS, as well as aspects such as condition/survival. A HIA may be required if the overhead line were sited in proximity to the south-eastern boundary of Core Route Corridor 4.

7.5.13 In summary, there are a limited number of designated heritage assets within or in close proximity to Route Corridor 4. Many of the assets within the corridor are screened by mature woodland, topography, or buildings, which reduces the potential for impacts on their settings. Therefore, the potential for impacts on designated heritage assets due to Route Corridor 4 is expected to be limited.

Ecology

7.5.14 Core Route Corridor 4 has been defined to avoid designated ecological areas where possible, however, there remains a range of ecological sensitivities, including designated sites, priority habitats, and protected species present within or close to the corridor. Potential impacts on ecological interests resulting from the construction of an overhead line within Core Route Corridor 4 include habitat loss or degradation and disturbance or displacement of protected species.

7.5.15 The corridor intersects or lies near several statutory and non-statutory designations, including SAC, SPA, SSSI, and areas of priority habitat. Notable designations which may be affected by an overhead line in Core Route Corridor 4 include:

- The River Eden SAC, located within 1km of segment 1e at its closest point, and designated for riparian habitats and fauna. Potential impacts to the River Eden SAC include water pollution, to which its designated features are particularly sensitive, and loss or fragmentation of functionally linked habitat
- The Solway Firth SAC, SPA, Ramsar Site and SSSI, located 1.3km west of the corridor at its closest point. Qualifying features of the Solway Firth, particularly wintering birds, may be present within parts of the corridor and could be impacted by activities associated with construction or routine operation of overhead lines in England, particularly within segments 1e, 1d and 1c that are located with relatively close proximity (within 1.3, 4.2 and 5.8km respectively) to the Solway Firth. Potential impacts include waterborne pollution, disturbance impacts to birds that are a qualifying feature of the Solway Firth through noise, vibration, lighting or human presence during the construction phase leading to displacement and impacts on population; habitat loss of functionally linked land for foraging or roosting during construction and operation phases; and mortality or injury due to bird strike into overhead lines. A stage 1 HRA would likely be required at the later stages of the design to assess potential impacts on the Solway Firth SAC, SPA, Ramsar and SSSI . With the implementation of careful routeing and standard construction and design measures, Core Route Corridor 4 provides opportunities to mitigate potential impacts on identified sites. Should the HRA identify impacts on the integrity of these designated sites, further assessment would be undertaken. The HRA would assess any indirect effects, such as the loss of functionally linked land used by SPA species.
- The Bolton Fell Moss SAC, located 2.9km to the south-east of segment 2e and designated for lowland raised bog.
- The Border Mires, Kielder – Butterburn SAC, located immediately to the east of segment 4b, designated for the presence of blanket bog.
- The Langholm-Newcastleton Hills SPA, located 4km to the west of segment 4a in Scotland and designated for the presence of breeding hen harrier (*Circus cyaneus*). There is potential for impacts on this site arising from the overhead lines within segment 4c in England and the overhead lines within segment 4a in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project).
- The Scaleby Moss SSSI located in segment 1e, the Black Snib SSSI located 150m east of segment 1d, the Lower Lyne Woods located in segment 2e. Given the minimal extent of SSSIs that enter into the corridor it is considered that direct impacts to this constraint could be avoided by careful routing.

- The Kershope Bridge SSSI located in 4c and on the Scottish side of the England-Scotland border. There is potential for impacts on this site arising from the overhead lines within segment 4c in England and the overhead lines within segment 4a in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). Given the minimal extent of SSSI that enter into the corridor it is considered that direct impacts could be avoided by careful routing.
- The Langholm-Newcastleton Hills SSSI, located 4km to the west of segment 4a in Scotland. There is potential for impacts on this site arising from the overhead lines within segment 4c in England and the overhead lines within segment 4a in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). Given that the SSSI is not located within the corridor it is considered that direct impacts could be avoided by careful routing.
- Areas of deciduous woodland priority habitat, scattered throughout the corridor segments. Other priority habitat present includes an area of traditional orchard in segment 1e and 4d, small areas of lowland raised bog in segment 1e, blanket bog in segments 4c and 4d, and grass moorland in segment 4c. These could be directly or indirectly impacted by activities associated with construction, including removal of vegetation or dust deposition.
- Parcels of ancient woodland and semi-natural woodland irreplaceable habitat, located within close proximity (within 50m-100m) from the corridor boundary. As these parcels are excluded from the route corridor, direct impacts on ancient woodland are not anticipated.

7.5.16 Although careful design of an overhead line route within the corridor could mitigate impacts on many protected and notable habitats and species, the proximity of Core Route Corridor 4 to internationally designated sites such as the Solway Firth would require thorough assessment in parallel with design development.

7.5.17 Routeing through segment 4a would be preferential to routing through segment 4b, due to the close proximity of segment 4b Border Mires, Kielder – Butterburn SAC.

Other Environmental Considerations

7.5.18 Other environmental aspects were considered as part of the options appraisal including water, geology and soils.

7.5.19 There are a number of surface and groundwater constraints or features within or close to Core Route Corridor 4. This includes surface water bodies such as rivers, burns or ponds, sections of Flood Zone 3 floodplain and ecological interests which are dependent on or linked to surface and groundwater. The corridor also intersects the River Lyne, a designated Principal Salmon River, and includes areas identified as GWDTEs, such as Scaleby Moss and Lyne Woods. Overall, there are no constraints which are considered to have potential to experience impacts to the extent that they would be determining factors in the appraisal of the routeing of an overhead line within Core Route Corridor 4, however, there are areas which would be avoided if possible or crossed by direct a route as possible and would require the implementation of standard mitigation measures.

7.5.20 Geology and soil receptors would pose a constraint to this option, necessitating careful consideration for avoiding or managing peat and peaty soils and for avoiding a Local Wildlife and Geological Site. Peat and peaty soils are distributed both locally and widely

throughout much of the corridor, particularly in the northern areas. While these soils can be avoided in some locations, they cannot be avoided in segment 4b.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

7.5.21 Segments 4c, 2e, 1d and 1e within Core Route Corridor 4 contain various sections of MSA, primarily relating to sand and gravel. Almost the entirety of segment 4d is populated with MSAs relating to both sand and gravel and shallow coal. Development within these areas has the potential to impact mineral resources, but this would not necessarily be determining factor of the appraisal of the development of an overhead line.

7.5.22 Core Route Corridor 4 entirely avoids areas ALC Grades 1 and 2 which are the most fertile and valuable for agriculture.

7.5.23 There are no Nationally Significant Infrastructure Project applications within Core Route Corridor 4, however, segment 4a is routed around the Liddesdale Wind Farm (ECU0004833) a S.36 consent in Scotland, which is at the scoping stage (as of July 2025). The latest consultation document for the application shows a reduced footprint for the proposed turbines. Careful siting of the proposed overhead line should mean it is possible to avoid the turbines completely. The northern section of segment 4b is routed across Larriston Fells. This area is subject to an approved planning application for peatland restoration works (23/00536/PN), the installation of overhead line in this location would have the potential to impact on peatland.

7.5.24 There are a number of approved major planning applications associated with Harker Substation, which is within segment 1e, including the substation expansion (20/0082, 22/0981) and three BESS applications (23/0833, 23/0444 and 24/0093) that are adjacent to Harker Substation. Segments 1d and 1e also include a number of approved major non-energy related applications, including warehousing and logistics (refs: 22/0909, 19/0859, 22/0836 and 23/0580). None of these would be a determining factor of the appraisal of the development of a new overhead line, however, there is the potential for some cumulative impacts.

7.5.25 Policy HO11 (Gypsy, Traveller and Travelling Showpeople Provision) of the Carlisle District Local Plan (2015-2030), designated land at Low Harker Dene for the accommodation needs of Gypsies, Travellers and Travelling Showpeople. This designated land has been excluded from segment 1e so as to avoid direct impacts. All Route Corridors are similarly constrained by this allocation.

7.5.26 There is also a Northumberland Local Plan designation (Northumberland Local Plan 2016-2036) (2022), Policy ENV2, included within segment 4b as a small area of land is a designated as a Local Wildlife and Geological Site, but this would not necessarily be a determining factor of the appraisal of the development of an overhead line.

Aviation and Defence

7.5.27 Segments 1c, 2e, 4d, 4c, 4a and 4b are entirely within the MoD TTA 20T which is used for low flying training between 100 and 250 feet (30 and 76m), overhead line pylons carrying 400 kV circuits are expected to be between 40m and 60m tall. As a result, pylons could pose a hazard and/or restrict flying activities. National Grid would engage

with the MoD should this option be taken forward to ensure that impacts are appropriately mitigated.

7.5.28 Core Route Corridor 4 is located 900m from the MoD Longtown hazard area as identified by Cumberland Council. As the corridor is located outside this hazard area, impacts on MoD Longtown are considered unlikely.

7.5.29 Overhead line development should generally be avoided within 4km from military airfields and possible issues may arise where overhead line development is within 10km from military airfields. The proximity of Core Route Corridor 4 to Carlisle Airport, at approximately 5.3km from segment 1e (at its closest point), may introduce aviation safeguarding considerations. Where avoidance of aviation constraints cannot be achieved, stringent design and construction measures would be required to mitigate potential impacts. These may include height restrictions on pylons, installation of aviation warning lights, and engagement with relevant authorities such as the MoD and the CAA to ensure compliance with aviation safety regulations. These measures would be confirmed through further assessment at the next stage of development.

Traffic and Transport

7.5.30 Core Route Corridor 4 is intersected by the M6 in segment 1e. The corridor is also crossed by four A and B roads that are managed by the local highway authorities: the A7 and A689 (segment 1e), the A6071 (segment 1d), and the B6318 (crossing segment 4c from east to west). Access to the section of the corridor west of the M6 would need to be via minor roads (Parkhouse Road). The nearest A roads are the A6071 and A7 (1-2km from segment 1c) in Longtown and the A7 in Canonbie which is 9km from segment 2f). The route via the B6318 and B6357/B7201 to the A7 has a number of constraints including road width and two bridges. As far as possible, construction traffic would be routed along the A and B roads, and it is also likely that some minor roads would be required to access the construction works along the corridor in some locations. Overall, it is expected that access routes could be improved by mitigation such as footpath diversion, removal of vegetation, junction improvements and widening.

7.5.31 There are two NCN routes that cross the Core Route Corridor 4, Route 7 (segment 1e) and Route 10 (segment 1e, 4a, and 4c) as well as a number of PRoW. The development of an overhead line close to or crossing recreational routes has the potential to impact on users, in particular during construction.. However, these are considered to be mitigable and would not be determining factor of the appraisal of the development of a new overhead line within Core Route Corridor 4. Bus routes operate on various roads in Core Route Corridor 4, bus users could be delayed if road closures and diversions are required.

Engineering and Systems Appraisal Summary

7.5.32 A number of constraints within Core Route Corridor 4 have been identified, which are likely to reduce routeing flexibility and/or increase the technical complexity of potential overhead line routes. These constraints are outlined in **paragraphs 7.5.33** to **7.5.39** below.

7.5.33 There are a number of existing high voltage overhead lines within the Core Route Corridor which may require the new overhead line to cross them or be routed in their vicinity. These include:

- The existing 400 kV Harker–Hutton overhead line, which is owned by National Grid and routed through segment 1e, is not expected to require crossing, as the proposed overhead line can likely be routed to avoid it.
- The existing 275 kV overhead line, which is owned by National Grid and routed through segment 1e, is not anticipated to require crossing, as the proposed overhead line can be routed to avoid it.

7.5.34 There are a number of overhead lines within Core Route Corridor 4 that could require crossing. These include two 132 kV lines in segment 1e and another 132 kV in segment 4e. A crossing of the 132 kV line will be required, as it runs through segment 4e and lies directly within the anticipated alignment. In contrast, while the 132 kV line in segment 1e runs in close proximity, it may be possible to avoid crossing it through appropriate route alignment. Where required, crossings of 132 kV lines are expected to be achievable using standard clearance and overhead line design practices.

7.5.35 The NWEP pipeline runs through segments 1d and 1e. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Within the corridor, and accounting for other constraints, sufficient space is available to achieve this.

7.5.36 Hallburn Wind Farm is located to the east of segment 1d. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate separation. Within the corridor, and considering other constraints, sufficient space is available to achieve this.

7.5.37 A communication tower is located at the northern end of segment 4b. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Within the corridor, and taking into account other constraints, sufficient space is available to achieve this.

7.5.38 Underlying ground conditions vary across the corridor comprising Glacial Till/Diamicton deposits (clay, sand and gravel), with localised areas of Glaciofluvial Deposits (predominantly sands and gravels and Alluvium i.e. clay, silt and sand). Peat and peaty soils are mapped locally throughout the corridor, becoming more frequent in segments 4a and particularly 4b and 4c. However, the distribution of mapped peat deposits in 4a suggest that they can likely be avoided in the development of an overhead line route within the corridor.

7.5.39 The superficial geology notably comprises of glacial material which have the potential to be variable in terms of composition, thickness and strength and may include localised soft spots and less favourable ground including peat, alluvium and alluvial materials that may require treatment or removal and replacement. While this would be a design consideration if the Siting Zone were to be selected, it is not a determining factor of the appraisal of the development of an overhead line within the Siting Zone. Areas of identified mines and quarries are within segments 1e, 2e, 4b and 4c but these are likely avoidable.

Holford Rules

7.5.40 Core Route Corridor 4 has been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.

7.5.41 Core Route Corridor 4 has generally avoided smaller areas of high amenity value which have specifically excluded from the corridor. The smaller areas of high amenity value which exist within the boundaries of the corridor comprise:

- Individual listed buildings within segments 1e, 4d, 4c, 4b, 4a.
- Priority habitats within segments 1e, 1d, 1c, 2e, 4d, 4c, 4b, 4a.

7.5.42 Where there are smaller areas of high amenity value, sufficient space has been included within the corridor to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.

7.5.43 Core Route Corridor 4 was defined to provide a central route from the new Carlisle substation infrastructure to the England-Scotland border which follows a largely direct route (in line with **Holford Rule 3**).

7.5.44 Core Route Corridor 4 was to avoid highly constrained areas, and specific constraints including settlements such as Longtown and Newcastleton (Holford Rule Supplementary Note 1). The width of the corridor reflects the constraints in a given area, with narrow sections where constraints are present such as in proximity to areas of ancient woodland (Foulton Wood, Cistern Wood, Carwinley and Wisk Woods), the Liddesdale Wind Farm (ECU0004833) a s.36 consent in Scotland and the Border Mires, Kielder – Butterburn SAC.

7.5.45 Core Route Corridor 4 includes more land than is needed for construction of an overhead line which provides flexibility and options when considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or frequent changes in direction of the overhead line in accordance with **Holford Rule 3**.

7.5.46 The features of Route Corridor 4 provide opportunities to identify a line route aligned with Holford Rules 4 and 5. In the northern segments (4a, 4b and 4c), the large-scale upland landscape with extensive coniferous forestry offers scope to use existing forest blocks for screening and backclothing, reducing sky-lining impacts (Landscape and Visual appraisal). The central sections (2e and 1c) transition into rolling agricultural land with patchy woodland and wooded watercourses, enabling careful routeing along lower contours and use of vegetation to limit visual exposure, consistent with **Holford Rule 5**. In the southern segments (1d and 1e), the presence of existing energy infrastructure and transport corridors reduces landscape susceptibility to change and supports the integration of a new overhead line with limited additional impact (Landscape and Visual appraisal). While careful routeing is essential to avoid more open ridgelines and maintain separation from sensitive views, the corridor offers flexibility to minimise visual prominence and integrate the line into the existing landscape character in accordance with Holford guidance.

7.5.47 Core Route Corridor 4 would require the crossing of existing overhead lines. While this could result in landscape and visual impacts, further assessment would be required during the next design phase. In accordance with **Holford Rule 6**, mitigation (re-routeing, removal or undergrounding) would be considered to minimise visual and landscape effects.

7.5.48 While the Holford Rules have been used to guide the definition of the Core Route Corridor, it is important to note that not all aspects of the rules can be fully applied at this stage of the project. Specifically, **Holford Rules 4, 5, 6** and **7** which relate to proximity to residential areas, visual intrusion, special areas, and skyline impacts,

require detailed alignment and tower positioning to be meaningfully assessed. These considerations depend on further design development, including visual impact assessments, ecological surveys, and topographic modelling, which will be undertaken during the next phase of route refinement. The current application of the Holford Rules is therefore strategic and high-level, with more detailed compliance to be demonstrated as the design progresses.

Summary of Appraisal of Core Route Corridor 4

Environmental

7.5.49 The key environmental considerations influencing the appraisal of Core Route Corridor 4 are predominantly landscape and visual amenity as well as ecology and soils and geology considerations. The baseline landscape has characteristics in the southern section and again in the northern section, amounting to a majority section of the potential route, which favour integration of overhead lines. There is potential for qualifying features of the Solway Firth (such of wintering birds) to be present within the corridor due to the proximity of the corridor to this designation (approximately 1.3km at its closest point); these qualifying features could be impacted by activities associated with construction and routine operation of the Proposed Development. The Border Mires, Kielder – Butterburn SAC is immediately to the east of the route; potential impacts on these designations may include disturbance to fauna or habitat loss. Further assessment would be required at the later stages of the Proposed Development to further understand impacts and guide the design of the overhead line. Peat and peaty soils are distributed throughout the corridor (particularly within the northern sections) and would also require careful consideration as part of design development.

Socio-economic

7.5.50 The socio-economic appraisal did not identify any constraints or impacts which would be a determining factor in the appraisal of the development of an overhead line within Core Route Corridor 4. While some impacts would be unavoidable, subject to routing the temporary diversion of PRoWs, these are considered to be mitigatable. The proximity of the corridor to Carlisle Airport (approximately 5.3km at its closest point), may introduce aviation safeguarding considerations; National Grid would engage with the MoD and the CAA should this option be taken forward to ensure that impacts are appropriately identified and mitigated.

Engineering and Systems

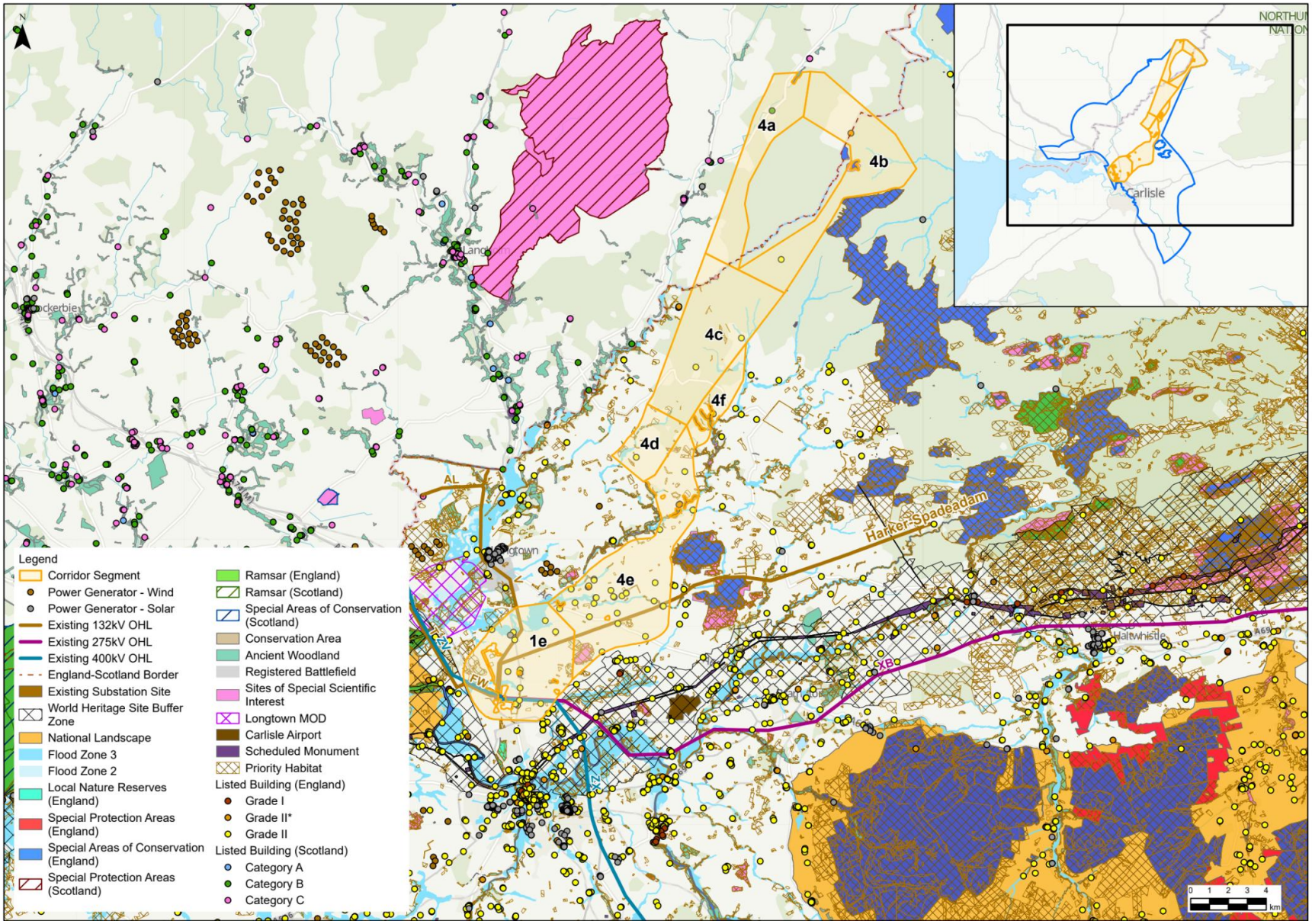
7.5.51 The main engineering factors influencing the appraisal of Core Route Corridor 4 relate to existing utilities. These include high-voltage overhead lines (132 kV, 275 kV, and 400 kV), which the proposed overhead line would need to cross or be routed in proximity to. The NWEP pipeline runs through segments 1d and 1e. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints. While ground conditions within the corridor would influence the design of the overhead line, they are not considered to be determining factors in the appraisal of its development.

7.6 Core Route Corridor 5

7.6.1 Core Route Corridor 5 is formed by segments 1e, 4e, 4d, 4f and 4c, with the option for either segment 4a or 4b to be used at the north-eastern extent of the corridor (see **Figure 7-5**). It is routed in a north-east direction from the existing Harker substation for approximately 7km, crossed by the existing National Grid 400 kV Harker-Hutton overhead line, an existing National Grid 275 kV overhead line, an existing 132 kV overhead line, and the A6071. The corridor then continues in a north-east direction to north direction for approximately 14km through mixed farmland interspersed with small sections of woodland. It is then routed within an area that is largely occupied by Kershope Forest for approximately 8.3km until it reaches the England-Scotland border at the northern extent of segment 4c. The corridor then continues into Scotland via either segment 4a (for approximately 10.5km) or segment 4b (for approximately 14.3km), providing alternative routing options around the proposed Liddesdale Wind Farm (ECU reference: ECU00004833) with segment 4a and segment 4b. Subject to detailed route design, Core Route Corridor 5 enables the development of an overhead line route of up to 34.8km long (using segment 4a) and 46.2km long (using segment 4b) respectively within England.

The alignment of Core Route Corridor 5 excludes constraints such as the settlement of Longtown and various areas of ancient woodland including Hopesike Woods, Sawmill Wood, Cistern Wood, Blackroots Wood. Furthermore, the corridor has been designed to avoid the Scaleby Moss SSSI, Lyne Woods SSSI, Bolton Fell and Walton Mosses SAC and SSSI, Kershope Bridge SSSI, Kielder Mires SAC and SSSI, Hadrian's Wall WHS and associated buffer zone, the Battle of Solway Moss Registered Battlefield and the MoD Longtown hazard zone.

Figure 7-5 – Core Route Corridor 5 with key environmental, socio-economic and technical constraints



Environmental Appraisal Summary

Landscape and Visual

7.6.2 Core Route Corridor 5 avoids crossing statutory landscape designations. At its closest point it lies approximately 1.1km east of the Solway Coast National Landscape and approximately 6.2km east of the Langholm Hills Regional Scenic Area. The Northumberland National Park and North Pennines National Landscape are approximately 17.7km and 12.9km to the east respectively at the closest point. Hadrian's Wall Path National Trail is located outside the corridor, approximately 2.6km to the south (segment 1e) at its closest point.

7.6.3 In Scotland Core Route Corridor 5 segment 4b predominantly occupies LCT 96 Southern Uplands with Forest with sections of segment 4a also in LCT 113 Upland Valley with Pastoral Floor.

7.6.4 At the national landscape scale in England, Core Route Corridor 5 lies within NCA 5 Border Moors and Forests in the north and NCA 6 Solway Basin in the south. At a local scale in England segment 4c-4f of the corridor lies predominantly within LCT 96 Southern Uplands with Forest- Borders with a small area in LCT 19a Kielder and Redesdale Forests with LCT sub type 5b Low Farmland occupying most of the southern extent. A smaller section of the Core Route Corridor also occupies LCT sub-type 9c Forests in segment 4c, LCT sub type 06 Intermediate Farmland in segment 4f and LCT 2c Coastal Plain and LCT 13 Urban Fringe within segment 1e.

7.6.5 LCT 96 Southern Uplands with Forest has key characteristics which reduce sensitivity to overhead line such as large-scale rolling landform, dominant coniferous forest cover and a simple, uniform character. LCT 113 Upland Valley with Pastoral Floor has slightly increased sensitivity as a result of strong enclosure by uplands with intermittent long views along valley corridors which would accentuate overhead line. LCT sub-type 5b has large scale fields, undulating topography and dispersed vegetation, as well as existing overhead line as key characteristics, which reduce sensitivity. The southern extent of Core Route Corridor 5 (segments 1e and 4e) is characterised by a more open, lowland agricultural landscape, comprising medium to large-scale arable and pastoral fields. In segment 1e, the presence of existing energy infrastructure, including the Harker Substation and associated overhead lines, as well as major transport corridors such as the M6, A7, and A6071, reduces the landscape's susceptibility to further overhead line development. However, careful routeing would be required to avoid a concentration of wirescape, particularly in open areas and within views towards the Solway Firth. While the existing infrastructure provides some visual context, impacts on visual amenity are still anticipated, particularly for residential receptors and users of the local road network.

7.6.6 Due to distance and baseline forestry there is only limited potential for impacts on the setting of the Langholm Hills Regional Scenic Area within Scotland arising from the overhead lines which would be required in segment 4a,4b and 4c in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). Overhead lines in England within segments 4b and 4c would be distant and unlikely to impact the Langholm Hills Regional Scenic Area.

7.6.7 Segment 4d and 4f represents a transitional landscape between upland and lowland character. It comprises a mix of improved pasture and arable farmland, interspersed with wooded river valleys. The smaller scale and reduced forestry cover increase the

landscape's susceptibility to overhead line development. However, routeing that avoids the more wooded lower slopes and watercourses, and follows the simpler patterns of improved pasture, would help to limit impacts on key landscape characteristics. The northern part of the corridor (segments 4a, 4b and 4c) is dominated by a large-scale upland landscape, characterised by extensive coniferous plantations and a simple landscape pattern. This results in a lower susceptibility to overhead lines. Avoiding open hilltops and ridgelines, and following lower contours to reduce skylining, would significantly reduce impacts on landscape character. The limited settlement in this area also reduces the concentration of visual receptors, although localised impacts may still occur, particularly in the valley of the Liddel Water. A small area at the northern tip of segment 4a lies within the Liddesdale valley, spanning the narrow valley of the Liddel Water. The introduction of pylons in this area would result in a change to landscape character. Positioning pylons on upper valley slopes could help reduce localised impacts, but the valley's enclosed nature increases visual sensitivity. Segment 4b comprises a simple, expansive upland landscape with dominant coniferous plantations, open grassland, and heather moorland. The large-scale and simple pattern of the landscape provides capacity to accommodate an overhead line with limited effect on key characteristics. However, the steep terrain of Larriston Fells in the northern part of the segment would accentuate localised impacts. While residential properties are largely avoided, isolated farmsteads and properties along the B6357 at Larriston, Riccarton, and Burnmouth would have views of the corridor, increasing visual impact. The presence of Core Paths and the NCN introduces some visual sensitivity, although impacts are expected to be limited and localised.

7.6.8 Across the corridor, the introduction of an overhead line has the potential to result in impacts on visual amenity. In the north, the lack of settlement and the opportunity to use forestry for screening helps reduce overall visual impacts. In the central and southern parts, the scattered nature of receptors and the presence of existing infrastructure influence susceptibility. Overall, impacts would be greatest where views are open or concentrated along transport corridors and recreational routes which do not currently contain overhead lines or where additional lines in confined landforms would add to cumulative impacts. While some of these areas already contain infrastructure that interrupts or impacts views, including the M6, A7, and A6071 roads, and the Harker Substation, additional overhead lines may still result in cumulative or intensified visual impacts, particularly for residential and recreational receptors. However, there is scope for mitigation by siting that utilises forestry and landform to aid integration throughout the corridor.

Historic Environment

7.6.9 Core Route Corridor 5 has been defined to avoid designated heritage assets where possible, however, the location and distribution of the assets means that some are unavoidable and are either within or are in closer proximity to the corridor. Notable designated heritage assets that could be affected by an overhead line in Core Route Corridor 5 include:

- The Grade II listed Alstonby Hall (NHLE 1335568), located in the north-east section of Segment 1e, and which may have been designed to have views across the valley of the River Lyne.
- The Solway Moss Registered Battlefield, located approximately 70m to the west of Segment 1d. Although Core Route Corridor 1 does not encroach on this asset, the

Proposed Development might result in an impact on the wider setting of the battlefield.

- The Currick Long Cairn (NHLE 1015734) located 60m east of segment 4b and the Long Knowe Long Cairn (HES ID SM2154), located in Scotland 1.1km to the north-west of segment 4b and 3.6km north-northwest of The Currick Long Cairn. There is potential for any intervisibility that was important to the design and setting of both assets to be partially interrupted, although the potential for this is considered to be low as a result of existing vegetation screening as well as the nature of an overhead line, which would only partially interrupt views. If segment 4a was selected for this corridor option, there would be potential for impacts on the setting of these assets in to arise from the overhead lines which would be required in segment 4a in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). If segment 4b as selected, there would be potential for impacts on the setting of these assets in Scotland from the overhead line provided in segment 4b in England.

7.6.10 Based on the assessment to date, there is limited potential for an overhead line in Core Route Corridor 5 to impact the setting of Hadrian's Wall WHS and its OUV. This is largely a result of the distance between the asset and Core Route Corridor 5, as well as screening from topography and tree cover. Furthermore, while the south-eastern boundary of Core Route Corridor 5 is adjacent to Hadrian's Wall WHS buffer, the nearest scheduled monument that forms a component of the WHS is at 1.8km from this boundary. As set out in the WHS Capacity Assessment Technical Note (included in **Appendix A** of this CPRSS), the section of Hadrian's Wall WHS buffer adjacent to the south-east boundary of Core Route Corridor 5 is considered less sensitive to change as a result of existing infrastructure including the M6 and two overhead lines, degrading the setting of the WHS, as well as aspects such as the condition/survival of the components of the WHS. A HIA may be required if the overhead line were sited in proximity to the south-eastern boundary of Core Route Corridor 5.

7.6.11 In summary, there are a limited number of designated heritage assets within or in close proximity to Route Corridor 5. Many of the assets within the corridor are screened by mature woodland, topography, or buildings, which reduces the potential for impacts on their settings. Therefore, the potential for impacts on designated heritage assets due to Route Corridor 5 is expected to be limited. Further assessment would be required at the later stages of the Proposed Development to guide the siting of the overhead line.

Ecology

7.6.12 Core Route Corridor 5 has been defined to avoid designated ecological areas where possible, however, there remains a range of ecological sensitivities, including designated sites, priority habitats, and protected species present within or close to the corridor. Potential impacts on ecological interests resulting from the construction of an overhead line within Core Route Corridor 5 include habitat loss or degradation and disturbance or displacement of protected species.

7.6.13 The corridor intersects or lies near several statutory and non-statutory designations, including SAC, SPA, SSSI, and areas of priority habitat. Notable designations which may be affected by an overhead line in Core Route Corridor 5 include:

- The River Eden SAC, located within 1km of segment 1e at its closest point, and designated for riparian habitats and fauna. Potential impacts to the River Eden SAC

include water pollution, to which its designated features are particularly sensitive, and loss or fragmentation of functionally linked habitat

- The Solway Firth SAC, SPA, Ramsar Site and SSSI, located 1.3km west of the corridor at its closest point. Qualifying features of the Solway Firth, particularly wintering birds, may be present within the corridor and could be impacted by activities associated with construction or routine operation of overhead lines in England, particularly within segments 1e and 4e that are located within relatively close proximity (within 1.3km and 7km respectively) to the Solway Firth at its closest point. Potential impacts include waterborne pollution, disturbance impacts to birds that are a qualifying feature of the Solway Firth through noise, vibration, lighting or human presence during the construction phase leading to displacement and impacts on population; habitat loss of functionally linked land for foraging or roosting during construction and operation phases; and mortality or injury due to bird strike into overhead lines. A stage 1 Habitat Regulations Assessment (HRA) would likely be required at the later stages of design to assess potential impacts on the Solway Firth SAC, SPA, Ramsar and SSSI. With the implementation of careful routeing and standard construction and design measures, Core Route Corridor 3 provides opportunities to mitigate potential impacts on identified sites. Should the HRA identify impacts on the integrity of these designated sites, further assessment would be undertaken. The HRA would assess any indirect effects, such as the loss of functionally linked land used by SPA species.
- Bolton Fell Moss SAC, located less than 100m to east of segment 4e and designated for lowland raised bog.
- The Border Mires, Kielder – Butterburn SAC, located immediately to the east of segment 4b, and designated for the presence of blanket bog.
- Walton Moss SAC located 1.2km to the east of segment 4e and designated for lowland raised bog.
- The Langholm-Newcastleton Hills SPA, located in Scotland 4km to the west of segment 4a and designated for the presence of breeding hen harrier (Circus cyaneus). There is potential for impacts on this site arising from the overhead lines within segment 4c in England and the overhead lines within segment 4a in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project).
- The Scaleby Moss SSSI located in segment 1e, the Black Snib SSSI located 150m east of segment 1d, the Lower Lyne Woods located in very close proximity to the west boundary of segment 4e. Given the minimal extent of SSSIs that enter into the corridor it is considered that direct impacts to this constraint could be avoided by careful routing.
- The Kershope Bridge SSSI located in segment 4c and on the Scottish side of the of the England-Scotland border. There is potential for impacts on this site arising from the overhead lines within segment 4c in England and the overhead lines within segment 4a in Scotland (which would not be part of the Proposed Development but would be part of the Scottish section of the Project). Given the minimal extent of the SSSI that enter into the corridor it is considered that direct impacts to this constraint could be avoided by careful routing.
- The Langholm-Newcastleton Hills SSSI, located 4km to the west of segment 4a in Scotland. There is potential for impacts on this site arising from the overhead lines within segment 4c in England and the overhead lines within segment 4a in Scotland

(which would not be part of the Proposed Development but would be part of the Scottish section of the Project). Given that the SSSI is not located within the corridor it is considered that direct impacts to this constraint could be avoided by careful routing.

- Areas of deciduous woodland priority habitat, scattered throughout the corridor segments. Other priority habitat present includes an area of traditional orchard in segment 1e and 4d, small areas of lowland raised bog in segment 1e, blanket bog in segments 4c and 4d, and grass moorland in segment 4c. These could be directly or indirectly impacted by activities associated with construction, including removal of vegetation or dust deposition.
- Parcels of ancient woodland and semi-natural woodland irreplaceable habitat, located within close proximity (within 50m-100m) from the corridor boundary. As these parcels are excluded from the route corridor, direct impacts on ancient woodland are not anticipated.

7.6.14 Although careful design of an overhead line route within the corridor could mitigate impacts to many protected and notable habitats and species, the proximity of Core Route Corridor 5 to internationally designated sites such as the Solway Firth would require assessment in parallel with design development.

7.6.15 Routing through segment 4b would be preferential to routing through segment 4a, due to the close proximity of segment 4b Border Mires, Kielder – Butterburn SAC.

Other Environmental Considerations

7.6.16 Other environmental aspects were considered as part of the options appraisal including water, geology and soils.

7.6.17 There are a number of surface and groundwater constraints or features within or close to Core Route Corridor 5. This includes surface water bodies such as rivers, burns or ponds, sections of Flood Zone 3 floodplain (notably associated with the River Lyne in segments 1e and 4e) and ecological interests which are dependent on or linked to surface and groundwater, including GWDTEs such as Scaleby Moss. The River Lyne, a designated Principal Salmon River, intersects segments 1e and 4e and is sensitive to changes in water quality and flow regime.

7.6.18 Geology and soil receptors would pose a constraint to this option, necessitating careful consideration for avoiding or managing peat and peaty soils and for avoiding a Local Wildlife and Geological Site. Peat and peaty soils are distributed both locally and widely throughout much of the corridor, particularly in the northern areas.

7.6.19 While both segments 4a and 4b are likely to encounter peat and peaty soils, segment 4a has slightly less mapped peat. On this basis routing through segment 4a would be preferential to routing through segment 4b.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

7.6.20 There are various areas designated as MSAs within Core Route Corridor 5, segments 4c, 4e and 1e contain sections of MSAs primarily relating to sand and gravel. Almost the entirety of segment 4d is populated with MSAs relating to both sand and gravel and

shallow coal. While it is preferable to avoid these areas as far as possible, they would not necessarily be determining factors in the appraisal of the development of an overhead line in Core Route Corridor 5.

7.6.21 Core Route Corridor 5 entirely avoids areas ALC Grades 1 and 2 which are the most fertile and valuable for agriculture.

7.6.22 There are no Nationally Significant Infrastructure Project applications or s36/37 applications within Core Route Corridor 5. However there are several approved major planning applications associated with Harker Substation which is located within segment 1e, including the substation expansion (20/0082, 22/0981) and three BESS applications (23/0833, 23/0444 and 24/0093) that are adjacent to Harker Substation. None of these would be determining factors of the appraisal of the development of a new overhead line, however, there is the potential for cumulative impacts.

7.6.23 Segment 4a is routed around the Liddesdale Wind Farm (ECU0004833) a s.36 consentin Scotland, which is at the scoping stage (as of July 2025). However, the latest consultation document shows a reduced footprint for the proposed turbines. Careful siting of the proposed overhead line would mean it is possible to avoid the turbines completely. The northern section of segment 4b is routed across Larriston Fells. This area is subject to an approved planning application for peatland restoration works (23/00536/PN), the installation of overhead line in this location would have the potential to impact on peatland.

7.6.24 Policy HO11 (Gypsy, Traveller and Travelling Showpeople Provision) of the Carlisle District Local Plan (2015-2030), designated land at Low Harker Dene for the accommodation needs of Gypsies, Travellers and Travelling Showpeople. This designation has been excluded from segment 1e to avoid any potential impacts. All Route Corridors are similarly constrained by this allocation.

Aviation and Defence

7.6.25 Segment 4e is partially included and segments 4d, 4c, 4f 4a and 4b are entirely included within the MoD TTA 20T which is used for low flying training between 100 and 250 feet (30 and 76m). overhead line pylons carrying 400 kV circuits are expected to be between 40m and 60m tall. As a result, pylons could pose a hazard and/or restrict flying activities. National Grid would engage with the MoD should this option be taken forward to ensure that impacts are appropriately mitigated.

7.6.26 Core Route Corridor 5 is located 900m from the MoD Longtown hazard area as identified by Cumberland Council. As the corridor is located outside this hazard area, impacts on MoD Longtown are considered unlikely.

7.6.27 Overhead line development should generally be avoided within 4km from military airfields and possible issues may arise where overhead line development is within 10km from military airfields. The proximity of Core Route Corridor 5 to Carlisle Airport, at approximately 3.3km from segment 4e (at its closest point), may introduce aviation safeguarding considerations. It is considered that impacts could be avoided or reduced to an acceptable level by careful routing and following the implementation of aviation-related design considerations, such as height restrictions on pylons and/or the installation of aviation warning lights to ensure safe operation and compliance with aviation regulations. Due to the width of segment 4e (up 5km) there is sufficient space within the segment to achieve a suitable separation between the overhead line and the airport. National Grid would engage with the MoD and the CAA should this option be taken forward to ensure that impacts are appropriately mitigated.

Traffic and Transport

7.6.28 Core Route Corridor 5 is intersected by the M6 in Segment 1e. The corridor is also crossed by five A and B roads that are managed by the local highway authorities, the A7 and A689 (segment 1e), A6071 (segment 4e), B6318 (segment 4c and 4f and adjacent to segment 4d), and B6357 (segment 4a and 4b). As far as possible, construction traffic would be routed along the A and B roads. It is also likely that some minor roads would be required to access the construction works along the corridor in some locations. Overall, it is expected that the impacts could be reduced by mitigation to enable site access, including footpath diversion, removal of vegetation, junction improvements and widening.

7.6.29 There are two NCN routes that cross Core Route Corridor 5, Route 7 (segment 1e) and Route 10 (segment 1e, 4a, 4c, 4e, and 4f) and a number of PRoWs. The development of an overhead line close to or crossing recreational routes has the potential to impact on users, in particular during construction. However, these are considered to be mitigable and would not be determining factors of the appraisal of the development of the overhead line in Core Route Corridor 5. Bus routes operate on various roads in Core Route Corridor 5, temporary construction delay impacts for bus users could occur if road closures and diversions are required.

Engineering and Systems Appraisal Summary

7.6.30 A number of constraints within Core Route Corridor 5 have been identified, which are likely to reduce routeing flexibility and/or increase the technical complexity of potential overhead line routes. These constraints are outlined in **paragraphs 7.6.31** to **7.6.36** below.

7.6.31 There are a number of existing high voltage overhead lines within the Core Route Corridor which may require the new overhead line to cross them or be routed in their vicinity. These include:

- The existing 400 kV Harker–Hutton overhead line, which is owned by National Grid and routed through segment 1e, is not expected to require crossing, as the proposed overhead line can likely be routed to avoid it.
- The existing 275 kV overhead line, which is owned by National Grid and routed through segment 1e, is not anticipated to require crossing, as the proposed overhead line can be routed to avoid it.
- There are a number of overhead lines within Core Route Corridor 5 that could require crossing. These include two 132 kV lines in segment 1e and another 132 kV line in segment 4e. A crossing of the 132 kV line will be required, as it runs through segment 4e and lies directly within the anticipated alignment. In contrast, while the 132 kV line in segment 4e runs in close proximity, it may be possible to avoid crossing it through appropriate route alignment. Where required, crossings of 132 kV lines are expected to be achievable using standard clearance and overhead line design practices.

7.6.32 The NWEP pipeline runs through segment 1e. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

7.6.33 Hallburn Wind Farm is located to the east of segment 1d. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate separation. Within the corridor, and considering other constraints, sufficient space is available to achieve this.

7.6.34 Communication towers are located at the northern end of segment 4b and the north-west corner of segment 4e. The proposed overhead line would be routed to avoid these assets, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

7.6.35 Underlying ground conditions vary across the corridor comprising Glacial Till/Diamicton deposits (clay, sand and gravel), with localised areas of Glaciofluvial Deposits (predominantly sands and gravels and Alluvium i.e. clay, silt and sand). Peat and peaty soils are mapped locally throughout the corridor, becoming more frequent in segments 4a, 4d and 4f and particularly 4b and 4c. However, the distribution of mapped peat deposits in 4a, 4d and 4f suggest that they can likely be avoided in the development of an overhead line route within the corridor.

7.6.36 The superficial geology notably comprises of glacial material which have the potential to be variable in terms of composition, thickness and strength and may include localised soft spots and less favourable ground including peat, alluvium and alluvial materials that may require treatment or removal and replacement. While this would be a design consideration if the Siting Zone were to be selected, it is not a determining factor in the appraisal of the development of an overhead line within the Siting Zone. Areas of identified mines and quarries are within segments 1e, 2e, 4a, 4b and 4c but these are likely avoidable.

Holford Rules

7.6.37 Core Route Corridor 5 has been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**.

7.6.38 Core Route Corridor 5 has generally avoided smaller areas of high amenity value which have specifically excluded from the corridor. The smaller areas of high amenity value which exist within the boundaries of the corridor comprise:

- Individual listed buildings within segments 1e, 4e, 4d, 4f, 4c, 4b, 4a.
- Priority habitats within segments 1e, 4e, 4d, 4c, 4b, 4a.

7.6.39 Where there are smaller areas of high amenity value, sufficient space has been included within the corridor to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.

7.6.40 Core Route Corridor 5 was defined to provide a central route from the new Carlisle substation infrastructure to the England-Scotland border which follows a largely direct route (in line with **Holford Rule 3**). However, deviation is introduced in segment 4b and further deviation to the east occurs in segment 4e and 1e to avoid key environmental and infrastructure constraints.

7.6.41 Core Route Corridor 5 was defined to avoid highly constrained areas, and specific constraints including settlements such as Longtown and Newcastleton (Holford Rule Supplementary Note 1). The width of the corridor reflects the constraints in a given area, with narrow sections where constraints are present such as in proximity to areas of ancient woodland (Foulton Wood, Cistern Wood, Carwinley and Wisk Woods, Epsy

Holme and Coldwell Wood), Bolton Fell Moss SAC, the Liddesdale Wind Farm (ECU0004833) a s.36 consent in Scotland and the Border Mires, Kielder – Butterburn SAC.

7.6.42 Core Route Corridor 5 includes more land than is needed for construction of an overhead line which provides flexibility and options when considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or changes in direction of the overhead line in accordance with **Holford Rule 3**.

7.6.43 The features of Route Corridor 5 provide opportunities to identify a line route that aligns with **Holford Rules 4** and **5**. The northern upland segments (4a, 4b, 4c) feature large-scale landscapes dominated by coniferous forestry and simple landform, allowing the potential use of forest blocks for screening and backclothing to reduce sky-lining (Landscape and Visual appraisal). The transitional and central segments (4d, 4f) contain rolling agricultural landscapes with wooded watercourses and patchy woodland, enabling careful routing along lower contours and the use of vegetation to help integrate pylons, supporting **Holford Rule 5**. In the southern segment (1e), existing infrastructure and major roads reduce the landscape's susceptibility to change. However, visual effects are still anticipated particularly for residential and recreational receptors. (Landscape and Visual appraisal). Careful routeing would be essential to address more open areas reduces visual prominence and integrates with the existing landscape in line with **Holford Guidance**.

7.6.44 Core Route Corridor 5 would require the crossing of existing overhead lines. While this could result in landscape and visual impacts, further assessment would be required during the next design phase. In accordance with Holford Rule 6, mitigation (re-routeing, removal or undergrounding) would be considered to minimise visual and landscape effects.

7.6.45 While the Holford Rules have been used to guide the definition of the Core Route Corridor, it is important to note that not all aspects of the rules can be fully applied at this stage of the project. Specifically, **Holford Rules 4, 5, 6,** and **7** which relate to proximity to residential areas, visual intrusion, special areas, and skyline impacts, require detailed alignment and tower positioning to be meaningfully assessed. These considerations depend on further design development, including visual impact assessments, ecological surveys, and topographic modelling, which will be undertaken during the next phase of route refinement. The current application of the Holford Rules is therefore strategic and high-level, with more detailed compliance to be demonstrated as the design progresses.

Summary of Appraisal of Core Route Corridor 5

Environmental

7.6.46 The key environmental considerations influencing the appraisal of Core Route Corridor 5 are predominantly landscape and visual amenity as well as ecology and soils and geology considerations. The corridor avoids statutory landscape designations but lies near some of them, including the Solway Coast National Landscape. In the north, large-scale upland landscapes with forestry reduce sensitivity, though enclosed valleys and steep terrain increase localised impacts. Central and southern sections are more open and settled, with existing infrastructure providing context but also contributing to

cumulative visual effects. Visual receptors include residential properties, recreational users, and transport corridors. Careful routeing and mitigation will be required to reduce impacts on landscape character and visual amenity. There is potential for qualifying features of the Solway Firth (such of wintering birds) to be present within the corridor due to the proximity of the corridor to this designation (approximately 1.3km at its closest point); these qualifying features could be impacted by activities associated with construction and routine operation of the Proposed Development. The Border Mires, Kielder – Butterburn SAC and the Bolton Fell and Walton Mosses SAC are immediately to the east of the route; potential impacts on these designations may include disturbance to fauna or habitat loss. Further assessment would be required at the later stages of the Proposed Development to further understand impacts and guide the design of the overhead line. Peat and peaty soils are distributed throughout the corridor (particularly within the northern sections) and would also require careful consideration as part of design development.

Socio-economic

7.6.47 The socio-economic appraisal did not identify any constraints or impacts which would be a determining factor of the appraisal of the development of an overhead line within Core Route Corridor 5. While some impacts would be unavoidable, subject to routing the temporary diversion of PRoWs, these are considered to be mitigatable. The proximity of the corridor to Carlisle Airport (approximately 3.3km at its closest point), may introduce aviation safeguarding considerations; National Grid would engage with the MoD and the CAA should this option be taken forward to ensure that impacts are appropriately identified and mitigated.

Engineering and Systems

7.6.48 The main engineering factors influencing the appraisal of Core Route Corridor 5 relate to existing utilities. These include high-voltage overhead lines (132 kV, 275 kV, and 400 kV), which the proposed overhead line would need to cross or be routed in proximity to. The NWEP pipeline runs through segment 1e, and the proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints. While ground conditions within the corridor would influence the design of an overhead line, they are not considered to be determining factors in the appraisal of its development.

7.7 Core Route Corridor 1-5 including segments 5a and 5b

7.7.1 These options would provide a route corridor to enable connection to the electricity transmission system via a proposed substation located to the south of the Hadrian's Wall WHS. The options comprise the five Core Route Corridor options 1 to 5 described in **Sections 7.2** to **7.7**, with the addition of segments 5a and 5b (see **Figure 7-6**).

7.7.2 The overall length of these corridor options is dependent on the combination of Core Route Corridor and the additional segments 5a and 5b, as follows:

- up to 40.6km (Core Route Corridor 1 + segment 5a, 5b);
- up to 47.7km (Core Route Corridor 2 using segment 2a + segment 5a, 5b);
- up to 47.7km (Core Route Corridor 2 using segment 2b + segment 5a, 5b);
- up to 41.3km (Core Route Corridor 3 + segment 5a, 5b);
- up to 50.7km (Core Route Corridor 4 using segment 4a + segment 5a, 5b);
- up to 62.1km (Core Route Corridor 4 using segment 4b + segment 5a, 5b);
- up to 57.5km (Core Route Corridor 5 using segment 4a + segment 5a, 5b); and
- up to 68.9km (Core Route Corridor 5 using segment 4b + segment 5a, 5b).

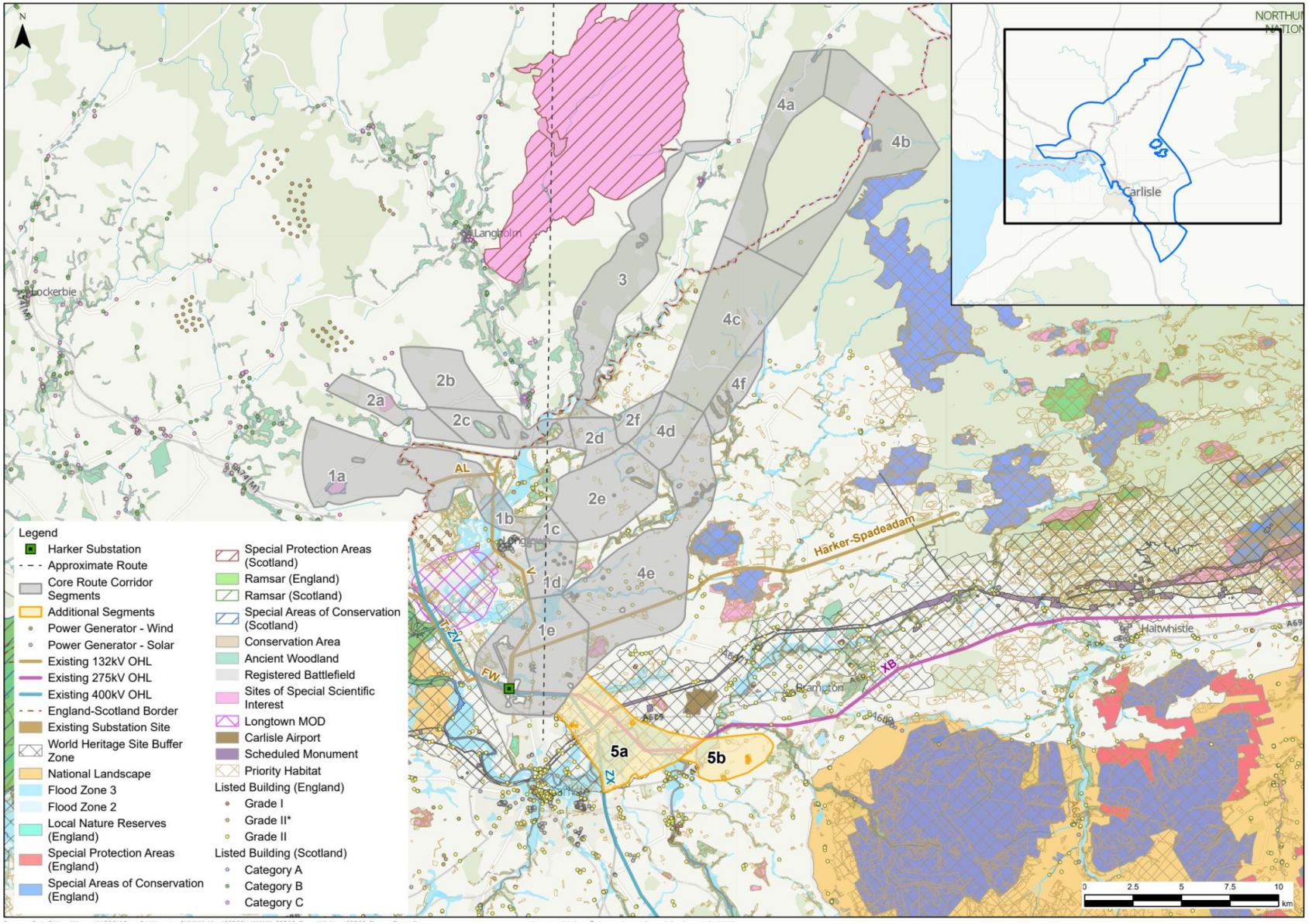
7.7.3 This section provides a description and appraisal of the additional segments 5a and 5b only. These segments would connect with the southernmost point of one of the Core Route Corridor options (which are described and appraised in **Sections 7.2** to **7.6**) and continue north of the Hadrian's Wall WHS.

7.7.4 As set out in **Chapter 5**, Core Route Corridor options 1 to 5 plus segment 5a and 5b would include an overhead line connection between the proposed substation to the south of the Hadrian's Wall WHS and the England-Scotland border, and an overhead line connection between proposed substation to the south of the Hadrian's Wall WHS and the existing Harker substation. In other words, the connection to the England-Scotland border would cross the Hadrian's Wall WHS and the further connection to the existing Harker substation would also cross Hadrian's Wall WHS, resulting in two new crossings of that receptor. The impact of these connections is accounted for in the appraisal of the additional segments 5a and 5b.

7.7.5 From south to north, a route corridor south of Hadrian's Wall in this option would run in a north-west direction from segment 5b for approximately 3.2km where it would cross the River Eden SAC. It would then route in a north-westerly direction in segment 5a where it would cross the River Eden SAC, Hadrian's Wall WHS and associated buffer, the Eden Golf Club, the A689, the existing 400 kV Harker-Hutton overhead line and the existing 275 kV overhead line. It would then connect with one of the Core Route Corridor options 1-5 and continue north. To connect the selected emerging preferred substation to the south of Hadrian's Wall WHS, there would also be an overhead line connection between the substation and the existing Harker substation, providing an onward connection to the existing network. The detailed route of this connection would depend on the final substation location. The potential constraints associated with this connection have been considered within this section as part of the appraisal of segments 5a and 5b, and are reflected in the Engineering and Environmental constraint discussions in **paragraphs 7.7.32** to **7.7.37.**

7.7.6 Within these segments 5a and 5b, constraints such as areas of ancient woodland including Hellbeck Wood, and the settlement of Warwick Bridge have been excluded.

Figure 7-6 – Core Route Corridor 1-5 plus segments 5a and 5b



Environmental Appraisal Summary

Landscape and Visual

7.7.7 In addition to NCAs already identified as part of Core Route Corridor 1 to 5, the inclusion of segment 5b would extend the corridor eastwards into NCA 9 Eden Valley, which encompasses the broad valleys of the River Eden and its tributaries, as well as a small part of the North Pennines National Landscape. At its closest, segment 5b would be approximately 2.4km from the North Pennines National Landscape, but not likely to be in its setting. Segment 5a would be approximately 5km east of the Solway Coast National Landscape and at its closest point it lies approximately 15km south-west of the Northumberland National Park, outside of either setting.

7.7.8 Most of segment 5a lies within LCT sub-type 5b, which has large scale fields, undulating topography and dispersed vegetation, as well as existing overhead line as key characteristics that reduce sensitivity. Most of segment 5b (and a very small area of 5a) lies within LCT sub-type 5c Rolling Lowland. LCT 5c is a lowland agricultural landscape dominated by pasture with some woodland, scrub and other marginal land. Field patterns are variable relating to topography and are generally regular at lower levels. In lower lying areas the landscape is generally undulating, and on higher ground land is more rolling and open. The complexity of the lower landscape increases sensitivity to overhead line while the key characteristic of openness adjacent to the National Landscape increase sensitivity of the elevated areas of LCT sub-type 5c.

7.7.9 Settlement is nucleated along the Eden Valley, increasing visual sensitivity from multiple small villages. Visual impacts would be anticipated, especially for users of the Hadrian's Wall National Trail, NCN Route 72, and local PRoWs. There is potential for distant views from the elevated northern flank of the North Pennines National Landscape. The potential impact to the Open Space Designation in segment 5b is likely to be avoided through appropriate mitigation.

7.7.10 There is potential for direct and more widespread indirect impacts on landscape character, particularly where the landscape is open around the River Eden valley and in the south-eastern parts of the segments.

Historic Environment

7.7.11 In addition to the impacts already identified for Core Route Corridor 1 to 5, the inclusion of segments 5a and 5b introduces further potential impacts on designated heritage assets as described below.

7.7.12 These corridor options cross the Hadrian's Wall WHS and its buffer zone within segment 5a. This section of the WHS buffer is considered less sensitive to change as a result of existing infrastructure including the M6 and two overhead lines, as set out in the WHS Capacity Assessment Technical Note (included in **Appendix A** of this CPRSS). While physical impacts may be avoided through careful routeing, there is potential for an overhead line to impact the setting of the WHS and its OUV. The scheduled components of the WHS within segment 5a are limited to a section of the Wall and associated vallum, which is assumed to survive as buried archaeological features, with no above ground remains or earthworks recorded. As such, its significance is largely derived from its archaeological value. It was, however, originally designed to have views to the north beyond the frontier, and there may also have been views to the south over the valley of the River Eden.

7.7.13 Although a new overhead line has the potential to result in impacts to the setting of the WHS, the overhead line would not sever views and instead partially interrupt views from the Wall, and it would still be possible to understand its positioning as a Frontier, engineering, and construction (which are Attributes of OUV). An overhead line would also not sever any views or interrelationships between the Wall and designated assets to the south of the Wall, as there are no assets (such as temporary forts and marching camps) recorded in this area. Finally, an overhead line would not alter the prominence of the Wall, which survives as below ground archaeological remains in this area, while the topography which falls to the south, and the valley of the River Eden, would also help to backcloth the pylons. Furthermore, a number of overhead lines already cross the Wall in this area, while other elements of modern infrastructure including main roads, as well as large industrial scale farmsteads, give the area a more urban/industrial character.

7.7.14 Other notable designated heritage assets that could be affected by an overhead line in Core Route Corridors 1 to 5 plus segment 5a and 5b include:

- The Grade II* listed Brunstock House (NHLE 1087726), located in segment 5a. This asset is located in an elevated position on the west side of the A689 overlooking the valley of the River Eden and may have been designed to have views over the non-designated parkland to the south, as well as the River Eden. These views have been partially interrupted by the construction of the A689 as well as existing overhead lines. The introduction of a new overhead line has the potential to result in further impacts on its setting and significance.
- The Grade II listed Eden Grove (NHLE 1087696), located in segment 5a. This asset is located in an elevated position to command views over the River Eden to the south, and as such the introduction of a new overhead line has the potential to result in impacts on the setting of the asset.
- The Grade II listed Edmond Castle (NHLE 1087551), located in segment 5b. This asset overlooks the River Irthing to the northwest, and as a result the introduction of a new overhead line has the potential to result in impacts on the setting of the asset.].
- The Grade II listed Toppin Castle (NHLE 1051105), located in segment 5b. The introduction of an overhead line could reduce the prominence of this asset in the landscape.

7.7.15 Overall, the introduction of a new overhead line in 5a and 5b may result in impacts on the setting of the Grade II* listed Brunstock House which is of high value and within the Corridor. There is also the potential for impacts on the setting of Eden Grove, Edmond Castle and Toppin Castle, all of which are Grade II listed (i.e. of medium value) and also located within the Corridor. There is also the potential for an overhead line in this Option to result in impacts on the setting and Outstanding Universal Value of the WHS, although impacts on the WHS are expected to be low and mitigation may further reduce the level of impact.

Ecology

7.7.16 In addition to the impacts already identified for Core Route Corridor 1 to 5, the inclusion of segments 5a and 5b introduces further potential impacts on designated ecological areas as described below.

7.7.17 Notable designated ecological areas that could be affected by an overhead line in segments 5a and 5b include:

- The River Eden SAC, which crosses segment 5a and 5b and is designated for the presence of riparian habitats as well as faunal species. Within segment 5a, it would not be possible to route the overhead line without crossing the River Eden. While overhead line span would be above ground and not directly impact the river channel, potential fragmentation of riparian habitat may result from the placement of pylon foundations and associated access infrastructure on either side of the river. Additional potential impacts to the River Eden SAC include disturbance of notable and protected species during construction, dust deposition, and water pollution. Potential indirect impacts may also include loss or fragmentation of functionally linked habitat. The potential impact on the SAC would be considered in detail within a HRA (conducted in absence of mitigation) at the later stages of the Proposed Development.
- The White Moss, Crosbymoor SSSI, located 1.1km north of segment 5a. This designation was originally a mire but has been degraded by recreational and grazing pressure to its current categorisation of wet heath and wet grassland with pasture woodland. Indirect impacts could arise from water pollution.
- Geltsdale & Glendue Fells SSSI, located 3km east of 5b and designated for the presence of raptors such as hen harrier as well as other upland birds and habitats. Potential impacts to this designation could include injury of avian fauna for which this site is designated by direct strike into the overhead line.
- The North Pennine Moors SAC and SPA, located approximately 3km east of 5b, which has been designated as a SAC for the presence of blanket bog, dry heaths and old sessile oakwoods, as well as other habitat features; and as an SPA for the presence hen harrier (Circus cyaneus) and golden plover (Pluvialis apricaria), as well as other upland species. Potential impacts to this designation could include impacts to functionally linked land, or on avian fauna for which the site is designated, including injury or mortality by direct strike to the overhead line.
- One area of ancient and semi-natural and two areas of ancient replanted woodland, located within 5b. As all parcels of ancient woodland have been excluded from the routing corridor, direct impacts on ancient woodland are not anticipated. However, if the overhead line runs within 50m of a parcel of ancient woodland, a precautionary working method statement would be adopted to prevent indirect negative impacts, for instance through dust deposition or pollution of surface water or watercourses.
- Numerous areas of deciduous woodland priority habitat, located within segment 5a, 5b, as well as areas of coastal and floodplain grazing marsh and an area of good quality semi-improved grassland priority habitat along the River Eden. These parcels of priority habitat could be impacted through habitat loss, fragmentation, or degradation, for instance by dust deposition or pollution of surface water.

7.7.18 The inclusion of segments 5a and 5b introduces additional ecological sensitivities due to the presence of designated sites, including SAC, SPA, and SSSI. Potential impacts such as habitat disturbance, fragmentation, and pollution are expected, and would require thorough assessment in parallel with design development.

Other Environmental Considerations

7.7.19 Other environmental aspects were considered as part of the options appraisal including water, geology and soils.

7.7.20 There are a number of surface and groundwater constraints or features within or close to segments 5a and 5b. This includes surface water bodies such as rivers, burns or ponds, sections of Flood Zone 3 floodplain and ecological interests which are dependent on or linked to surface and groundwater. Overall, there are no constraints which are considered to have potential to experience impacts to the extent that they would be determining factors in the appraisal of the routeing of an overhead line within Core Route Corridor 5, however, there are areas which would be avoided if possible or crossed by direct a route as possible and would require the implementation of standard mitigation measures.

7.7.21 No additional impacts with respect of geology and soils are anticipated with the inclusion of segments 5a and 5b.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

7.7.22 In addition to issues already identified as part of the Core Route Corridor, the inclusion of segments 5a and 5b introduces the following additional impacts.

7.7.23 Both segments 5a and 5b include areas of Best and Most Versatile (BMV) Grade 2 (which is defined as very good quality agricultural land). It would not be possible to avoid this land in either segment, although crops can still be grown under overhead line. Areas with BMV Grade 2 could incorporate mitigation measures such as optimising the space used for temporary construction sites wherever practicable and prioritising the use of Grade 3 or lower quality land for permanent development to avoid permanent impact on good quality soils.

7.7.24 There is a small area of allocated Open Space (Carlisle District Local Plan 2015-2030 (2016), Policy GI 14) within segment 5b. However, this area appears to be a village green surrounded by housing withing the village of Hayton and it is anticipated that it could be avoided when routing an overhead line.

7.7.25 Like most corridor segments, segment 5a includes areas of MSA in relation to sand and gravel. Development within these areas has the potential to impact mineral resources but this would not necessarily be a determining factor of the appraisal of the development of an overhead line.

Aviation and Defence

7.7.26 In addition to issues already identified as part of the Core Route Corridor 1 to 5, the inclusion of segments 5a and 5b introduces the following additional impacts.

7.7.27 The proximity to Carlisle Airport, at approximately 1.2km from segment 5a and 1.7km from segment 5b, may introduce aviation safeguarding considerations. The development of pylons within these segments could pose a hazard and/or restrict low flying activities. National Grid would engage with the MoD and the CAA should this option be taken forward to ensure to ensure that likely impacts and mitigation requirements are identified.

Traffic and Transport

7.7.28 In addition to the points already identified as part of the Core Route Corridor, the inclusion of segments 5a and 5b introduces the following additional impacts.

7.7.29 Segment 5a is crossed by the M6, as well as various A and B roads managed by the local highway authorities including the A689 and B6264 in segment 5a and A69 segment 5b. The A69 has width constraints of c.5.5-6m on the bridge over the River Eden to the east but no apparent height or weight restrictions. It is likely that some minor roads would be required to access the construction works along the corridor in some locations. Overall, it is expected that the impacts could be reduced by mitigation to enable access, including footpath diversion, removal of vegetation, junction improvements and widening. The impacts would largely be temporary during construction.

7.7.30 The Rivers Eden and Irthing bisect segments 5a and 5b, meandering in an east/west orientation. The only road crossing the river within the segments is a minor road, Little Corby Road, which is also NCN Route 72. The crossing is a single lane bridge with traffic signals, which may not be wide enough for HGVs. In addition, the junction to the north of the bridge crossing is spatially constrained as is the road to the south through Little Corby, which means that there are no suitable river crossings within segments 5a and 5b. Construction traffic may need to use longer distance routes outside of the segments including the A69 and A689 to cross these rivers and gain access to all parts of segments 5a and 5b.

7.7.31 There are a number of PRoW that cross the segments, notably the Hadrian's Wall path crosses segment 5a. The development of an overhead line close to or crossing recreational routes has the potential to impact on users. However, these are considered to be mitigable and would not be determining factors in the appraisal of the development of the overhead line.

Engineering and Systems Appraisal Summary

7.7.32 In addition to that already identified as part of the Core Route Corridors, the inclusion of segments 5a and 5b introduces a number of constraints which are considered likely to reduce routeing flexibility and/or increase the technical complexity of overhead line routes. These constraints are outlined in **paragraphs 7.7.33 to 7.7.37** below.

7.7.33 There are a number of existing high voltage overhead lines within segment 5a which may require the new overhead line to cross them or be routed in their vicinity. These include:

- The existing 400 kV Harker–Hutton overhead line, which is owned by National Grid and routed through segment 5a, is not expected to require crossing, as the proposed overhead line can likely be routed to avoid it.
- The existing 275 kV overhead line, also owned by National Grid and routed through segment 5a, will require crossing by the proposed overhead line, as it lies within the anticipated corridor and cannot be reasonably avoided. This crossing is expected to be achievable using standard overhead line clearance and design practices

7.7.34 The NWEP pipeline runs through segment 5a. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

7.7.35 A solar farm and a wind turbine are located within segment 5a. These assets would be avoided where practicable, with the proposed overhead line routed so that pylons and associated infrastructure are positioned away from these features. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

7.7.36 In addition to that already identified in the Core Route Corridor options, segments 5a and 5b also feature some very broad extents of Alluvium, River Terrace Deposits (sands and gravels but also some clays and silts), associated with the River Eden floodplain. Localised Glaciofluvial Deposits are also present in this area.

7.7.37 They comprise glacial material which have the potential to be variable in terms of composition, thickness and strength and may include localised soft spots and less favourable ground including alluvium and alluvial materials that may require treatment or removal and replacement. While this would be a design consideration if the Siting Zone were to be selected, it is not a determining factor in the appraisal of development of an overhead line within the Siting Zone.

Holford Rules

7.7.38 Core Route Corridors 1 to 5 plus segment 5a and 5b have been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**, with exception of the Hadrian's Wall WHS and its buffer zone. The corridors cross the Hadrian's Wall WHS and its buffer zone within segment 5a; the attributes of OUV in this section of the WHS and associated buffer are considered less sensitive to change as a result of elements including the condition of the monument and existing infrastructure including the M6 and two overhead lines, as set out in the WHS Capacity Assessment Technical Note (included in **Appendix A** of this CPRSS).

7.7.39 Core Route Corridors 1 to 5 plus segment 5a and 5b have generally avoided smaller areas of high amenity value which have specifically been excluded from the corridors. In addition to the smaller areas of high amenity value which exist within the boundaries of Core Route Corridor 1 to 5, the corridors include the following smaller areas of high amenity:

- individual listed buildings within segments 5a and 5b;
- one scheduled monument within segment 5a (Hadrian's Wall and vallum); and
- and priority habitats within segments 5a and 5b.

7.7.40 Where there are smaller areas of high amenity value, sufficient space has been included within the corridor to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.

7.7.41 Core Route Corridors 1 to 5 plus segment 5a and 5b were defined to provide a central route from the new Carlisle substation infrastructure to the England-Scotland border which follows a largely direct route (in line with **Holford Rule 3**).

7.7.42 Core Route Corridors 1 to 5 plus segment 5a and 5b were defined to avoid highly constrained areas, and specific constraints including settlements such as Longtown and of Aglionby (**Holford Rule Supplementary Note 1**). The width of the corridor reflects the constraints in a given area, with narrow sections where constraints are present such as in proximity to the settlement of Aglionby.

7.7.43 Core Route Corridors 1 to 5 plus segment 5a and 5b include more land than is needed for construction of an overhead line which provides flexibility and options when

considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or changes in direction of the overhead line in accordance with **Holford Rule 3**.

7.7.44 Segments 5a and 5b present varying opportunities to identify a line route that aligns with **Holford Rules 4 and 5**. Segment 5a, with its larger-scale, rolling field patterns and patchy woodland, offers opportunities to utilise existing vegetation for partial screening and backclothing of pylons, while also benefitting from the presence of existing high-voltage infrastructure to reduce landscape susceptibility. This allows for potential alignment with Holford guidance through careful routeing to avoid prominent skylines and integrate the line into the landscape context. In contrast, segment 5b comprises a more intimate and smaller-scale landscape with narrow fields and mature vegetation along watercourses, making it more susceptible to visual impacts from new overhead line infrastructure. While some screening can be achieved through existing woodland and riparian vegetation, achieving full compliance with **Holford Rules 4 and 5** in this segment would be more limited. This would require careful routeing and the use of vegetative cover to reduce visual prominence. Overall, segment 5a aligns more readily with Holford guidance due to its larger-scale landscape and existing infrastructure. Although segment 5b presents more constrained opportunities, the corridor as a whole has been developed with regard to all relevant **Holford Rules.**

7.7.45 Core Route Corridors 1 to 5 plus segment 5a and 5b would require the crossing of existing overhead lines. While this could result in landscape and visual impacts, further assessment would be required during the next design phase. In accordance with Holford Rule 6, mitigation (re-routeing, removal or undergrounding) would be considered to minimise visual and landscape effects.

7.7.46 While the Holford Rules have been used to guide the definition of Core Route Corridors 1 to 5 plus segment 5a and 5b, it is important to note that not all aspects of the rules can be fully applied at this stage of the project. Specifically, Holford Rules 4, 5, 6, and 7 which relate to proximity to residential areas, visual intrusion, special areas, and skyline impacts, require detailed alignment and tower positioning to be meaningfully assessed. These considerations depend on further design development, including visual impact assessments, ecological surveys, and topographic modelling, which will be undertaken during the next phase of route refinement. The current application of the Holford Rules is therefore strategic and high-level, with more detailed compliance to be demonstrated as the design progresses.

Summary of Appraisal of Core Route Corridors 1 to 5 plus segment 5a and 5b

Environmental

7.7.47 The key environmental considerations influencing the appraisal of Core Route Corridor 1 to 5 plus segments 5a and 5b are predominantly landscape and visual amenity as well as historic environment and ecology considerations. In addition to the impacts identified for Core Route Corridor 1 to 5, the inclusion of segments 5a and 5b introduces further potential impacts summarised below.

7.7.48 The proximity of the segments to settlements along the Eden Valley increases visual sensitivity, particularly for users of Hadrian's Wall National Trail, NCN Route 72, and local PRoW. Both segments 5a and 5b may also result in direct and more widespread

indirect impacts on landscape character, particularly in the open areas around the River Eden and the south-eastern parts of the segments. However, the presence of two existing overhead lines within segment 5a, the 400 kV Harker-Hutton line and an existing 275 kV overhead line, provides existing context and influences the character of the local landscape, making it less susceptible to the introduction of a new overhead line.

7.7.49 Segment cross 5a the section of Hadrian's Wall WHS and associated buffer with reduced sensitivity to change due to the introduction of an overhead line, as set out in the WHS Capacity Assessment Technical Note (included in Appendix A of this CPRSS). While physical impacts to the WHS may be avoided through careful design, there is the potential for an overhead line to impact the settings of the WHS and its OUV. Other notable heritage assets that may be affected by an overhead line within the additional segments include Grade II* listed building (Brunstock House) and the Grade II listed buildings (Eden Grove, Edmonton Castle and Toppin Castle).

7.7.50 The inclusion of segments 5a and 5b, both located in England, introduces additional ecological sensitivities beyond those identified for Core Route Corridor 1-5. Segments 5a and 5b cross the River Eden SAC. Potential impacts to this receptor may include disturbance of species and loss or fragmentation of riparian habitat from overhead line infrastructure crossing the river. Further assessment would be required at the later stages of the Proposed Development to further understand impacts and guide the design of the overhead line.

Socio-economic

7.7.51 The socio-economic appraisal did not identify any constraints or impacts which would be determining factors in the appraisal of the development of an overhead line within segments 5a and 5b. While some impacts would be unavoidable, subject to routing the use of Grade 2 ALC land, temporary diversion of PRoWs, these are considered to be mitigatable. The proximity of the corridor to Carlisle Airport (approximately 1.2km at its closest point), may introduce aviation safeguarding considerations. National Grid would engage with the MoD and the CAA should this option be taken forward to ensure that likely impacts and mitigation requirements are identified.

Engineering and Systems

7.7.52 The main engineering factors influencing the appraisal of Core Route Corridors 1 to 5, including segments 5a and 5b, relate to additional existing utilities. These include existing high-voltage overhead lines (275 kV and 400 kV) in segment 5a; the Proposed Development is anticipated to require a crossing of the existing 275 kV overhead line and is expected to be routed in proximity to the existing 400 kV overhead line. The NWEP pipeline runs through segment 5a. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints. While ground conditions within the corridor would influence the design of the overhead line, they are not considered to be determining factors in the appraisal of its development.

7.8 Core Route Corridor 1-5 plus segments 5a, 5c and 5d

7.8.1 These options would provide a route corridor to enable connection to the electricity transmission system via a proposed substation located to the south of the Hadrian's Wall WHS. They comprise the five Core Route Corridor options 1 to 5 described in **Sections 7.2** to **7.7** with the addition of segments 5a, 5c and 5d (see **Figure 7-7**).

7.8.2 The overall length of these corridor options is dependent on the combination of Core Route Corridor and the additional segments 5a, 5c and 5d, as follows:

- up to 37km (Core Route Corridor 1 + segment 5a, 5c and 5d);
- up to 44.1km (Core Route Corridor 2 using segment 2a + segment 5a, 5c and 5d);
- up to 44.1km (Core Route Corridor 2 using segment 2b + segment 5a, 5c and 5d);
- up to 37.7km (Core Route Corridor 3 + segment 5a, 5c and 5d);
- up to 47.1km (Core Route Corridor 4 using segment 4a + segment 5a, 5c and 5d);
- up to 58.5km (Core Route Corridor 4 using segment 4b + segment 5a, 5c and 5d);
- up to 53.9km (Core Route Corridor 5 using segment 4a + segment 5a, 5c and 5d); and
- up to 65.3km (Core Route Corridor 5 using segment 4b + segment 5a, 5c and 5d).

7.8.3 This section provides a description and appraisal of the additional segments 5a, 5c and 5d. These segments would connect with the southernmost point of one of the Core Route Corridor options (which are described and appraised in **Sections 7.2** to **7.6**) and include a crossing of the Hadrian's Wall WHS and buffer zone.

7.8.4 As set out in **Chapter 5**, Core Route Corridor options 1 to 5 plus segment 5a, 5c and 5c would include an overhead line connection between the proposed substation to the south of the Hadrian's Wall WHS and the England-Scotland border. The connection from the proposed substation to the existing network would consist of a connection to the existing Harker-Hutton line. This configuration would result in one additional crossing of the WHS. The impact of this connection is accounted for in the appraisal of the additional segments 5a, 5c and 5c.

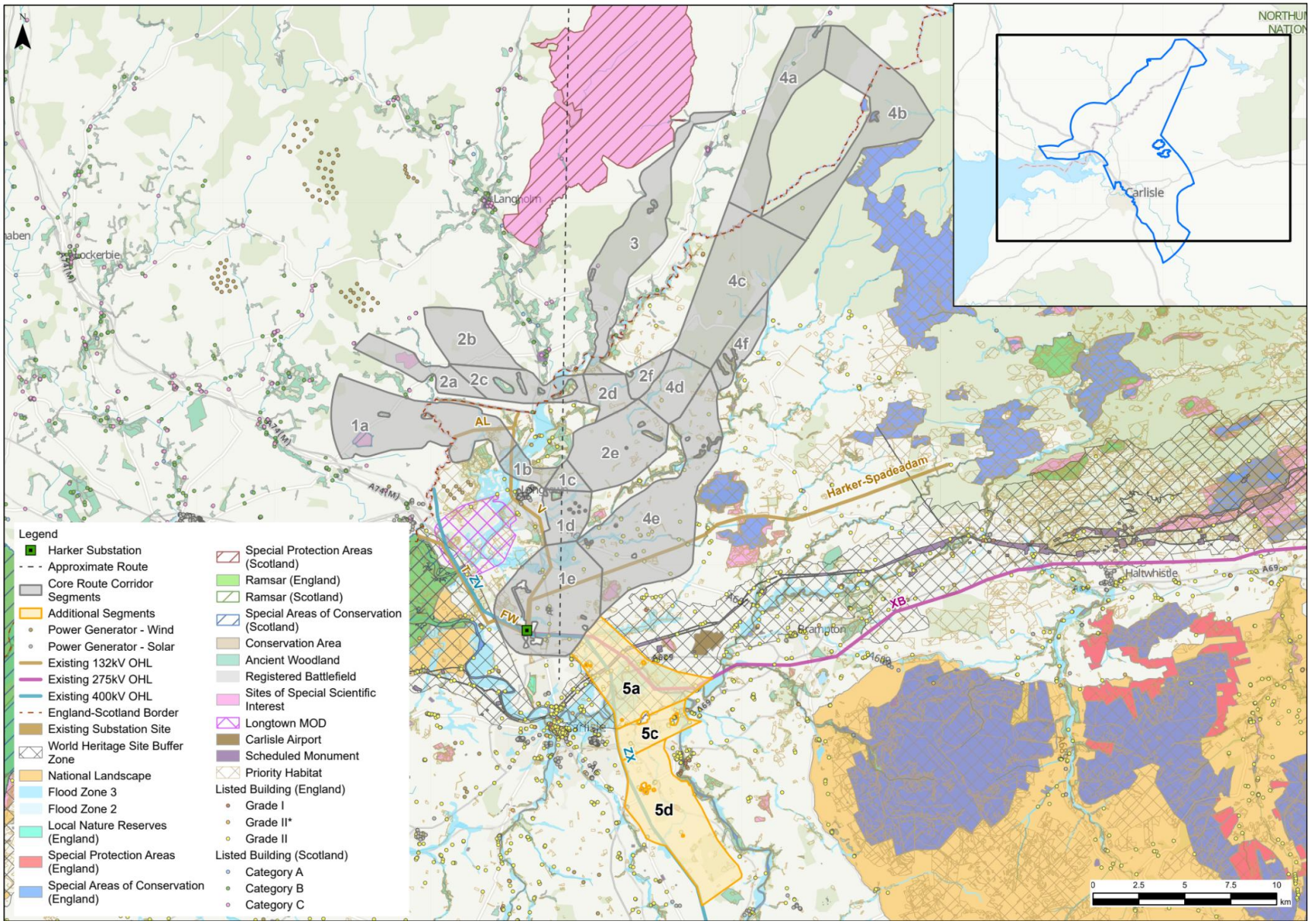
7.8.5 From south to north, a route corridor south of Hadrian's Wall in this option would run in a north-west direction within segment 5d for approximately 8.5km where it crosses the Carlisle-Settle Railway and associated conservation area and the B263. It would continue in a north-west direction through segment 5c where it crosses Carlisle Golf Club and the A69. It would then route in a north-westerly direction in segment 5a where it would cross the River Eden SAC, Hadrian's Wall WHS and associated buffer, the Eden Golf Club, the A689, the existing 400 kV Harker-Hutton overhead line and the existing 275 kV overhead line. It would then connect with one of the Core Route Corridor options 1-5 and continue north.

7.8.6 To connect the selected emerging preferred substation to the south of Hadrian's Wall WHS, there would also be an overhead line connection between the substation and the existing 400 kV Harker–Hutton line, providing an onward connection to the existing network. The detailed route of this connection would depend on the final substation location. However, the appraisal presented in this section accounts for the potential environmental and engineering constraints associated with this connection — including anticipated crossings of existing 275 kV and 400 kV infrastructure, gas pipelines, and

NWEP — within segments 5a, 5c, and 5d, as summarised in **paragraphs 7.8.37** to **7.8.43**.

7.8.7 Within these segments 5a, 5c and 5d constraints such as areas of ancient woodland including Hellbeck Wood, and the settlements of Cumwhinton, Aglionby and Warwick on Eden, have been excluded.

Figure 7-7 – Core Route Corridor 1 to 5 (plus segments 5a, 5c, 5d)



Environmental Appraisal Summary

Landscape and Visual

7.8.8 In addition to NCAs already identified as part of the Core Route Corridors, the inclusion of segments 5c and 5d would extend the corridor southwards into NCA 9 Eden Valley, which encompasses the broad valleys of the River Eden and its tributaries, as well as a small part of the North Pennines National Landscape. At its closest, segment 5a would be approximately 4.9km east of the Solway Coast National Landscape and segment 5d would be approximately 5km from the North Pennines National Landscape. Segment 5a at its closest point, lies approximately 18.2km south-west of the Northumberland National Park. The Lake District National Park is approximately 14km to the south-west of segment 5d at its closest point.

7.8.9 At a local landscape level, the corridor extension to encompass segments 5a, 5c and 5d passes through LCT sub-type 5b, LCT sub-type 5c and an additional area of LCT sub-type 10 Sandstone Ridge. The corridor extension also abuts LCT sub-type 08a Gorges which is a highly sensitive local landform of limited extent and higher value and sensitivity. Most of segment 5a lies within LCT sub-type 5b, which has large scale fields, undulating topography and dispersed vegetation, as well as existing overhead line as key characteristics that reduce sensitivity. Most of segment 5b (and a very small area of 5a) lies within LCT sub-type 5c Rolling Lowland.

7.8.10 LCT 5c is a lowland agricultural landscape dominated by pasture with some woodland, scrub and other marginal land. Field patterns are variable relating to topography and are generally regular at lower levels. In lower lying areas the landscape is generally undulating, and on higher ground land is more rolling and open. The complexity of the lower landscape increases sensitivity to overhead line while the key characteristic of openness adjacent to the National Landscape increase sensitivity of the elevated areas of LCT sub-type 5c.

7.8.11 LCT 10 is an open, large-scale landscape of varied character including improved farmland, conifer plantation and unimproved heathland. Open expansive views from the prominent north south ridge are present both toward and away from the Lake District National Park and increase sensitivity to overhead line. Careful routeing of an alignment to avoid interrupting views of the distant landforms of the Lake District would be required, particularly from any noted viewpoint or recreational location.

7.8.12 Consequently, the inclusion of additional segments 5a, 5c and 5d introduces further landscape and visual sensitivities due to the presence of a smaller scale more complex landscape, a relatively dense network of PRoW, and the close proximity of villages including Wetheral Shield, Stripes, Cumwhinton and Scotby and connecting rural lanes. Overall, the segments are characterised by an undulating and rolling landscape dominated by pasture, with field boundaries comprising hedgerows, hedgerow trees and fences, and many mature trees forming notable features. Across the north-western part of the segments (segment 5a), patchy blocks of woodland and tree belts form some of the field boundaries. The meandering course of the River Eden flows through the northern part of the segments and follows the western boundary of the central and southern parts (segments 5c and 5d), which are associated with the gorge landscape to the east, with long-distance views across the gorge available.

7.8.13 Two high voltage overhead lines cross through the north-western parts of the segments (segment 5a), one of which continues south along the western boundary of segments

5c and 5d. The proposed overhead line would appear relatively prominent across the majority of the segments. The southernmost part of segment 5d is likely to be less susceptible to the type of development proposed due to the limited number of potential visual receptors, large-scale of the landscape and presence of plantation woodland. The northern part of segment 5d is likely to be more susceptible due to the relatively dense network of PRoW and the proximity of villages including Wetheral Shield, Stripes, Cumwhitton and Scotby. In general, susceptibility reduces from east to west across segment 5d due to the presence of existing overhead line, road infrastructure including the A6 and M6, and proximity to the Carlisle fringe.

7.8.14 Across the central parts of the segments (segments 5c and 5d), there is a relatively dense network of PRoW connecting the villages of Cotehill, Cocklakes, Wetheral Shield, Cumwhitton, Aglionby and Warwick on Eden, which could experience visual impacts. Visual transport receptors include those along the A69 and A689, users of the local road network, and people travelling along the Newcastle–Carlisle railway line. The presence of existing overhead lines across the northern parts of the segments (segment 5a) provides existing context and locally influences the character of the landscape, making it less susceptible to the introduction of new overhead lines. However, the introduction of overhead line close to the gorge landscape within the eastern part of the segments (segments 5a and 5d) would likely be prominent and could result in impacts to the setting of the gorge, noting that it is not a designated landscape and its value is landform related.

Historic Environment

7.8.15 In addition to the impacts already identified for Core Route Corridor 1 to 5, the inclusion of segments 5a, 5c and 5d introduces further potential impacts on designated heritage assets as described below.

7.8.16 These corridor options cross the Hadrian's Wall WHS and its buffer zone within segment 5a. This section of the WHS buffer is considered less sensitive to change as a result of existing infrastructure including the M6 and two overhead lines, as set out in the WHS Capacity Assessment Technical Note (included in Appendix A of this CPRSS). While physical impacts may be avoided through careful routeing, there is potential for an overhead line to impact the setting of the WHS and its OUV. The scheduled components of the WHS within segment 5a are limited to a section of the Wall and associated vallum, which is assumed to survive as buried archaeological features, with no above ground remains or earthworks recorded. As such, its significance is largely derived from its archaeological value. It was, however, originally designed to have views to the north beyond the frontier, and there may also have been views to the south over the valley of the River Eden.

7.8.17 Although a new overhead line has the potential to result in impacts to the setting of the WHS, the overhead line would not sever views and instead partially interrupt views from the Wall, and it would still be possible to understand its positioning as a Frontier, engineering, and construction (which are Attributes of OUV). An overhead line would also not sever any views or interrelationships between the Wall and designated assets to the south of the Wall, as there are no assets (such as temporary forts and marching camps) recorded in this area. Finally, an overhead line would not alter the prominence of the Wall, which survives as below ground archaeological remains in this area, while the topography which falls to the south, and the valley of the River Eden, would also help to backcloth the pylons. Furthermore, a number of overhead lines already cross the Wall in this area, while other elements of modern infrastructure including main roads, as

well as large industrial scale farmsteads, give the area a more urban/industrial character.

7.8.18 Other notable designated heritage assets that could be affected by an overhead line in Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d include:

- The Grade II* listed Brunstock House (NHLE 1087726), located in segment 5a. This asset is located in an elevated position on the west side of the A689 overlooking the valley of the River Eden and may have been designed to have views over the non-designated parkland to the south, as well as the River Eden. These views have been partially interrupted by the construction of the A689 as well as existing overhead lines. The introduction of a new overhead line has the potential to result in further impacts on its setting and significance.
- Grade II listed Alstonby Hall (NHLE 1335568) is located on a slight terrace overlooking the River Lyne to the north. As a result, the introduction of a new overhead line has the potential to result in impacts to the setting of the asset.
- The Grade II listed Eden Grove (NHLE 1087696), located in segment 5a. This asset is located in an elevated position to command views over the River Eden to the south, and as a result the introduction of a new overhead line has the potential to result in impacts to the setting of the asset.
- Barrock Fell scheduled enclosure (NHLE 1007874), located on high ground approximately 800m to the west of segment 5d. This asset may have been designed to command views over the surrounding landscape, as well as appear as visually dominant features. This dominance in the landscape has, however, been large lost as a result of woodland planting, and arable cultivation that has removed all earthworks resulting in the asset surviving as a cropmark only. Further assessment would be required to determine whether an overhead line would impact on its significance.
- Corby Castle Registered Park and Garden (NHLE 1000662), located approximately 150m east of Segment 5d, and associated listed buildings of varying grades. While the assets are reasonably well screened by intervening topography, as well as elements such as mature woodland and the built environment (i.e. the settlements/parkland in which they are located), a review of the designation for the parkland highlights key designed views from the main house to the south and along the valley of the River Eden. As a result, there is the potential for significant effects on the setting of Grade I listed parkland as well as the main house.

7.8.19 Both Corby and Wetheral, located to the east of Segment 5d, are also Conservation Areas, as is Warwick-on-Eden within Segment 5c, and the Carlisle to Settle Railway which passes through Segment 5d. Although Conservation Area Appraisals are not publicly available, and therefore it is not clear what the key views are, it is possible that some of the Conservation Areas may have key views out, such as views along the Eden Valley from Warwick, Wetheral, and Great Corby. However, the built environment, topography and mature woodland in the area provides relatively good screening, thus reducing the potential for significant impacts on the setting of the assets.

7.8.20 In conclusion, the introduction of segments 5a, 5c and 5d has the potential to result in impacts due to the crossing of the WHS, as well as other possible setting impacts on the designated assets, including Corby Castle Grade I Registered Park and Garden.

Ecology

7.8.21 In addition to the impacts already identified for Core Route Corridor 1 to 5, the inclusion of segments 5a, 5c and 5d introduces further potential impacts on designated ecological areas as described below.

7.8.22 Notable designated ecological areas that could be affected by an overhead line in Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d include:

- The River Eden SAC, which crosses segment 5a and 5c and is designated for the presence of riparian habitats as well as faunal species. Within segment 5a, it would not be possible to route the overhead line without crossing the River Eden. Potential impacts to the River Eden SAC include disturbance of notable and protected species during construction, loss and fragmentation of riparian habitat, dust deposition, and water pollution. Potential indirect impacts include loss or fragmentation of functionally linked habitat. The potential impact on the SAC would be considered in detail within a HRA (conducted in absence of mitigation) at the later stages of the Proposed Development. The HRA would assess any indirect effects, such as the loss of functionally linked land used by SAC species.
- The White Moss, Crosbymoor SSSI, located 1.1km north of segment 5a. This designation was originally a mire but has been degraded by recreational and grazing pressure to its current categorisation of wet heath and wet grassland with pasture woodland. Potential indirect impacts to the SSSI could result from water pollution due to the proximity of the segment.
- Cotehill Pastures and Ponds SSSI, located entirely within corridor segment 5d. Potential impacts to this SSSI could include direct impacts through habitat loss, or indirect impacts through disturbance or pollution, for instance through dust deposition or pollution of surface water.
- Numerous areas of deciduous woodland priority habitat, located within segment 5a, 5c and 5d, as well as areas of coastal and floodplain grazing marsh and an area of good quality semi-improved grassland priority habitat along the River Eden located in segment 5a. These habitats could be negatively impacted through habitat loss, fragmentation, or degradation, for instance by dust deposition or pollution of surface water.

7.8.23 In conclusion, the introduction of segments 5a, 5c and 5d, has the potential to result in significant direct and indirect ecological impacts due to the unavoidable crossing of the River Eden SAC. Other features within the additional segments that may be impacted through the introduction of an overhead line include Cotehill Pastures and Ponds SSSI and priority habitats. These factors collectively contribute to the ecological sensitivity of the corridor.

Other Environmental Considerations

7.8.24 Other environmental aspects were considered as part of the options appraisal including water, geology and soils.

7.8.25 There are a number of surface and groundwater constraints or features within or close to segments 5a, 5c and 5d. These include sensitive ecological sites (e.g., SSSIs, SACs, GDTEs), floodplains (Flood Zone 3), and key watercourses such as the River Eden and River Lyne. The inclusion of segments introduces additional risks and constraints that could result in residual effects even after mitigation. It is expected that the majority of

effects could be mitigated; however the additional constraints by segments 5a, 5c and 5d present additional risks with increased potential for residual negative impacts after mitigation.

7.8.26 No additional impacts with respect of geology and soils are anticipated with the inclusion of segments 5a, 5c and 5d.

Socio-economic Appraisal Summary

Economic Activity (including Planning)

7.8.27 In addition to issues already identified as part of the Core Route Corridor, the inclusion of segments 5a, 5c and 5d introduces the following additional impacts.

7.8.28 Segment 5a includes an area of BMV Grade 2, which is defined as very good quality agricultural land which would be avoided. It would not be possible to avoid this land in either segment, although crops can still be grown under overhead line. Areas with BMV Grade 2 could incorporate mitigation measures such as optimising the space used for temporary construction sites wherever possible and prioritising the use of Grade 3 or lower quality land for permanent development to avoid permanent impact on good quality soils. Segment 5d also includes a live application (ref: 23/0671) for holiday lodges around a lake formed from a disused quarry. Segments 5c and 5d also include areas of open space allocated in the adopted Carlisle District Local Plan which would be capable of being avoided.

7.8.29 Part of segment 5d was previously included within an early draft of the Local Plan allocation for St Cuthbert's Garden Village. St Cuthbert's Garden Village is now identified in the adopted Carlisle District Local Plan 2015-2030 (2016) under Policy SP3: 'Broad location for growth: Carlisle South', see **paragraph 6.10.17**. If segment 5d was selected as preferred, consideration would need to be given to the draft Local Plan, to the capacity of the Golden Fleece junction and the B6263. It is anticipated that any issues could be dealt with through standard mitigation measures.

Aviation and Defence

7.8.30 In addition to the impacts already identified for Core Route Corridor 1 to 5, the inclusion of segments 5a, 5c and 5d introduces further potential impacts on aviation and defence as described below.

7.8.31 The proximity of the corridor to Carlisle Airport, at approximately 1.2km from segment 5a, 2.4km from segment 5c and 4.9km from segment 5d, may introduce aviation safeguarding considerations. The development of pylons within these segments could pose a hazard and/or restrict low flying activities. National Grid would engage with the MoD and the CAA should this option be taken forward to ensure to ensure that likely impacts and mitigation requirements are identified.

Traffic and Transport

7.8.32 In addition to issues already identified as part of the Core Route Corridor, the inclusion of segments 5a, 5c and 5d introduces the following additional impacts.

7.8.33 Segment 5a is crossed by the M6 and four A and B roads managed by the local highway authorities, the A689 and B6264 (segment 5a), A69 (segment 5c), and B6263

(segment 5c and 5d). The A69 and B6263 could be used for construction routes despite notable constraints. As far as possible, construction traffic would be routed along the A and B roads. The B6263 has a 7.5t weight restriction on and a narrow section in Cumwhinton where property frontage is up against the road and there is also a bridge over the railway.

7.8.34 The Rivers Eden and Irthing bisect segment 5a. The only road crossing the river within the segment is a minor road (Little Corby Road), which is also an NCN (Route 72). The crossing is a single lane bridge with traffic signals, which may not be wide enough for HGVs. In addition, the junction to the north of the bridge is spatially constrained as is the road to the south through Little Corby, which means there are no suitable river crossings within segment 5a. Construction traffic may need to use longer distance routes outside of the segment including the A69 and A689 to cross these rivers and gain access to all parts of segment 5a.

7.8.35 There are potential rail crossings of access routes within these segments, the Carlisle to Newcastle railway line crosses the corridor with an east-west orientation (segments 5c and 5d) and the Settle to Carlisle railway line crosses the corridor with a north-west-south-east orientation (segment 5d). The presence of narrow rail bridges would mean new and lengthy haul roads would need to be provided and that access issues would be considered as a determining factor in the appraisal of the development of a new overhead line.

7.8.36 There are a number of PRoW that cross the segments, notably the Hadrian's Wall path crosses segment 5a. The development of an overhead line close to or crossing recreational routes has the potential to impact on users, in particular during construction. However, these are considered to be mitigable and would not be determining factors of the appraisal of the development of the overhead line.

Engineering and Systems Appraisal Summary

7.8.37 In addition to that already identified as part of the Core Route Corridors, the inclusion of segments 5a, 5c and 5d introduces a number of constraints which are considered likely to reduce routeing flexibility and/or increase the technical complexity of overhead line routes. These constraints are outlined in **Sections 7.8.38** to **7.8.43** below.

7.8.38 There are a number of existing high voltage overhead lines within segment 5a which may require the new overhead line to cross them or be routed in their vicinity. These include:

- The existing 400 kV Harker–Hutton overhead line, which is owned by National Grid and routed through segment 5a, is not expected to require crossing, as the proposed overhead line can likely be routed to avoid it.
- The existing 275 kV overhead line, also owned by National Grid and routed through segment 5a, will require crossing by the proposed overhead line, as it lies within the anticipated corridor and cannot be reasonably avoided. This crossing is expected to be achievable using standard overhead line clearance and design practices.

7.8.39 The NWEP pipeline runs through segments 5a, 5c, and 5d. The proposed overhead line would be routed to avoid this asset, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

7.8.40 Two existing gas pipelines run through the southern section of segment 5d, connecting to a petroleum site. The proposed overhead line should be routed to avoid these assets, with pylons and associated infrastructure positioned to maintain appropriate clearance. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

7.8.41 A solar farm and a wind turbine are located within segment 5a. These assets would be avoided where practicable, with the proposed overhead line routed so that pylons and associated infrastructure are positioned away from these features. Sufficient space is available within the corridor to accommodate this, taking into account other constraints.

7.8.42 In addition to that already identified in the Core Route Corridor options, segments 5a and 5c also feature some very broad extents of Alluvium, River Terrace Deposits (sands and gravels but also some clays and silts), associated with the River Eden floodplain. Localised Glaciofluvial Deposits are also present in this area.

7.8.43 The superficial geology notably comprises of glacial material which have the potential to be variable in terms of composition, thickness and strength and may include localised soft spots and less favourable ground including alluvium and alluvial materials that may require treatment or removal and replacement. Areas of identified mines are within the extent of Segment 5d including the possible workings associated with Cocklakes Mine.

Holford Rules

7.8.44 Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d have been defined to exclude larger areas of the highest amenity value and interest in accordance with **Holford Rule 1**, with exception of the Hadrian's Wall WHS and its buffer zone. The corridors cross the Hadrian's Wall WHS and its buffer zone within segment 5a; this section of the WHS buffer is considered less sensitive to change, as set out in the WHS Capacity Assessment Technical Note (included in **Appendix A** of this CPRSS).

7.8.45 Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d have generally avoided smaller areas of high amenity value which have specifically been excluded from the corridors. In addition to the smaller areas of high amenity value which exist within the boundaries of Core Route Corridor 1 to 5, the corridors include the following smaller areas of high amenity:

- Individual listed buildings within segments 5a, 5c and 5d.
- One scheduled monument within segment 5a (Hadrian's Wall and vallum).
- Priority habitats within segments 5a, 5c and 5d.

7.8.46 Where there are smaller areas of high amenity value, sufficient space has been included within the corridor to enable routing to avoid them, potentially by local deviation, in accordance with **Holford Rule 2**.

7.8.47 Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d were defined to provide a central route from the new Carlisle substation infrastructure to the England-Scotland border which follows a largely direct route (in line with **Holford Rule 3**).

7.8.48 Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d were defined to avoid highly constrained areas, and specific constraints including settlements such as Aglionby and of Cumwhinton (Holford Rule Supplementary Note 1).

7.8.49 Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d include more land than is needed for construction of an overhead line which provides flexibility and options when considering more detailed routeing, following consultation feedback, at later project development stages. This also provides the opportunity to implement the most direct route (avoiding constraints) and reduce the need for sharp angles or changes in direction of the overhead line in accordance with **Holford Rule 3**.

7.8.50 Segments 5a, 5c, and 5d present varying opportunities to identify a line route that aligns with **Holford Rules 4** and **5**. Segment 5a offers good potential due to its larger-scale, rolling field patterns, presence of existing overhead lines, and mature vegetation that can be used for partial screening and backclothing, supporting both rules. Segment 5c presents more challenges given its smaller-scale, more complex field patterns and proximity to settlements, which reduce flexibility for routeing the avoidance of skylining more difficult; however, some integration is possible through careful use of existing tree belts and hedgerows. In contrast, the southern part of segment 5d, with its large-scale landscape and extensive woodland and plantation areas, provides the best opportunity to achieve alignment with Holford guidance, allowing for significant screening and reduced visual prominence. The northern part of segment 5d is more sensitive due to a denser settlement pattern and smaller-scale landscape, requiring careful routeing to mitigate visual impacts. Overall, segments 5a and the southern part of 5d offer the most promising opportunities to align with **Holford Rules 4** and **5.** Segment 5c and northern 5d present greater constraints. In these areas, careful routeing and siting will be essential to reduce visual impacts, though some residual effects are likely to remain despite mitigation measures such as screening and vegetation, which could help reduce visual impacts.

7.8.51 Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d would require the crossing of existing overhead lines. While this could result in landscape and visual impacts, further assessment would be required during the next design phase. In accordance with Holford Rule 6, mitigation (re-routeing, removal or undergrounding) would be considered to minimise visual and landscape effects.

7.8.52 While the Holford Rules have been used to guide the definition of the Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d , it is important to note that not all aspects of the rules can be fully applied at this stage of the project. Specifically, **Holford Rules 4, 5, 6,** and **7** which relate to proximity to residential areas, visual intrusion, special areas, and skyline impacts, require detailed alignment and tower positioning to be meaningfully assessed. These considerations depend on further design development, including visual impact assessments, ecological surveys, and topographic modelling, which will be undertaken during the next phase of route refinement. The current application of the Holford Rules is therefore strategic and high-level, with more detailed compliance to be demonstrated as the design progresses.

Summary of Appraisal of Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d

Environmental

7.8.53 The key environmental considerations influencing the appraisal of Core Route Corridor 1 to 5 plus segments 5a, 5c and 5d are predominantly landscape and visual amenity as well as historic environment and ecology considerations. In addition to the impacts

identified for Core Route Corridor 1 to 5, the inclusion of segments 5a, 5c and 5d introduces further potential impacts summarised below.

7.8.54 The inclusion of segments 5a, 5c and 5d introduces further landscape and visual sensitivities due to the presence of a small scale, complex landscape, a relatively dense network of PRoWs and the close proximity to the villages of Wetheral Shield, Stripes, Cumwhitton and Scotby. The proposed overhead line would appear relatively prominent across the majority of the segments. However, the presence of two existing overhead lines within segment 5a, the 400 kV Harker-Hutton line and an existing 275 kV overhead line, provides existing context and influences the character of the local landscape, making it less susceptible to the introduction of a new overhead line. The southernmost part of segment 5d is likely to be less susceptible to the introduction of an overhead line due the limited number of potential visual receptors, the large-scale landscape and the presence of planted woodland.

7.8.55 Segment 5a crosses the section of Hadrian's Wall WHS and associated buffer with reduced sensitivity to change due to the introduction of an overhead line as set out in the WHS Capacity Assessment Technical Note (included in Appendix A of this CPRSS); while physical impacts to the WHS may avoided through careful design, there is the potential for an overhead line to impact the settings of the WHS and its OUV. Other notable designated heritage assets that could be affected by an overhead line within the additional segments include the Grade II* listed building (Brunstock House), Grade II listed buildings (Alstonby Hall, Eden Grove, Barrock Fell) and Corby Castle Registered Park and Garden.

7.8.56 Segment 5a and 5c also cross the River Eden SAC; potential impacts to this designation may include disturbance of species and loss or fragmentation of habitat. Further assessment would be required at the later stages of the Proposed Development to further understand impacts and guide the design of the overhead line.

Socio-economic

7.8.57 The key socio-economic factors influencing the appraisal of the development of an overhead line within Core Route Corridors 1 to 5 plus segment 5a, 5c and 5d relate to traffic and transport, with access issues a determining factor. While some other impacts would be unavoidable, subject to routing the use of Grade 2 ALC land and temporary diversion of PRoWs, these are considered to be mitigatable. The proximity of the corridor to Carlisle Airport (approximately 1.2km at its closest point), may introduce aviation safeguarding considerations. National Grid would engage with the MoD and the CAA should this option be taken forward to ensure to ensure that likely impacts and mitigation requirements are identified.

Engineering and Systems

7.8.58 The main engineering factors influencing the appraisal of Core Route Corridor 1 to 5 plus segment 5a, 5c and 5d relate to additional existing utilities. These include existing high-voltage overhead lines (275 kV and 400 kV) in segment 5a; the Proposed Development is anticipated to require a crossing of the existing 275 kV overhead line and is expected to be routed in proximity to the existing 400 kV overhead line. In addition, the NWEP runs through segments 5a, 5c, and 5d, and two existing gas pipelines are located in the southern part of segment 5d. The overhead line should be routed to avoid these assets although there is sufficient space within the corridor to accommodate this, subject to other constraints. While ground conditions within the

corridor would influence the design of an overhead line within the corridor, they are not considered to be determining factors of the appraisal of the development of an overhead line but consideration for the areas of identified mines associated with Cocklakes Mine will be required as they noted within segment 5d.

8. Cost

8.1 Introduction

8.1.1 Section 9 of the Electricity Act requires National Grid to 'develop and maintain an efficient, coordinated and economical system of electricity distribution', therefore, due regard should be given to the potential cost associated with different options for each component of the Proposed Development, as well as the environmental, socio-economic and technical consideration described in this report so far.

8.1.2 In line with the methodology identified in **Chapter 5**, following the appraisal of the route corridors, cost estimates were developed for those corridors. Cost estimates are high-level at this stage, based on simple indicative overhead lines distances. The cost estimates do not include capital cost associated with the new substation or any connection works. It is considered that all routes would require similar works at the substation and therefore substation costs would not impact on the comparative estimate to inform option appraisal or be a differentiator between corridor options. Similarly, as explained in **Chapter 5**, cost is not a differentiating factor in the comparison of the Siting Zones or Siting Areas themselves. Therefore, costs in respect of these elements are not considered in this section.

8.1.3 Cost will continue to be developed and refined through further design and survey work. The cost estimates are also highly influenced by market forces such as resource availability and external market rates.

8.1.4 This CPRSS does not provide cost estimates for the full Project. Cost estimates are provided for the Proposed Development only, that is the section of the route to be delivered by National Grid in England, up to the border with Scotland. SP Energy Network will be responsible for defining the cost and delivering the remaining section of the Project in Scotland.

8.1.5 There are five Core Route Corridors considered in the appraisal, as described in **Chapter 7** and shown in **Figure** 7-1 to **Figure 7-5**.

8.1.6 The Core Route Corridors include some corridor segments which fall in Scotland. Although these segments inform the options appraisal for the Proposed Development, the parts within Scotland are not included in the indicative costs. The segments in Scotland for each Core Route Corridor are as follows:

- Core Route Corridor 1 includes segment 1a which would partially be within Scotland;
- Core Route Corridor 2 includes segment 2a and the option of using either segment 2b or segment 2c. Segments 2a and 2b would be wholly within Scotland while segment 2c would be partially within Scotland;
- Core Route Corridor 3 includes segment 3 which would be partially within Scotland; and
- Core Route Corridor 4 and Core Route Corridor 5 both include options to use either segment 4a or 4b. Segment 4a would be wholly within Scotland and segment 4b would be partially within Scotland.

8.1.7 This chapter sets out the costs for the parts of these Core Route Corridors that fall in England only.

8.2 Costing

8.2.1 A simple assessment has been undertaken to determine the relative costs associated with the overhead line connection between the new Carlisle substation and the England-Scotland border and the connection from the new Carlisle substation to the existing network.

8.2.2 The estimated route lengths have been costed using National Grid historic project outturn data in line with the cost per km provided in the SOR[43].

8.2.3 **Table 8-1** outlines the indicative cost of the relevant proposed technology. For the purpose of the costing exercise, it is assumed that an overhead line solution will be provided with no undergrounding required for any option at this stage.

8.2.4 The route corridor options are described in **Chapter 5** and appraised in **Chapter 7** and would provide connections between the new Carlisle substation and the England-Scotland border.

8.2.5 There are five route corridor options north of Carlisle, referred to as the Core Route Corridors, which would connect between the new Carlisle substation north of Carlisle and the England-Scotland border[44]. For these options there would also be a connection between the new Carlisle substation and the existing Harker substation. The estimated length of overhead line for these options ranges between 17.9km and 46.2km as shown in **Table 8-2**.

8.2.6 The route corridor options to the south of Carlisle would follow the same route as the Core Route Corridors and then continue to the new Carlisle substation south of Carlisle. These options would also include a connection to the existing network, which would consist of a connection between the new Carlisle Substation and the existing Harker substation, or a connection between the new Carlisle Substation and the existing Harker-Hutton line. The estimated length of overhead line for these options ranges between 37.0km and 68.9km as shown in **Table 8-3.**

8.2.7 Indicative costs of route corridor options set out in this chapter include the connection between the England-Scotland border and the new Carlisle substation and the connection to the existing network.

8.2.8 Recognising that there is potential variance in the specific alignment through a route corridor, for the purposes of developing simplified cost estimates, an assumption was made for each of the route corridor options that the alignment would follow a centre line route through the corridor, whilst considering key routeing constraints and professional expertise pertaining to overhead line design. The pylon type and conductor configuration used to define a unit cost per km of overhead line are assumed to be standard lattice pylon as described in **Chapter 2**.

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[43] The costs have been developed using the assumptions set out in the SOR. The cost assumptions in the SOR were estimated based on prices from the financial year 2021/22 and as such would need adjustment for inflation with time. However, they provide a consistent cost point for comparison of options at this stage.

[44] Note that for some of the Core Route Corridors, there are different segment options within the corridors which could be used, as described in Chapter 5 and appraised in Chapter 7. Where the different segment options would result in different indicative costs, these are identified in Chapter 8.

8.2.9 Secondary costs arising as a result of significant environmental or engineering constraints (which would require a major localised adjustment to the transmission technology selected) have been considered in the costing. Engineering constraints identified within the overhead line study area include waterway crossings, major road crossings and high voltage line crossings. For example, the length of overhead line crossing a major waterway would require specific construction and engineering works which would likely increase the capital cost. The increase in cost to route the overhead line to avoid areas of high environmental sensitivity as shown in the heat maps in **Chapter 4** has also been considered. The cost of implementing environmental mitigation has not been included.

8.2.10 All corridor options cross many lower voltage overhead lines (33 kV and below), and therefore these low voltage lines are not included as they are not considered to be a significant cost differentiator.

Table 8-1 — Indicative Cost of Technology

Technology	Indicative Rating for Double Circuit	No. of Conductors on each Pylon Arm	Indicative Cost for Double Circuit Route
400 kV overhead line	6930MVA (2 x 3465MVA)	3 conductors per phase (9 per circuit)	£3.98m/km

8.3 Indicative Results

8.3.1 **Table 8-2** and **Table 8-3** provide the cost estimates for the potential route corridors and connections to existing infrastructure to the north of Carlisle (Option A) and to the south of Carlisle (Option B) respectively. These are based on route lengths and the National Grid cost factors taken from historic project outturn data. It is currently assumed that the Proposed Development will be developed as an overhead line and therefore consideration has not been given to costs associated with undergrounding. The indicative route lengths and overall costs (including secondary costs) are for the sections of route which would fall in England only. As described in **Section 8.1,** the sections of route which would fall in Scotland have been excluded.

Table 8-2 — Indicative Cost Summary where substation located north of Carlisle (Option A)

Ref.	Route Corridor Description	Indicative Route Length (km)	Capital and Lifetime Cost (£m)	Secondary Cost (£m)	Indicative Overall Cost (£m)
1	Core Route Corridor 1	17.9	133	4	137
2	Core Route Corridor 2	25	186	2	188
3	Core Route Corridor 3	18.6	138	1	140

4	Core Route Corridor 4 using segment 4a	28	208	1	210
5	Core Route Corridor 4 using segment 4b	39.4	293	1	295
6	Core Route Corridor 5 using segment 4a	34.8	259	7	266
7	Core Route Corridor 5 using segment 4b	46.2	344	7	351

Table 8-3 – Indicative Cost Summary where substation located south of Carlisle (Option B)

Ref.	Route Corridor Description	Indicative Route Length (km)	Capital and Lifetime Cost (£m)	Secondary Cost (£m)	Indicative Overall Cost (£m)
1	Core Route Corridor 1 + segment 5a, 5b	40.6	302	16	318
2	Core Route Corridor 2 + segment 5a, 5b	47.7	355	14	369
3	Core Route Corridor 3 + segment 5a, 5b	41.3	307	13	321
4	Core Route Corridor 4 + segment 5a, 5b using segment 4a	50.7	377	13	391
5	Core Route Corridor 4 + segment 5a, 5b using segment 4b	62.1	462	13	475
6	Core Route Corridor 5 + segment 5a, 5b using segment 4a	57.5	428	19	447
7	Core Route Corridor 5 + segment 5a, 5b using segment 4b	68.9	513	19	532
8	Core Route Corridor 1 + segment 5a, 5c, 5d	37.0	275	7	283
9	Core Route Corridor 2 + segment 5a, 5c, 5d	44.1	328	5	333
10	Core Route Corridor 3 + segment 5a, 5c, 5d	37.7	281	5	285

Ref.	Route Corridor Description	Indicative Route Length (km)	Capital and Lifetime Cost (£m)	Secondary Cost (£m)	Indicative Overall Cost (£m)
11	Core Route Corridor 4 + segment 5a, 5c, 5d using segment 4a	47.1	351	5	355
12	Core Route Corridor 4 + segment 5a, 5c, 5d using segment 4b	58.5	435	5	440
13	Core Route Corridor 5 + segment 5a, 5c, 5d using segment 4a	53.9	401	11	412
14	Core Route Corridor 5 + segment 5a, 5c, 5d using segment 4b	65.3	486	11	497

Note to **Table 8-3**:

- Substation Siting Areas within Core Route Corridor 1-5 and within Core Route Corridor 1-5 + segment 5a, 5b are located at more than 2km from the existing 400 kV Harker-Hutton line. Therefore, costs of overhead lines for these options, have been estimated assuming that a 400 kV overhead connection from the Siting Area to the existing Harker Substation and a new 400 kV overhead line connection from the Siting Area to the England-Scotland border would be implemented.
- Substation Siting Area within Core Route Corridor 1-5 + segment 5a, 5c, 5d are within 2km from the existing 400 kV Harker-Hutton line. Therefore, costs of overhead lines for these options, have been estimated assuming that a connection from the Siting Area to the Harker-Hutton line and a 400 kV overhead line connection from the Siting Area to the England-Scotland border would be implemented. The length of the connection from the Siting Area to the Harker-Hutton line has been assumed as 2km for the purposes of providing a consistent approach to cost estimation across the options.

8.4 Conclusion

8.4.1 Twenty-one end-to-end connection route corridor options (to include Core Route Corridors with different segment options) were appraised on cost in conjunction with the technical and environmental appraisals as part of the options appraisal process. These indicative cost assessments are shown in **Table 8-2** and **Table 8-3** above. Cost assessments considered the length of the new overhead line required for each option utilising National Grid cost factors per km for new overhead line and also considered significant engineering and environmental constraints based on preliminary data (secondary costs). Costs for items such as the required substation which would be

similar for each option were not included as the cost would be comparable for each option, and it is only the costs associated with length of overhead line that is a significant differentiator. Preliminary indicative route lengths are shown in **Table 8-2** and **Table 8-3**. When comparing these indicative costs, the following was noted:

- Core Route Corridor 1 and Core Route Corridor 3 would have the lowest indicative cost of all options due to reduced route length to the Scottish border, with Core Route Corridor 1 marginally the lower.
- Core Route Corridors 4 and 5 have two indicative cost variants, depending on inclusion of either segment 4a or segment 4b in the route. Core Route Corridor 4 with segment 4a and Core Route Corridor 5 with segment 4a comprise lesser overall route length and therefore cost.
- Core Route Corridor 2, Core Route Corridor 4 using segment 4a and Core Route Corridor 5 using segment 4a all have costs within approximately 20% of their mean value. That is not considered significantly different given the level of detail in the design and accuracy of costing conducted at this preliminary stage and therefore not a differentiator when considering options.

9. Option Selection

9.1 Introduction

9.1.1 The options appraisals for the substation Siting Zones and Siting Areas, and the end-to-end route corridors are presented in **Chapter 6** and **Chapter 7** respectively.

9.1.2 As part of Step 8 of the CPRSS methodology described in **Chapter 4** (Step 8: Confirm Emerging Preferred Siting Zone, Siting Areas and Corridor and Develop Graduated Swathe for Consultation), the options appraisal findings were reviewed to identify the emerging preferred options based on a comparative appraisal of the environmental, socio-economic and engineering and systems aspects, as well as consideration of indicative costs. The outcome of this was to identify two emerging preferred options: one route corridor and substation option to the north of Carlisle, and one route corridor and substation option to the south of Carlisle.

9.1.3 The review of the options to select the emerging preferred corridors and substation siting areas considered the need case for the Proposed Development itself, as well as the role of the Proposed Development as part of a network of other regional reinforcement projects, as described in **Section 1.2**.

9.1.4 The Proposed Development would meet the need for provision of the section in England of a new circuit between South East Scotland and North West England. The strategic proposal identified in the SOR for the overall Project, includes the siting of a new substation in the Carlisle area as part of the Proposed Development. Therefore, to satisfy the requirements of the Proposed Development, the options selection process identified an emerging preference for a route corridor and substation option to the north of Carlisle. This is referred to in this CPRSS as Option A.

9.1.5 The Proposed Development alone does not address the entirety of the B6 boundary capacity and capability shortfall described in **Section 1.2**. Other projects in conjunction with the Proposed Development would be required to achieve this. Whilst these other projects fall outside of the scope of this CPRSS, their interactions with the Proposed Development and the need to consider the Projects in a coordinated manner, would introduce additional considerations to the routeing and siting of the new infrastructure forming part of the Proposed Development. A substation located to the south of the Carlisle would facilitate the connection of the Proposed Development and other regional reinforcement projects identified by the Beyond 2030 report. Therefore, to facilitate the delivery of the wider regional network capacity, the options selection process also identified an emerging preference for a route corridor and substation option to the south of Carlisle. This is referred to in this CPRSS as Option B.

9.1.6 Therefore, both options will be progressed for further development and Stage 1 consultation. This is to maintain future flexibility for the development of the Proposed Development as part of a network of projects to meet the wider regional need.

9.1.7 On this basis, the Step 8 process was undertaken in the following stages:

- Stage 1: Review options for the Core Route Corridor to the north of Carlisle and identify an emerging preferred option;

- Stage 2: Review the substation Siting Zones and Siting Areas within the core route corridor identified as the emerging preference in Stage 1 and identify an emerging preferred substation Siting Zone and Siting Area option within that corridor;
- Stage 3: Review the substation Siting Zones and Siting Areas outside the route corridor identified as the emerging preference in Stage 1 as a confirmatory check that the route corridor and Siting Area identified in Stages 1 and 2 remain the emerging preference overall;
- Stage 4: Review the substation Siting Zones and Siting Areas to the south of Carlisle and identify an emerging preferred option; and
- Stage 5: Review options for the route corridor to the south of Carlisle and identify an emerging preferred option.

9.1.8 The outcome of Stages 1-3 identifies the emerging preferred option north of Carlisle. The outcome of Stages 4 and 5 would identifies the emerging preferred option south of Carlisle.

9.1.9 This chapter summarises the outcomes of the comparative appraisals undertaken, with reference to the five stages set out above. It presents a summary of the determinative factors in identifying the emerging preferred route options and substation Siting Areas.

9.1.10 The emerging preferred route options and associated substation Siting Areas are considered to provide the most appropriate overall solutions taking into account the need case and wider regional reinforcements as well as environmental, socio-economic, engineering and technical constraints and considering indicative costs.

9.1.11 As the design progresses, regular reviews will be undertaken to ensure the emerging preferred options taken forward at this stage remain the preferred route options. This will be informed by consultation responses and future design development including progress of the other Projects that form part of the wider regional strategy. Ultimately, only one of the identified emerging preferred options will be taken forward for the Proposed Development following Stage 1 consultation.

9.2 Stage 1: Review Core Route Corridors north of Carlisle

9.2.1 Stage 1 of the options selection process was to identify the emerging preferred route corridor north of Carlisle. This would be the emerging preferred corridor for Option A to meet the requirements described in **paragraph 9.1.4**. The identified preferred corridor would provide the core route corridor which would comprise a 400 kV overhead line connection between the new Carlisle substation and the England-Scotland border, and a 400 kV overhead line connection between the new Carlisle substation and the existing Harker substation.

9.2.2 This section provides:

- A summary of the constraints for each of the five Core Route Corridors 1-5 north of Carlisle described in **Section 7.2** to **Section 7.6;**
- A comparative appraisal of the options, considering the environmental, socio-economic and engineering and systems aspects and indicative costs; and
- A summary of key factors in identifying the emerging preferred option.

9.2.3 The constraints identified for the Core Route Corridors north of Hadrian's Wall WHS, and used to undertake the comparative appraisal, are shown in **Table 9-1.**

Table 9-1 — Summary of Key Constraints for Core Route Corridors 1 to 5

Sub-topic	Core Route Corridor 1	Core Route Corridor 2	Core Route Corridor 3	Core Route Corridor 4	Core Route Corridor 5
Environmental					
Landscape and visual	• Traverses varied landscapes. • Open, flat landscape in north-western section of corridor (segment 1a). • Open and uninterrupted views to the Solway Firth and Lakeland Fells in north-west section of corridor (segment 1a) • Presence of existing energy infrastructure and major roads within southern section of corridor (segment 1e and 1d). • Areas of settlement mainly avoided by the corridor. Presence of dispersed properties and denser residential clusters within the southern section of the corridor (segment 1e and 1e). • Presence of sparse PRoW network and of some NCN routes within the corridor. • Proximity to: Solway Coast National Landscape (1.1km) and Hadrian's Wall Path National Trail (2.6km) in England; Langholm Hills Regional Scenic Area (4.4km) in Scotland.	• Traverses varied landscape. • Presence of existing energy infrastructure and major roads within southern section of corridor (segment 1e and 1d). • Areas of settlement mainly avoided by the corridor. Presence of dispersed properties and denser residential clusters within the southern section of the corridor (segment 1e and 1d). • Presence of sparse PRoW network and of some NCN routes within the corridor. • Proximity to: Solway Coast National Landscape (1.1km) and Hadrian's Wall Path National Trail (2.6km).in England; Langholm Hills Regional Scenic Area (1km) in Scotland.	• Traverses varied landscapes. • Presence of existing energy infrastructure and major roads within southern section of corridor (segment 1e and 1d). • Areas of settlement mainly avoided by the corridor. Presence of dispersed properties and denser residential clusters within the southern section of the corridor (segment 1e and 1d). • Proximity to: Solway Coast National Landscape (1.1km) and Hadrian's Wall Path National Trail (2.6km) in England; Langholm Hills Regional Scenic Area (1.3km) in Scotland.	• Traverses varied landscapes. • Presence of existing energy infrastructure and major roads within southern section of corridor (segment 1e and 1e). • Areas of settlement mainly avoided by the corridor. Presence of dispersed properties and denser residential clusters within the southern section of the corridor (segment 1e and 1d). • Proximity to: Solway Coast National Landscape (1.1km and Hadrian's Wall Path National Trail (2.6km) in England; Langholm Hills Regional Scenic Area (5.5km) in Scotland; • Narrow valley of the Liddel Water present (within segment 4a). • Large-scale upland forested landscape (within segment 4a). • Expansive upland landscape dominated by coniferous plantations, open grassland and moorland (within segment 4b) • Proximity to the Dark Sky Park (from segment 4b)	• Traverses varied landscapes. • Presence of existing energy infrastructure and major roads within southern section of corridor (segment 1e). • Areas of settlement mainly avoided by the corridor. Presence of dispersed properties and denser residential clusters within the southern section of the corridor (segment 1e). • Proximity to: Solway Coast National Landscape (1.1km) and Hadrian's Wall Path National Trail (2.6km) in England; Langholm Hills Regional Scenic Area (6.2km) and Narrow valley of the Liddel Water present (within segment 4a). in Scotland; • Large-scale upland forested landscape (within segment 4a). • Expansive upland landscape dominated by coniferous plantations, open grassland and moorland (within segment 4b) • Core Paths (one within segment 4b and one located to the west of the segment)
Historic environment	• Proximity to or presence of various assets located in England include: ○ Solway Moss Registered Battlefield (70m east of segment 1d). ○ Grade II listed property (Alstonby Hall) present (in	• Proximity to or presence of the following assets in England section of the corridor: ○ Proximity to Solway Moss Registered Battlefield (70m west of the corridor)	• Proximity to or presence of the following assets in England section of the corridor: ○ Proximity to Solway Moss Registered Battlefield (70m west of corridor).	• Proximity to or presence of the following assets in England section of the corridor: ○ Proximity to Solway Moss Registered Battlefield (70m west of corridor).	• Proximity to or presence of the following assets in England section of the corridor: ○ Solway Moss Registered Battlefield (70m east of corridor).

Sub-topic	Core Route Corridor 1	Core Route Corridor 2	Core Route Corridor 3	Core Route Corridor 4	Core Route Corridor 5
	the northern section of segment 1e). ○ Proximity to Grade II* property (Netherby Hall) (within 1.5km northeast of segment 1b). • Proximity to section of Hadrian's Wall WHS buffer with reduced sensitivity to change (adjacent to the southern boundary of corridor). • Proximity to the Scots' Dyke scheduled monument (NHLE 1016860 and HES ID SM660) located in Scotland (within 130m of corridor)	○ Grade II listed property (Alstonby Hall) present in the northeast section of segment 1e. ○ Scheduled Liddel Strength motte and bailey castle and fortified tower present within segment 2c. • Proximity to the Scots' Dike scheduled monument (NHLE 1016860 and HES ID SM660) within 300m south of segments 2a and 2c at the England-Scotland border. • Proximity to section of Hadrian's Wall WHS buffer with reduced sensitivity to change (adjacent to the southern boundary of corridor). • Category B listed Woodslee House present in the segment 2c located in the Scottish side of the England-Scotland boarder.	○ Grade II listed property (Alstonby Hall) present in segment 1e. ○ Proximity to section of Hadrian's Wall WHS buffer with reduced sensitivity to change (adjacent to the southern boundary of corridor). • Scheduled Kirk Hill enclosure located on the eastern boundary of segment 3 in Scotland. • Proximity to Castleton former church complex in Scotland (within 100m from the north boundary of segment 3).	○ Grade II listed property (Alstonby Hall) present in segment 1e. ○ Proximity to Currick Long Cairn (within 60m east of segment 4b) ○ Proximity to section of Hadrian's Wall WHS buffer with reduced sensitivity to change (adjacent to the southern boundary of corridor). • Long Knowe Long Cairn (within 1.1km to the north-west of segment 4b) located in Scotland.	○ Grade II listed property (Alstonby Hall) present in segment 1e. ○ Section of Hadrian's Wall WHS buffer with reduced sensitivity to change (adjacent to the southern boundary of corridor). ○ Currick Long Cairn (60m east of segment 4b) • Long Knowe Long Cairn (1.1km NW of segment 4b) located in Scotland.
Ecology	• Proximity to designated sites in England include: ○ River Eden SAC (within 1km) and Solway Firth SAC, SPA, Ramsar Site and SSSI (within 1.3km). ○ Black Snib SSSI (within 150m) ○ Scaleby Moss SSSI present. • Presence of designated sites in Scotland within the corridor include: • Raeburn Flow SAC and SSSI within the western part of segment 1a. ○ Greenwrae Flow, Cowgarth Flow, and Cadgill Flow LNCS present. • Areas of priority habitat present throughout the corridor. • Proximity to parcels of areas of ancient woodland (within 50m-100m of the corridor boundary).	• Proximity to the following designated sites in England: ○ River Eden SAC, located (within 1km of segment 1e), Solway Firth SAC, SPA, Ramsar Site and SSSI (within 1.3km west of the corridor). ○ Proximity to Black Shib SSSI (within 150m east of segment 1d). ○ Scaleby Moss SSSI located within segment 1e ○ Lyne Woods SSSI within segment 2e • The Bell's Flow SSSI present within segment 2a in Scotland. • Areas of priority habitat present throughout the corridor. • Proximity to parcels of areas of ancient woodland (within 50m-100m of the corridor boundary).	• Proximity to or presence of the following designated sites in England: ○ River Eden SAC (within 1km), ○ Solway Firth SAC, SPA, Ramsar Site and SSSI (within 1.3km), ○ Proximity to Black Shib SSSI (within 150m). ○ Scaleby Moss SSSI (segment 1e), Lyne Woods SSSI (segment 2e) and Jockie's Syke SSSI (segment 3) are present. ○ Proximity to Penton Linns SSSI (150m from the eastern boundary of segment 3). • Langholm–Newcastleton Hills SPA and SSI (within 60m) in Scotland. • Proximity to parcels of areas of priority habitat present located within 50m–100m throughout the corridor.	• Proximity to or presence of the following designated sites in England: ○ River Eden SAC (within 1km), ○ Solway Firth SAC, SPA, Ramsar Site and SSSI (within 1.3km), ○ Bolton Fell Moss SAC (within 2.9km from segment 2e) ○ Scaleby Moss SSSI present in segment 1e, ○ Lower Lyne Woods SSSI present in segment 2e ○ Border Mires, Kielder – Butterburn SAC (immediately east of segment 4b) ○ Black Shib SSSI (within 150m east of segment 1d), • Proximity to or presence of the following designated sites in Scotland:	• Proximity to or presence of the following designated sites in England: ○ River Eden SAC (within 1km of segment 1e), ○ Solway Firth SAC, SPA, Ramsar Site and SSSI (within 1.3km west of the corridor), ○ Proximity to Bolton Fell Moss SAC (within 100m east of segment 4e) ○ Border Mires, Kielder – Butterburn SAC (immediately east of segment 4b) ○ Walton Moss SAC (1.2km east of segment 4e) ○ Scaleby Moss SSSI present within segment 1e. ○ Black Shib SSSI (within 150m east of segment 1d) ○ Lyne Woods SSSI (close to the west boundary of segment 4e).

Sub-topic	Core Route Corridor 1	Core Route Corridor 2	Core Route Corridor 3	Core Route Corridor 4	Core Route Corridor 5
			• Proximity to areas of ancient woodland (within 50m-100m of the corridor boundary).	○ Langholm–Newcastleton Hills SPA and SSI (within 4km). ○ Kershope Bridge SSSI on the Scottish side of the England-Scotland border • Areas of priority habitat present in various segments. • Proximity to areas of ancient woodland (within 50m-100m of the corridor boundary).	○ Border Mires, Kielder – Butterburn SAC (immediately east of segment 4b) • Kershope Bridge SSSI on the Scottish side of the England-Scotland border. • Proximity to or presence of the following designated sites in Scotland: ○ Langholm–Newcastleton Hills SPA and SSI (within 4km west of segment 4a). • Areas of priority habitat present in various segments. • Proximity to areas of ancient woodland (within 50m-100m of the corridor boundary).
Other environmental constraints (water, geology and soils)	• Flood Zone 3 within the corridor. • Peat and peaty soils (likely avoidable) within the present within the corridor.	• Flood Zone 3 within the corridor. • Groundwater Dependent Terrestrial Ecosystem within the corridor. • Notable and expansive areas of peat within the corridor, particularly in segment 2a and in the north of segment 2b.	• Flood Zone 3 within the corridor. • Groundwater Dependent Terrestrial Ecosystem. • Peat and peaty soils distributed throughout the corridor, particularly within the northern areas (segment 3). Within this segment and west of Newcastleton, it is unlikely that the mapped areas of peat can be avoided.	• Flood Zone 3 present within the corridor. • Groundwater Dependent Terrestrial Ecosystem within the corridor. • Peat and peaty soils distributed throughout the corridor, particularly within the northern areas (segment 4a and 4b). Unavoidable within segment 4b.	• Flood Zone 3 present within the corridor. • Groundwater Dependent Terrestrial Ecosystem within the corridor. • Peat and peaty soils distributed throughout the corridor, particularly within the northern areas (segment 4a and 4b). Unavoidable within segment 4b. • Akenshaw Burn, a Local Wildlife and Geological Site.
Socio-economic					
Economic activity (including Planning)	• MSA (except segment 1c). • Grade 2 ALC (BMV) land • Presence of energy applications associated with Harker substation. • A number of major non-energy related applications • PRoWs and NCN 7 and 10 present. • No NSIPs • A small extent of segment 1a overlaps with Scottish Application (ECU00004999)	• MSA (except 1c and 2a) • No NSIPs or s36/37 projects. • Presence of energy applications associated with Harker substation. • Major energy (e.g. BESS) and non-energy (e.g. warehousing) applications near Harker Substation. • Proximity of Segment 2a in Scotland to the proposed Bloch Wind Farm	• MSA (except segment 1c). • No NSIPs but proximity to major energy applications associated with Harker Substation. • Presence of energy applications associated with Harker substation. • Liddesdale Wind Farm (Scoping stage) in Scotland at approximately 200m east of segment 3. • A number of major non-energy applications.	• MSA in various segments • No NSIPs but proximity to energy applications associated with Harker Substation. • Presence of energy applications associated with Harker substation. • A number of other major non-energy applications. • Proximity to Liddesdale Windfarm in Scotland • Community receptors.	• MSA in various segments. • No NSIPs or s36/37 projects • Presence of energy applications associated with Harker substation.

Sub-topic	Core Route Corridor 1	Core Route Corridor 2	Core Route Corridor 3	Core Route Corridor 4	Core Route Corridor 5
			• Community receptors.		
Aviation and defence	• Within Tactical Training Area. • 5.3km from Carlisle Airport.	• Within Tactical Training Area. • 5.3km from Carlisle Airport.	• Within Tactical Training Area. • 5.3km from Carlisle Airport.	• Within Tactical Training Area. • 5.3km from Carlisle Airport.	• Within Tactical Training Area. • 3.3km from Carlisle Airport.
Traffic and transport	• Intersected by M6. • Crossed by four A roads, one B road, two NCNs, and PRoWs.	• Intersected by M6. • Crossed by three A roads, three B roads, two NCNs and PRoWs.	• Intersected by M6. • Crossed by three A roads, two B roads, two NCNs, PRoWs. Scottish Core Paths.	• Intersected by M6. • Crossed by three A roads, one B road, two NCN, PRoWs.	• Intersected by M6. • Crossed by three A roads, two B roads, two NCNs, PRoWs.
Engineering and systems					
Technical	• Existing 400 kV, 275 kV and 132 kV overhead line present within the corridor. • NWEP present. • Hallburn Wind Farm present in England. • Existing 400 kV overhead line present in Scotland.	• Existing 400 kV, 275 kV and 132 kV overhead line present. • Hallburn Wind Farm present in England. • NWEP present. • An existing high-pressure gas pipeline runs through the southern part of segment 2c. •	• Existing 400 kV, 275 kV and 132 kV overhead line. • NWEP present. • Former shallow coal mine workings, mine entries, and probable shallow workings present	• Existing 400 kV, 275 kV and 132 kV overhead line. • Hallburn Wind Farm present in England. • NEWP present. • Communication tower located at the northern end of segment 4b	• Existing 400 kV, 275 kV and 132 kV overhead line. • Hallburn Wind Farm present in England. • NWEP present. • Communication tower is present at the north of segment 4b and in the northwest corner of segment 4e.
Cost (indicative)	• £137m based on 17.9km route length within England.	• £188m based on 25km route length within England.	• £140m based on 18.6km route length within England.	• £210m based on 28km route length within England (corridor using segment 4a). • £295m based on 39.4km route length within England (corridor using segment 4b).	• £266m based on 34.8km route length within England (corridor using segment 4a). • £351m based on 46.2km route length within England (corridor using segment 4b).

Comparative appraisal of Core Route Corridor options north of Carlisle

9.2.4 The corridor options north of Carlisle presented a range of environmental, socio-economic and/or technical constraints.

9.2.5 Core Route Corridors 1, 2 and 3 fall within open landscapes which could increase susceptibility to impacts as a result of overhead lines. Overhead lines in Core Route Corridor 1 and Corridor 2 in particular would be prominent in the currently uninterrupted views to Solway Firth and Lakeland Fells, and Core Route Corridor 3 would be close to the Regional Scenic Area near Langholm Hills. Core Route Corridor 4 and Route Corridor 5 would be longer than the other route corridor options, and therefore more present in the landscape. However, Core Route Corridor 4, provides stronger opportunities for mitigation by use of landform and existing forestry in the middle part of the corridor, and in the northern part offers opportunities for integrating overhead lines into forested upland landscapes in a way which would limit landscape and visual effects. Route corridor segment 4a is more sparsely settled than segment 4b, which would reduce the potential visual impact on receptors. Core Route Corridor 4 using segment 4a was identified as the more preferable option for landscape and visual.

9.2.6 Core Route Corridors 1 and 2 would have the potential for historic environment impacts in relation to the setting of designated sites, including the Scot's Dike scheduled monument and the scheduled Liddel Strength motte and bailey castle and fortified tower in Core Corridor 2. Both Core Route Corridors 2 and 3 had potential to impact Category B listed buildings across the border in Scotland. Core Route Corridors 4 and 5 would be further from high value assets, with the setting of assets in proximity to parts of these corridors screened by woodland and through topography. Core Route Corridor 4 was identified as the marginally more preferable option for historic environment.

9.2.7 All corridor options had the potential for ecological impacts, with the corridors intersecting, or in proximity to, statutory and non-statutory designated sites, including SAC, SSSI, LNCS, and areas of ancient and priority woodland. Core Route Corridor 4 was identified as having fewer impacts on European designated sites, with Core Route Corridor 4 using segment 4a the more preferable option as it would avoid the risk of indirect effects at Border Mires, Kielder–Butterburn SAC and Kielder Mires SSSI.

9.2.8 All corridor options included areas of Flood Zone 3, and all except Core Route Corridor 4 included WFD-designated waterbodies. As all options would have broadly similar constraints, consideration of water environment was not a key differentiator in selecting the preferred option.

9.2.9 Core Route Corridors 1 and 2, and the southern part of Core Route Corridor 5 had the least potential for disturbance of peat areas. Core Corridors 3 and 4 included peat and peaty soils throughout much of the corridors. Whilst it would be likely that peat could be avoided through design through in most parts, it could not be avoided in the northern part of Core Corridor 3 or in segment 4b of Core Corridors 4 and 5, therefore these options were the least preferable for geology and soils.

9.2.10 All corridor options included some areas within MSA and/or Mineral Consultation Areas, as well as agricultural land of varying quality across all the options. There would be somewhat more agricultural land constraints in Core Route Corridor 1 compared to the other corridors, however as overhead lines do not generally substantively constrain agricultural use, ALC land was not a key differentiator in selecting the preferred option.

In addition, planning and economic activity constraints were not considered a key differentiator in selecting the preferred option.

9.2.11 Core Route Corridor 1 and Core Route Corridor 2 were identified as providing better transport access compared to the other corridor options, as they were located closest to roads with A and B road classifications. Core Route Corridor 1 was identified as the more preferable option for transport on the basis that it provided marginally better access to A roads compared to Core Route Corridor 2. The other corridors were all further from A and B classification roads and would likely require widening or similar localised works to enable construction of the Proposed Development and were therefore considered less preferable.

9.2.12 Core Route Corridors 2, 3, 4 and 5 would be similar to each other in terms of technical constraints, requiring routeing design to avoid high voltage overhead lines, and requiring crossings of lower voltage overhead lines. The NWEP intersects segment 1e which would be included in all route options and in addition a high pressure gas pipeline is within Core Route Corridor 2. Core Route Corridor 4 using segment 4a was identified as the more preferable option as it contained the fewest technical constraints in terms of overhead lines, particularly in the northern part of the corridor where it would avoid interaction with communication towers that are located in segment 4b. Core Route Corridor 1 would require the section of overhead line within segment 1a, (which would be located in Scotland and would not form part of the Proposed Development) to cross an existing 400 overhead line in Scotland (the licence holder for this is SPT). Although the overhead line in this segment would form part of the Scottish section of the Project rather than part of the Proposed Development, this interaction was considered as part of the comparative appraisal to identify the most preferable route corridor option from a technical perspective.

9.2.13 Core Route Corridor 3 was the more preferable option with regard to topography, with Core Route Corridors 4 and 5 crossing more undulating areas and therefore with more challenging topography. However, from a geotechnical perspective, Core Route Corridor 3 included coal mining areas which could pose a risk to development and would need to be avoided. The other Core Route Corridors identified some geotechnical constraints, all of which could be managed through design, with Core Route Corridor 2 identified as the marginally more preferable option.

9.2.14 The indicative cost estimates identified at this stage are described in **Chapter 8**, which presents the indicative costs for the sections of route corridors for the Proposed Development (i.e. in England only). Core Route Corridor 1 and Core Route Corridor 3 would have the lowest cost of all options. Core Corridors 2 and 5 would have similar costs. Core Route Corridor 4 using segment 4b would be the highest cost, as it would provide the longest route to be delivered by National Grid Although Core Route Corridor 1 would be the lowest cost for the Proposed Development (i.e. the section of the Project in England only), the estimates did not include costs associated with the route within Scotland and therefore also excluded the cost associated with crossing the 400 kV line in segment 1a in Scotland as part of the Scottish section of the Project. This would not form part of the cost of the Proposed Development and the cost has not been estimated. However, the crossing would be likely to result in an increased cost for the Scottish section of the Project, which is subject to a separate routeing exercise conducted by SP Energy Network.

Summary of key factors in identifying the Core Route Corridor option north of Carlisle

9.2.15 Core Route Corridor 4 was considered to provide the most preferable option when considering landscape and visual, historic environment, ecology and overhead line technical complexity considerations. Although there was some variance between topics as to the preference for segment 4a or 4b at the northern extent of the corridor, on balance, Core Route Corridor 4 using segment 4a was selected as the emerging preferred option. This option was considered the preferred environmental and technical option, with landscape and ecology constraints being particular determining factors.

9.2.16 Whilst transport, topography and geotechnical considerations, identified different options as more preferable, there were no constraints identified which would outweigh the benefits of Core Route Corridor 4 identified for the other topics. It was considered that mitigation, including siting and design, would limit the potential for impacts arising from the constraints identified in Core Route Corridor 4 for these topics.

9.2.17 Core Route Corridor 4 using segment 4a would provide a more expensive option based on the indicative cost, compared to some of the other options. However, when considering all aspects of the appraisal, the higher indicative cost of this option was outweighed by the preferable environmental and technical solution which would be realised through Core Route Corridor 4.

9.2.18 At the conclusion of Stage 1 of the options selection process, Core Route Corridor 4 option using segment 4a was therefore identified as the emerging preferred route corridor north of Carlisle.

9.3 Stage 2: Review of Carlisle substation Siting Zones within the identified emerging preferred corridor north of Carlisle

9.3.1 Following Stage 1, and the identification of Core Route Corridor 4 as the emerging preferred option for the corridor north of Carlisle, Stage 2 reviewed the substation Siting Zones within the preferred corridor. The two Siting Zones within Core Route Corridor 4 comprised:

- CSZ2: containing Siting Areas CSZ2.A, CSZ2.B and CSZ2.C; and
- CSZ4: containing Siting Areas CSZ4.A, CSZ4.B and CSZ4.C.

9.3.2 This section provides:

- A summary of the constraints for the substation Siting Areas within each of the two Siting Zones within the emerging preferred core route corridor**;**
- A comparative appraisal of the Siting Areas within each Siting Zone, considering the environmental, socio-economic and engineering and systems aspects; and
- A summary of the key factors in identifying the overall emerging preferred Siting Area from across the Siting Zones.

9.3.3 The constraints identified for the substation Siting Areas north of Carlisle, and used to undertake the comparative appraisal, are shown in **Table 9-2.**

Table 9-2 ─ Summary of Key Constraints for the CSZ2 and CSZ4 Siting Areas

Sub-topic	CSZ2.A	CSZ2.B	CSZ2.C	CSZ4.A	CSZ4.B	CSZ4.C
Environmental						
Landscape and visual	• Relatively open and elevated position, with limited containment and mature vegetation.	• Ridge line on the northern boundary with a locally distinctive tree line susceptible to impacts. • Proximity to residential properties and PRoW.	• Lower-lying position with mature vegetation along boundaries.	• Presence of mature vegetation, with proximity to existing infrastructure (M6 and Harker substation).	• Limited vegetation, with presence of residential properties and PRoWs. • Proximity to existing infrastructure (Harker Substation and overhead lines).	• Presence of mature vegetation in the northern and central sections. More open and rolling landscape within the southern section. • Proximity to existing infrastructure (overhead line).
Historic environment	• Grade II and II* listed buildings (Netherby Hall and associated buildings) within 2km.	• Grade II* listed Brackenhill Tower and Brackenhill Farmhouse within 1km.	• Grade II* Brackenhill Tower and Grade II Brackenhill Farmhouse within 200m.	• Grade II listed buildings (Newton Farmhouse and Firbank Farmhouse) within 1km. • Hadrian's Wall WHS buffer within 800m, with scheduled	• Grade II milestone on the A7, immediately to the west. • Hadrian's Wall WHS within 1km, with scheduled monuments defining the	• Grade II listed building (Houghton Hall) within 1km. • Hadrian's Wall WHS within 100m, with scheduled monuments

Sub-topic	CSZ2.A	CSZ2.B	CSZ2.C	CSZ4.A	CSZ4.B	CSZ4.C
				monuments defining the WHS at more than 4km.	WHS at more than 4km.	defining the WHS at more than 2.2km.
Ecology	• Lyne Woods SSSI within 2.8km. • Lockies Wood within 200m. • Proximity to ancient woodland (Carwinley and Wisk Woods). • 9.7km from Solway Firth SPA, SAC, Ramsar Site and SSSI.	• Adjacent to the Lyne Woods SSSI. • Within SSSI IRZ. • Proximity to Hobbie's Beck and Dry Beck. • 11km from Solway Firth SPA, SAC, Ramsar Site, and SSSI.	• Lyne Woods SSSI within 200m. • Within SSSI IRZ. • Fragmentation of line of trees connecting to Lyne Wood. • 10km from Solway Firth SPA, SAC, Ramsar Site, and SSSI.	• 2km from Solway Firth Ramsar site, SAC, SPA and SSSI. • Parcels of priority deciduous woodland.	• 4.1km from Solway Firth Ramsar site, SAC, SPA, and SSSI. • 1.2km from Scaleby Moss SSSI.	• 7km from Solway Firth Ramsar site, SAC, SPA, and SSSI. • 140m from Scaleby Moss SSSI. • Parcel of ancient woodland (Mapus Wood). • Parcels of priority deciduous woodland.
Other environmental constraints (water, geology and soils)	• Spring present.	• No notable constraints. • Peat and peaty soils present.	• Small reservoir present.	• Section of Flood Zone 2 associated with Rockcliffe Beck present. • Peat and peaty soils present.	• Watercourses and drains present.	• Intersected by Rockcliffe Beck. • Peat and peaty soils present in southern part of Siting Area.
Socio-economic						

Sub-topic	CSZ2.A	CSZ2.B	CSZ2.C	CSZ4.A	CSZ4.B	CSZ4.C
Economic activity (including Planning)	• Within a MSA for sand and gravel.	• Within a MSA for sand and gravel.	• Within a MSA for sand and gravel.	• Entirely within a MSA for sand and gravel. • Moor House farm complex adjacent to road within the Siting Area. • Energy applications within 2km including BESS application.	• MSA within a small section of the Siting Area. • Energy applications within 3km including BESS application.	• MSA within a small section of the Siting Area. • Energy applications within 1.7km including BESS application.
Aviation and defence	• Within Tactical Training Area.	• Within Tactical Training Area.	• Within Tactical Training Area.	• No notable constraints.	• No notable constraints.	• No notable constraints.
Traffic and transport	• Vehicular access to Siting Area is limited.	• Intersected by a C road and Public Footpath 101006. • Vehicular access to Siting Area is limited.	• Intersected by a C road and Public Footpath 101010. • Vehicular access to Siting Area is limited.	• Intersected by Public Footpaths 137008 and 137009, NCN 10 and two unnamed roads that connect to the A7.	• Intersected by Footpath 137001, NCN10 and two C roads.	• Intersected by Footpaths 137007, 132016, 137002 and 137003 and two C roads.
Engineering and systems						

Sub-topic	CSZ2.A	CSZ2.B	CSZ2.C	CSZ4.A	CSZ4.B	CSZ4.C
Technical	• Intersected by existing DNO overhead line.	• Intersected by existing DNO overhead line. • Alluvium present.	• Intersected by existing DNO overhead line.	• Intersected by existing DNO overhead line. • Intersected by two 132 kV lines. • Former brick and tile works (Todhills Brick and Tile Works) to the north of the Siting Area.	• Intersected by existing DNO overhead line. • Intersected by two 132 kV lines. • Intersected by NWEP. • Adjacent to DNO substation.	• Intersected by existing DNO overhead line. • Intersected by NWEP. • Former Brick Works (Blackford) in the Siting Area. • Alluvium present.

Comparative appraisal of substations north of Carlisle

9.3.4 The Siting Areas within CSZ4 would have mixed landscape and visual constraints. CSZ4.A would be closer to a concentration of energy infrastructure, Harker substation and the M6, and therefore within a landscape less sensitive to change and less likely to result in impacts compared to the other Siting Areas in both CSZ4 and CSZ2. On this basis CSZ4.A would be the more preferable option for landscape and visual. The northern part of Siting Area CSZ4.C would have the opportunity for mitigation screening to limit impacts, and locating a substation in this part of the Siting Area would be preferable to the southern part of CSZ4.C. CSZ4.B and all the Siting Areas within CSZ2 would be more constrained and less preferable due to smaller scale and open landscapes and limited potential for mitigation.

9.3.5 Whilst there were some historic environment constraints identified for all of the Siting Areas in both CSZ2 and CSZ4, it was considered that potential for impacts on designated assets at all Siting Areas would be limited. CSZ4.A and the northern part of CSZ4.C were identified as the more preferable options. CSZ2.C would provide the most constrained option due to its proximity to the Grade II* listed Brackenhill Tower associate assets.

9.3.6 The review did not identify a preference between the better performing Siting Areas within Siting Zone CSZ2 and Siting Zone CSZ4 for ecology, with Siting Areas CSZ2.A and CSZ4.B identified as the least ecologically constrained options overall. Siting areas CSZ2.C and CSZ4.C would have similar constraints, with priority deciduous and ancient woodland respectively within the Siting Areas. CSZ2.B would potentially be constrained by its proximity to Lyne Woods SSSI. CSZ4.C would potentially be constrained by its proximity to Scaleby Moss SSSI and the presence of ancient woodland; however, locating the substation in the northern extent of the Siting Area would avoid the ancient woodland and reduce ecological constraints.

9.3.7 As all options would have broadly similar water environment and geology and soils constraints, with the potential to mitigate any impacts, these topics were not key differentiators in selecting the preferred option. Similarly, consideration of planning and economic activity were not key differentiators.

9.3.8 Siting zone CSZ4 would be the preferred option for transport, on the basis of its proximity to the A7. Access to CSZ2 would be via rural roads, with the A7 located over 3km from the Siting Zone. Within CSZ4, Siting Areas CSZ4.B and CSZ4.C were the more preferable options. Although access from Siting Area CSZ4.C would require some widening works, this was not considered a major constraint.

9.3.9 The review did not identify an overall preference between Siting Zone CSZ2 and Siting Zone CSZ4 for engineering technical constraints. Existing DNO overhead lines pass over all the Siting Areas in CSZ2 and CSZ4, which would require diversion to avoid constraining a substation within this Siting Zone. Within CSZ4, an NWEP runs through the Siting Areas CZS4.B and CSZ4.C and would need to be avoided. Overall from a technical perspective, Siting Area CSZ4.C was identified as a more preferable option within Siting Zone CSZ4 on the basis that there would be greater flexibility for substation siting.

9.3.10 Siting Zone CSZ4 was identified as the preferable Siting Zone in terms of geotechnical and topography constraints. Siting areas CSZ4.B and CSZ4.C were broadly similar, and whilst the southern part of CSZ4.C identified areas of peat, the northern part of the CSZ4.C would not have this constraint.

Summary of key factors in identifying the emerging preferred option

9.3.11 On balance, Siting Zone CSZ4 was more preferable compared with Siting Zone CSZ2, on the basis that it is subject to fewer constraints, including for landscape and visual, historic environment, transport and geotechnical considerations. In particular, the landscape context with existing energy infrastructure and the better accessibility via the A7 identified CSZ4 as a more suitable location.

9.3.12 Within Siting Zone CSZ4, a range of different constraints were identified for each of the Siting Areas, with each Siting Area having the potential for impacts or requiring mitigation. On balance, Siting Area CSZ4.C was considered to perform more favourably across the broadest range of the environmental, socio-economic, and engineering aspects considered. The northern part of CSZ4.C specifically was identified as the preferred location within the Siting Area, as this part of the site had fewer constraints and a lower potential for impacts.

9.3.13 Therefore, at the conclusion of Stage 2 of the options selection process, substation Siting Area CSZ4.C was selected as the emerging preferred substation Siting Area north of Carlisle.

9.4 Stage 3: Review of substation Siting Zones outside the emerging preferred route corridor north of Carlisle

9.4.1 Following Stage 2, a review of the other substation Siting Zones to the north Carlisle was undertaken. The purpose of this review was to provide a confirmatory check that the emerging preferred Siting Area CSZ4.C within the emerging preferred core route corridor identified in Stage 2 remained the emerging preferred option when compared to the other Siting Areas located outside the corridor identified as emerging preferred in Stage 1. The two Siting Zones reviewed as part of Stage 3 were:

- CSZ1: two Siting Areas CSZ1.A and CSZ1.B; and
- CSZ3: three Siting Areas CSZ3.A, CSZ3.B and CSZ3.C.

9.4.2 Early in the Stage 3 review, Siting Area CSZ1.A was identified as a less preferable option due to the proximity to Scots' Dyke scheduled monument and the potential for impacts on the setting of the monument. Similarly, there would be potential for impacts on the designated Corries Mill Bridge in Scotland from both Siting Areas CSZ1.A and CSZ1.B. In addition, access to CSZ1 would be via an unclassified road, with the A7 located approximately 3km from the Siting Zone. These constraints, when considered in isolation would not necessarily be determinative in the appraisal. However, when compared to the other Siting Zones considered in the Stage 2 review, on the basis it would not provide a substantially better performing option and would be outside the identified emerging preferred corridor option, CSZ1 was not subject to further consideration as part of the Stage 3 review.

9.4.3 Siting Zone CSZ3 was reviewed and was also identified as a less preferable option on the basis of the potential adverse effects to ecology, particularly due to proximity to Lyne Woods, Solway Firth, Scaleby Moss and Bolton Fell and Walton Mosses SSSI and the ecological connectivity between the Siting Zone and European designated sites. In addition, CSZ3 would be constrained by traffic access due to distance from A and B roads. Therefore, on the basis that it would not provide a substantially better performing

option and would be outside the identified emerging preferred corridor option, CSZ3 was also not subject to further consideration as part of the Stage 3 review.

9.4.4 The conclusion of the Stage 3 review confirmed that Siting Area CSZ4.C, located within the identified emerging preferred corridor identified at Stage 2, remained the emerging preferred option.

9.5 Stage 4: Review of substation Siting Zones and Siting Areas to the south of Carlisle

9.5.1 Following Stages 1 – 3 to identify the emerging preferred corridor and Siting Area north of Carlisle, the substation Siting Zones to the south of Carlisle were reviewed. As described in **Section 9.1**, the driver for identifying an emerging preferred option to the south of Carlisle was to provide infrastructure to facilitate the delivery of the wider regional network capacity.

9.5.2 The Siting Zones considered in the Stage 4 review comprised:

- CSZ5: two Siting Areas CSZ5.A, CSZ5.B;
- CSZ6 two Siting Areas CSZ6.A, CSZ6.B;
- CSZ7: one Siting Area CSZ7.A;
- CSZ8: two Siting Areas CSZ8.A, CSZ8.B; and
- CSZ9: one Siting Area CSZ9.A.

9.5.3 At the outset of the Stage 4 review, CSZ6 was removed from further consideration in the comparative appraisal on the basis of substantive transport constraints which could not be reasonably mitigated. The nearest A road (the A69) is almost 4km from the Siting Zone. Routes from the A69 would not be suitable for HGV access, with no opportunity to mitigate though widening or passing points due to substantive constraints including proximity of the roads to residential frontages and bends which restrict visibility. Constraints also include a railway level crossing which could not be widened and has long vehicle restrictions. On this basis, this Siting Zone was not considered a feasible option.

9.5.4 Siting Zone CSZ8 was also removed from further consideration primarily due to the proximity to and hydrological connectivity with the River Eden SAC/SSSI, which could result in ecological impacts, as well as the potential for landscape and visual impacts at the settlement of Hayton.

9.5.5 For the remaining Siting Zones and Siting Areas carried forward into the Stage 4 review, this section provides:

- A summary of the constraints for the substation Siting Areas within each of the three carried forward Siting Zones**;**
- A comparative appraisal of the Siting Areas within each Siting Zone, considering the environmental, socio-economic and engineering and systems aspects; and
- A summary of the key factors in identifying the overall emerging preferred Siting Area from across the Siting Zones.

The constraints identified for the substation Siting Areas south of Carlisle, and used to undertake the comparative appraisal, are shown in **Table 9-3**.

Table 9-3 – Summary of the Key Constraints for the CSZ5, CSZ7 and CSZ9 Siting Areas

Sub-topic	CSZ5.A	CSZ5.B	CSZ7.A	CSZ9.A
Environment				
Landscape and visual	• Proximity to Wetheral, Wetheral Memorial Garden and Cemetery. • Small-scale field pattern in parts, particularly near Wetheral and rural setting with limited existing infrastructure.	• Elevated and open landscape and more visible in the landscape. • Small-scale field pattern in parts, particularly and rural setting with limited existing infrastructure.	• One residential property adjacent to the Siting Area. • Visual amenity of recreational users of PRoW. • Some existing overhead line infrastructure in the vicinity.	• Existing infrastructure in landscape including the M6 / A6 corridors and overhead lines. • Undulating landform. • Visual amenity for receptors along the A6 and a PRoW that crosses the Siting Area.
Historic environment	• 500m from Grade I listed Corby Castle Registered Park and Garden. • Wetheral Priory Gatehouse and walls (Scheduled and Grade I listed), the Grade II* Church of the Holy Trinity, and the Grade I listed Corby Bridge within 1km. • Grade II listed buildings within 200m at Cumwhiton Station, • Elements of the Carlisle to Settle Railway is also located near the western boundary.	• Wetheral Priory Gatehouse and walls (Scheduled and Grade I listed) within 1km. • 200m from Grade I Corby Castle Registered Park and Garden. -	• Approximately 1km from Barrock Fell Hillfort scheduled monument. • Three Grade II listed buildings within 1km. • Elements of the Settle to Carlisle Railway within 800m.	• 1km from Scalesceugh Roman kilns site and Park House Roman Fort scheduled monuments. • Partial views from Cringles Farm Grade II listed building, 400m to the north.
Ecology	• 200m from the River Eden SAC/SSSI. • Within the River Eden SSSI IRZ.	• 100m from the River Eden SAC/SSSI. • Within the River Eden SSSI IRZ. • Within 10m of ancient and priority woodland that is functionally linked to the River Eden SAC.	• 1.2km west of the River Eden and Tributaries SSSI and within its associated IRZ. • Proximity to River Eden and tributaries which are hydrologically connected to the Solway Firth SAC, SPA, SSSI, and Ramsar site.	• River Eden SAC and SSSI within 2.5km. • Within the IRZ of both the Cotehill Pastures and Ponds SSSI and River Eden and Tributaries SSSI.
Other environmental constraints (water, geology and soils)	• Partially within Flood Zone 3. • Proximity to Pow Maughan main watercourse. • Areas of surface water ponding.	• No notable constraints.	• Intersected by tributaries of the River Eden and Pow Maughan. • Blackmoss Waterbody Pond within the Siting Area.	• Intersected by Unnamed tributary of the River Petteril. • Tributary forms part of a WFD-designated waterbody. • Wet and marshy areas present.
Socio-economic				
Economic activity (including Planning)	• Grade 2 ALC (BMV) within Siting Area. • Within a MSA for sand and gravel. • Part of site designated as open space.	• Within a MSA for sand and gravel.	• Within a MSA for sand and gravel, and sections within a MCA.	• Employment land allocation north of the B6263 adjacent to the north.
Aviation and defence	• No notable constraints.	• No notable constraints.	• No notable constraints.	• No notable constraints.

Sub-topic	CSZ5.A	CSZ5.B	CSZ7.A	CSZ9.A
Traffic and transport	• Intersected by Footpaths 138007 and 138033, bridleway 138012 and a C road (Wetheral Pastures). • Would require crossing the Settle to Carlisle railway and the Tyne Valley Line railway during construction.	• Intersected by Public Footpath 13803. • Would require crossing the Settle to Carlisle railway and the Tyne Valley Line railway during construction.	• Interested by a C road and an unclassified road. • Railway within 1km. • Access via A C road connecting to the A6.	• Intersected by the A6, the B6263, an un-named road, and Public Footpath 138040.
Engineering and systems				
Technical	• Intersected by DNO overhead line. • Intersected by NWEP in north-western corner. • Intersected by existing water pipeline. • Some small extents of alluvium along the western boundary of Siting Area.	• Intersected by DNO overhead line.	• Intersected by NWEP. • Intersected by DNO overhead line. • Intersected by two gas pipelines. • Glaciolacustrine deposits in the north-west corner.	• Intersected by DNO overhead line. • Intersected by Harker-Hutton 400 kV overhead line. • Former mine present within Siting Area, possible presence of gypsum.

Comparative appraisal of substations south of Carlisle

9.5.6 The Siting Areas within Siting Zones CSZ7 and CSZ9 (each of which only contain one Siting Area option) would have broadly similar landscape constraints, with existing infrastructure associated with the Harker-Hutton line influencing the landscape of both. There would be limited visual impacts from locating a substation in CSZ7 or CSZ9, due to limited nearby properties and existing planting which would screen a substation within these Siting Zones. In contrast, CSZ5, in particular the more open and elevated CSZ5.B, would have more potential to impact landscape character and visual amenity, lying within a relatively smaller scale landscape and close to Wetheral and other properties. On this basis CSZ5 would be less preferable to the other two Siting Zones.

9.5.7 The Siting Areas within both Siting Zones CSZ5 and CSZ7 would have the potential to impact on historic environment receptors. In particular, Siting Area CSZ5.B would have the potential for setting impacts on the Grade I Corby Castle Registered Park and Garden. Similarly, Siting Area CSZ7.A would be in proximity to the scheduled hillfort on Barrock Fell, located on high ground and which would partially overlook the Siting Area. Siting area CSZ9.A would have the fewest historic environment constraints and is therefore the preferred option for historic environment. At all three Siting Zones no impacts on the setting of the Hadrian's Wall WHS, or attributes of its OUV, would be anticipated, on the basis of distance, topography and existing screening.

9.5.8 Siting Zone CSZ5 would be in close proximity to nationally and internationally designated ecological sites, in particular the River Eden and Tributaries SSSI and SAC, with Siting Area CSZ5.B the closest to the SSSI and SAC. Siting area CSZ7.A would also be in proximity to the River Eden and Tributaries SSSI and SAC, and would have the added potential for indirect impacts on the Solway Firth. CSZ9.A would be less ecologically constrained and have lower potential for impacts compared to the other Siting Areas and is therefore the more preferable option for ecology.

9.5.9 All options would have broadly similar geology and soils constraints. Although Siting Area CSZ5.A would be partially within Flood Zone 3 and therefore be a less preferred option on the basis of potential increased flood risk, water environment was not a key differentiator in selecting the preferred option, on the basis that any impacts could be managed or mitigated. Similarly, consideration of planning and economic activity were not key differentiators.

9.5.10 Siting area CSZ9.A would be the preferred option for transport, on the basis of its proximity to the A6. Access to Siting Area CSZ7.A would be via rural roads from the A6. Access to both Siting Areas within Siting Zone CSZ5 would require crossing the Settle to Carlisle railway and the Tyne Valley Line railway which would be difficult to mitigate.

9.5.11 The review identified CSZ9.A as the preferred option in terms of civil engineering and technical considerations, on the basis that there would be fewer constraints to where a substation could be located within the Siting Area. CSZ5 would be constrained by existing DNO lines, as well as a water pipeline through CSZ5.A. There would be a NWEP pipeline and National Gas Transmission pipelines crossing CSZ7. In both Siting Zones this would provide limited flexibility on substation location, which in turn could constrain overhead line connection. CSZ5.A would have fewer geotechnical constraints and a flatter topography compared to the other Siting Areas. Part of Siting Area CSZ7.A would be constrained by steep topography, providing a more challenging location for a substation. Siting area CSZ9.A would be located in close proximity to the former Cocklakes Gypsum Mine. At this stage, the extent or condition of these workings are not

known, and further investigations would be required to develop an understanding of the extent, presence and potential condition of these former workings..

Summary of key factors in identifying the emerging preferred option

9.5.12 Siting area CSZ9.A was identified as the emerging preferred option, on the basis of fewer constraints, including for landscape and visual, historic environment, ecology, transport and technical engineering considerations. Whilst the review identified the potential for geotechnical constraints within CSZ9.A, subject to further investigations, these were not considered to outweigh the environmental and engineering benefits of CSZ9.A compared to the other Siting Areas.

9.5.13 Therefore, under Stage 4 of the options selection process, Siting Area CSZ9.A was identified as the emerging preferred Siting Area south of Carlisle.

9.6 Stage 5: Review options for the route corridor to the south of Carlisle

9.6.1 Stage 1 of the options selection process identified Core Route Corridor 4 as the emerging preferred core route corridor option to the north of Carlisle. If the new Carlisle substation were located to the south of Carlisle, this would require the alignment of Core Route Corridor 4 to be extended to the south of Carlisle.

9.6.2 As described in **Chapter 5**, two options were identified to extend the core route corridors to the south of the Carlisle:

- Core route corridors 1 to 5 to the north of Carlisle + segments 5a and 5b; and
- Core route corridor 1 to 5 to the north of Carlisle + segments 5a, 5c and 5d.

9.6.3 These options are described and appraised in **Chapter 7** and shown on **Figure 7-6** and **Figure 7-7**.

9.6.4 To provide a deliverable option to the south of Carlisle, it would be necessary for the emerging preferred substation selected at Stage 4 to be within the emerging preferred route corridor identified at Stage 5.

9.6.5 There were no proposed substation Siting Zones identified within segment 5a (see **Figure 5-12**). Therefore, if segments 5a and 5b were progressed, a Siting Area within segment 5b would also need to be progressed. Siting Zone CSZ8 was the only Siting Zone within segment 5b and, as described in **Section 9.5**, CSZ8 was discounted early in the Stage 4 review process on the basis of substantive constraints. As a result, the route corridor option for Core Route Corridor 4 + segments 5a and 5b would not be viable, as it would not provide a substation to the south of Carlisle. On this basis, Core Route Corridor 4 + segments 5a and 5b was discounted and no environmental, socio-economic and engineering comparative appraisal between the corridor options to the south of Carlisle was undertaken.

9.6.6 Therefore, at the conclusion of Stage 5 of the options selection process, Core Route Corridor 4 + segments 5a, 5c and 5d was selected as the emerging preferred route corridor to the south of Carlisle.

9.7 Summary of the identified emerging preferred route corridor options and associated substation Siting Areas

9.7.1 Following the comparative appraisal of the route corridors, Siting Zones and Siting Areas undertaken as part of Step 8 of the CPRSS, the following two emerging preferred route corridor and substation options were identified:

- Option A – North of Carlisle: Core Route Corridor 4, using segment 4a at its northern extent, with a substation located within Siting Area CSZ4.C (as shown in Figure 9-1); and
- Option B – South of Carlisle: Core Route Corridor 4 using segment 4a + segments 5a, 5c and 5d, with a substation located within Siting Area CSZ9.A (as shown in Figure 9-2).

9.7.2 Option A would provide a route corridor wholly to the north of the Hadrian's Wall WHS which would contribute to meeting the regional need but would not cross Hadrian's Wall WHS. As set out in **paragraph 3.8.1**, other projects would inevitably be required to cross Hadrian's Wall WHS to meet the overall regional need.

9.7.3 Option B would provide a route corridor crossing Hadrian's Wall WHS. It would contribute to addressing the requirement to cross Hadrian's Wall WHS as part of meeting the regional need as described in **paragraph 3.8.1**.

9.7.4 The identification of the two emerging preferred route corridor and substation options provide the necessary flexibility for the future stages and responds to both the need case for the Proposed Development, as well as the wider regional need as described in **Section 1.2**.

9.7.5 Overall, the emerging preferred route corridors and Siting Areas would provide the optimum balance between environmental, socio-economic, engineering and cost considerations.

Alignment of the emerging preferred options for the Proposed Development with the Scottish section of the Project

9.7.6 The independent comparative appraisal undertaken for the Proposed Development identified two emerging preferred options, in respect of the English section of the Project.

9.7.7 Following the options selection stage, a review was undertaken to compare the emerging preferred route corridor options for the Proposed Development with the alignment of the proposed route for the Scottish section of the Project, proposed by SP Energy Network and subject to public consultation in Autumn 2024 and Spring 2025. The purpose of this review was to provide a confirmatory check as to geographic alignment at the England-Scotland border, to ensure that the Project as a whole would be able to meet its objective of providing the necessary infrastructure to reinforce the electricity transmission system between Scotland and England, as described in **Chapter 1**.

9.7.8 This review confirmed that the emerging preferred options for the Proposed Development would geographically align with the route identified as proposed by SP Energy Networks for the Scottish section of the Project.

Figure 9-1 – Emerging preferred Option A, north of Carlisle

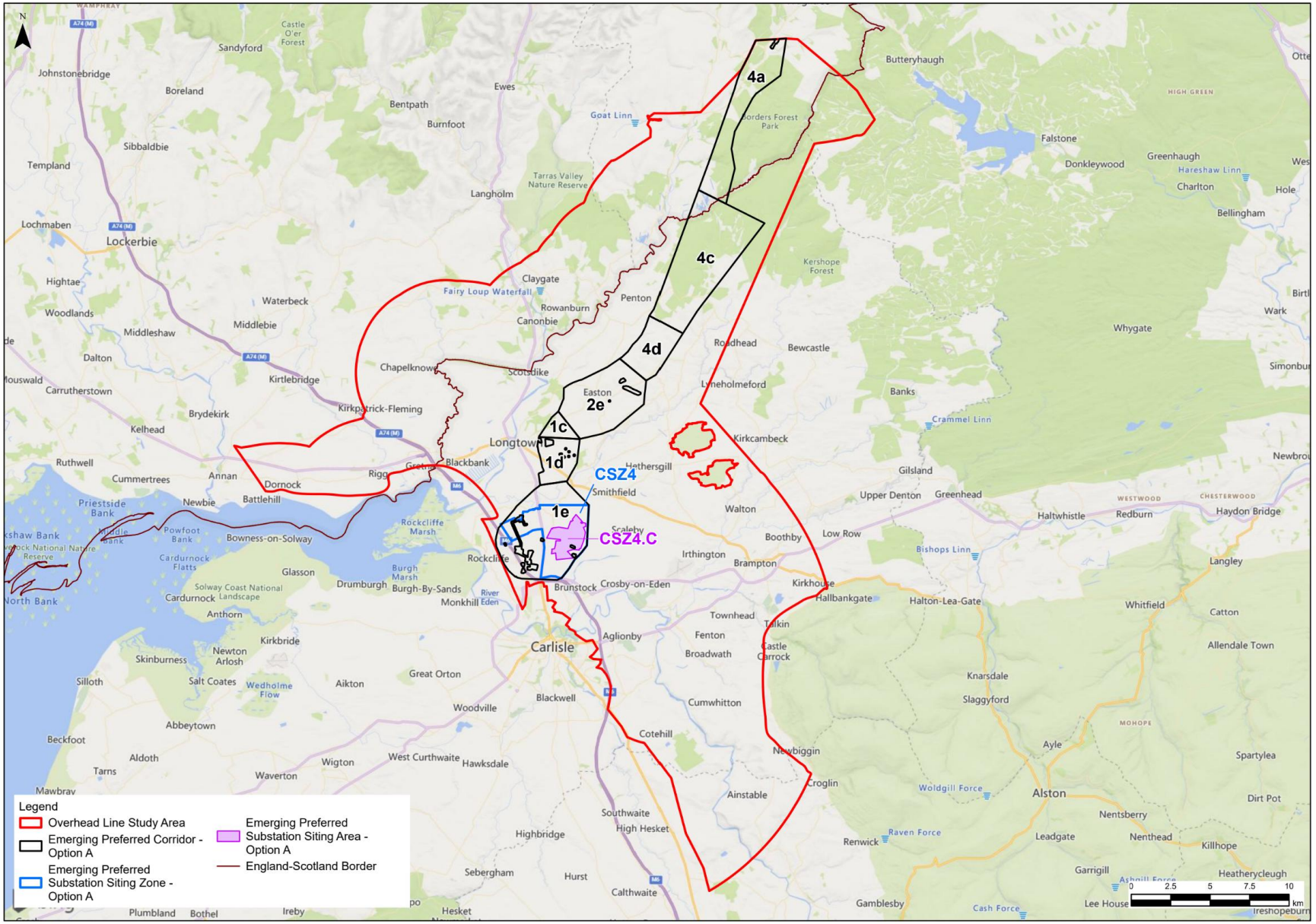
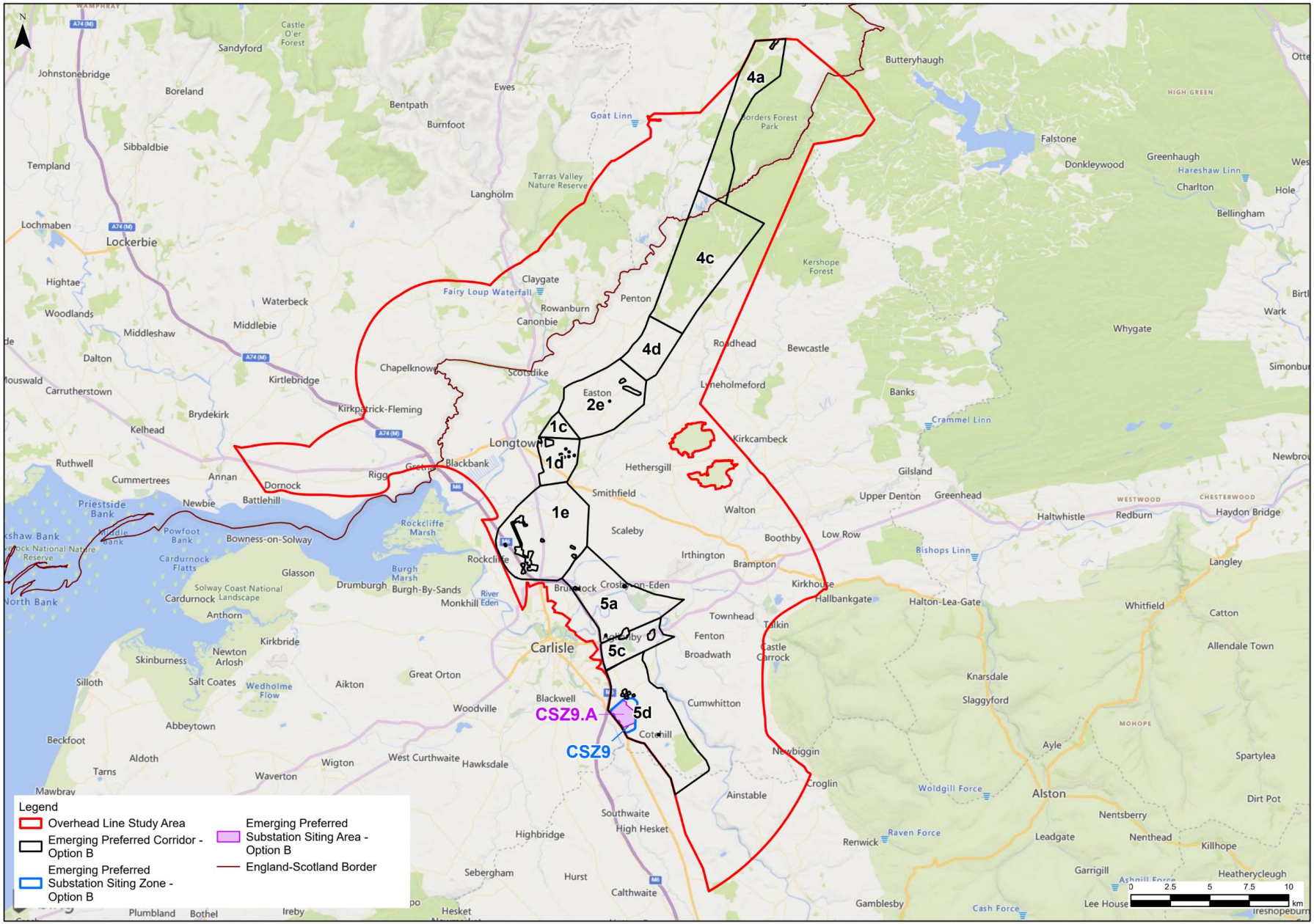


Figure 9-2 – Emerging preferred Option B, south of Carlisle



10. Development of Graduated Swathe

10.1 Introduction

10.1.1 As set out in **Section 9.7**, two emerging preferred options were selected for the Proposed Development: one route corridor and substation north of Carlisle (Option A, shown in **Figure 9-1**); and one route corridor and substation south of Carlisle (Option B, shown in **Figure 9-2**). Following the selection of the emerging preferred route corridors, preferred Siting Zones and preferred Siting Areas, a preliminary design exercise was undertaken to identify where it may be more appropriate to locate the required infrastructure within the corridors (based on the information understood about the emerging preferred route options at the time of writing this report). This exercise considered the Holford and Horlock Rules alongside local sites and features. This included features such as larger settlement areas, environmental and socio-economic constraints, and other technical and cost considerations. The outcome of this exercise is shown by a 'graduated swathe' – coloured shading of varying intensity to indicate areas more likely (darker colour) and less likely (lighter colour) to be the most suitable location of the proposed infrastructure.

10.1.2 A graduated swathe was developed for the two emerging preferred options for the Proposed Development (Option A and Option B). Figures showing the location of the proposed graduated swathe for both Option A and Option B are presented in **Section 10.3** of this chapter. Detailed plans showing the location of the proposed graduated swathe are included in **Appendix B**.

10.1.3 The graduated swathe is based on a feasible potential alignment of the new overhead line and on feasible potential new substation sites which are both preliminary and indicative. It is intended as a tool for Stage 1 consultation and engagement with communities and other stakeholders, including landowners. The feedback from Stage 1 consultation will inform further design development of the Proposed Development. The development of the graduated swathe allows for more meaningful engagement and Stage 1 consultation, prompting more beneficial feedback.

10.1.4 Within the area covered by the graduated swathe there are areas where there is greater flexibility for routeing, and areas where there is less flexibility. This is reflected in the way the width of the darker parts of the graduated swathe varies: in some areas the darker shading covers a broader area (greater flexibility), and in other areas the darker shading is more focused (lesser flexibility).

10.1.5 In some sections the graduated swathe forms two or more distinct paths, defined by local sites and features that may constrain the routeing of a new overhead line. In other places the graduated swathe follows a single path with the width varying dependent upon local sites and features and design principles, such as the preference to follow more direct routes where opportunities exist.

10.1.6 The outcomes of the analysis, as depicted in the graduated swathe, may be subject to change as the design and consenting process continues, more information becomes available, surveys are undertaken, and the views of stakeholders and communities are considered. It does not rule out development within other parts of the emerging

preferred corridor, or indeed outside of the emerging preferred corridor, if necessary, after considering these inputs.

10.1.7 As discussed in **Chapter 3**, detailed localised routeing of the new overhead line will follow the guidelines set out in the Holford Rules and other principles of good design. In order to limit the number of bulkier angle pylons and develop a more coherent design solution, opportunities will be sought to develop straight sections of route wherever practicable. Accordingly, any detailed design proposal will be a response to local environmental, technical, cost, and socio-economic considerations and will seek to follow the holistic principles of good design.

10.2 Developing the Graduated Swathe

10.2.1 The development of the graduated swathe was informed by the location of designated sites and environmental and social features within and beyond the emerging preferred route corridor options, which were identified from extensive desk-based data collection, mapping, thorough review and appraisal and confirmed by site visits.

10.2.2 The emerging preferred route corridors, Siting Zones and Siting Areas for both Option A and Option B were appraised to identify areas that may be more, or less, sensitive to the introduction of new infrastructure, then preliminary designs were developed to identify where a new overhead line may most appropriately be routed or substation located, designing in accordance with the Holford and Horlock Rules respectively. Environmental and socio-economic features, cost and technical requirements were also considered. Where the options appraisal identified potential opportunities for close parallel routes, this opportunity was considered in the development of the graduated swathe. As the design of the Proposed Development evolves, mitigation measures will be developed and assessed on a case-by-case basis.

Avoidance of properties and ancient woodland

10.2.3 The removal of larger settlements and of areas of ancient woodland from the route corridors to the extent practicable, was a key consideration in the development of route corridor options presented in **Chapter 5**. As a result, it is considered that potential impacts to larger settlements and residential properties, and on areas of ancient woodland have been avoided and/or minimised through the definition of route corridor options.

10.2.4 In developing the graduated swathe, further consideration was given to residential properties and larger settlements and to areas of ancient woodland. Known residential properties and larger settlements and a buffer zone of 25m around their boundary have been excluded from the graduated swathe. Areas of ancient woodland and a buffer zone 50m around their boundary have also been excluded from the graduated swathe.

10.2.5 Further analysis regarding potential impacts to residential properties and ancient woodland and appropriate mitigation measures will be undertaken as the Proposed Development progresses. However, as previously stated, it is anticipated that potential impacts to residential properties and ancient woodland may be avoided through the definition of route corridors options and the appropriate routing of the Proposed Development's infrastructure within the corridors.

Refinement of emerging preferred route corridor boundaries

10.2.6 In the process of developing the graduated swathe, the boundary of the emerging preferred corridors for both Option A and Option B was rationalised in some locations, to exclude parts of these corridors that are not required for the Proposed Development's infrastructure. These refinements are described below.

- The corridor boundary of segment 4d was initially drawn to provide a continuation to segments 4a and 4b (as shown in **Figure 5-12**). Once the preferred end to end route corridor was selected which incorporated segments 4d and 4a, the western part of segment 4d was removed, as it didn't allow a continuation to segment 4a. This approach also limited potential incursion of the infrastructure required for the Proposed Development into the comparatively more sensitive valley landscape along the Bailey Water. This refinement is relevant for both Option A and B, as segment 4d is within the emerging preferred corridors for both options.
- The corridor boundary of segment 5a was initially drawn to provide a continuation to segments 5c and 5b (as shown in **Figure 5-12**). Once the preferred end to end route corridor was selected which incorporated segment 5a and 5c, the western part of segment 5a was removed, as it didn't allow a continuation to segment 5c. This approach also limited potential incursion of the infrastructure required for the Proposed Development into the settlement of Newby East which includes a number of Grade II listed buildings and from an area of Priority Habitat Inventory. This refinement is relevant for Option B, as segment 5a is within the emerging preferred corridor for this option.
- The corridor boundary of segment 5c was initially drawn to provide a continuation to segments 5d and 5e (as shown in **Figure 5-12**). Once the preferred end to end route corridor was selected which incorporated segment 5c and 5d, the western part of segment 5c was removed, as it didn't allow a continuation to segment 5d. This approach also limited potential incursion of the infrastructure required for the Proposed Development into the settlement of Warwick-on-Eden and associated conservation area which includes a number of Grade II and Grade II* buildings. This refinement is relevant for Option B, as segment 5c is within the emerging preferred corridor for this option.
- The corridor boundary of segment 5d was initially drawn to include three Siting Zones: CSZ5, CSZ7 and CSZ9. The comparative appraisal undertaken at Step 8 of the CPRSS selected Siting Zone CSZ9 as the emerging preferred option. On this basis, segment 5d was reduced to terminate at the location of CSZ9 which would represent the southern terminus of the overhead line infrastructure. This refinement is relevant for Option B, as segment 5d is within the emerging preferred corridor for this option.

10.2.7 In the process of developing the graduated swathe, the boundary of the emerging preferred corridors for both Option A and Option B was marginally expanded in some locations to provide a suitable separation between potential overhead line alignments and key environmental, technical constraints.

- The corridor boundary of segment 4d was marginally extended in the north-western direction (by up 400m) to enable consideration of an overhead line alignment adjacent to the north-west boundary of the corridor segment which is suitably separated from residential properties and other sensitive ecological areas, such as priority habitat (deciduous woodland). This refinement is relevant for both Option A and B, as segment 4d is within the emerging preferred corridors for both options.

- The corridor boundary of segment 1d was marginally extended in the eastern direction in proximity to the Hallburn Wind Farm (by up to 100m). This enabled consideration of an overhead line alignment to the east of the Hallburn Wind Farm that is separated from the wind farm by a distance of up to three times the diameter of the turbine rotor, in accordance with best practice guidance[45,46]. Wind turbine clearances around the Hallburn Wind Farm will require detailed consideration at the later stages of design. This refinement is relevant for both Option A and B, as segment 1d is within the emerging preferred corridors for both options.

10.3 Description of the Graduated Swathe

10.3.1 For the purposes of Stage 1 consultation, the graduated swathe has been split into its different infrastructure components (substations and overhead line). The graduated swathes for the substations and the overhead line need to overlap to provide an end-to-end solution for the Proposed Development. The graduated swathe for the overhead line has also been split into separate sections to allow visual detail to be illustrated and discussed. These have been largely defined by geographical features and are intended to provide clarity during reporting and to aid public feedback to Stage 1 consultation. A summary of the graduated swathe for both Option A and Option B and for each infrastructure component of the Proposed Development is provided below.

Option A, north of Hadrian's Wall WHS Site

New Carlisle Substation

10.3.2 Within Siting Zone 4 (CSZ4), Siting Area CSZ4.C was identified as the emerging preferred location through the comparative appraisal as set out in **Chapter 9**. Siting Area CSZ4.C is located approximately 1.7km to the east of the existing Harker substation and approximately 200m to the east of the A7. The graduated swathe for the New Carlisle substation (Option A) is shown in **Figure 10-1**, where outline of Siting Area CSZ4.C and of Siting Zone CSZ4 is also shown.

10.3.3 Within the Siting Area emerging as preferred (CSZ4.C), outline potential substation layouts were developed by engineering specialists and reviewed by the environment specialists. This Siting Area largely avoids environmental constraints. There are parcels of priority habitat (deciduous woodland) and a small section of ancient woodland within the north-west section of the Siting Area that can be avoided by design. This Siting Area largely avoids technical constraints. There is an existing NWEP that runs through the Siting Area that will need to be considered in developing the design. An unnamed C road crosses the Siting Area from east to west. The southern section of the Siting Area (to south of the unnamed C road) is comparatively more open than the northern section of the Siting Area (to the north of the unnamed C road), where mature vegetation and tree belts provide a degree of containment and opportunities for mitigation. The northern section of the Siting Area is therefore better suited for careful siting to reduce visual and landscape impacts. On this basis, the northern section of CSZ4.C was identified as the most likely location for the infrastructure.

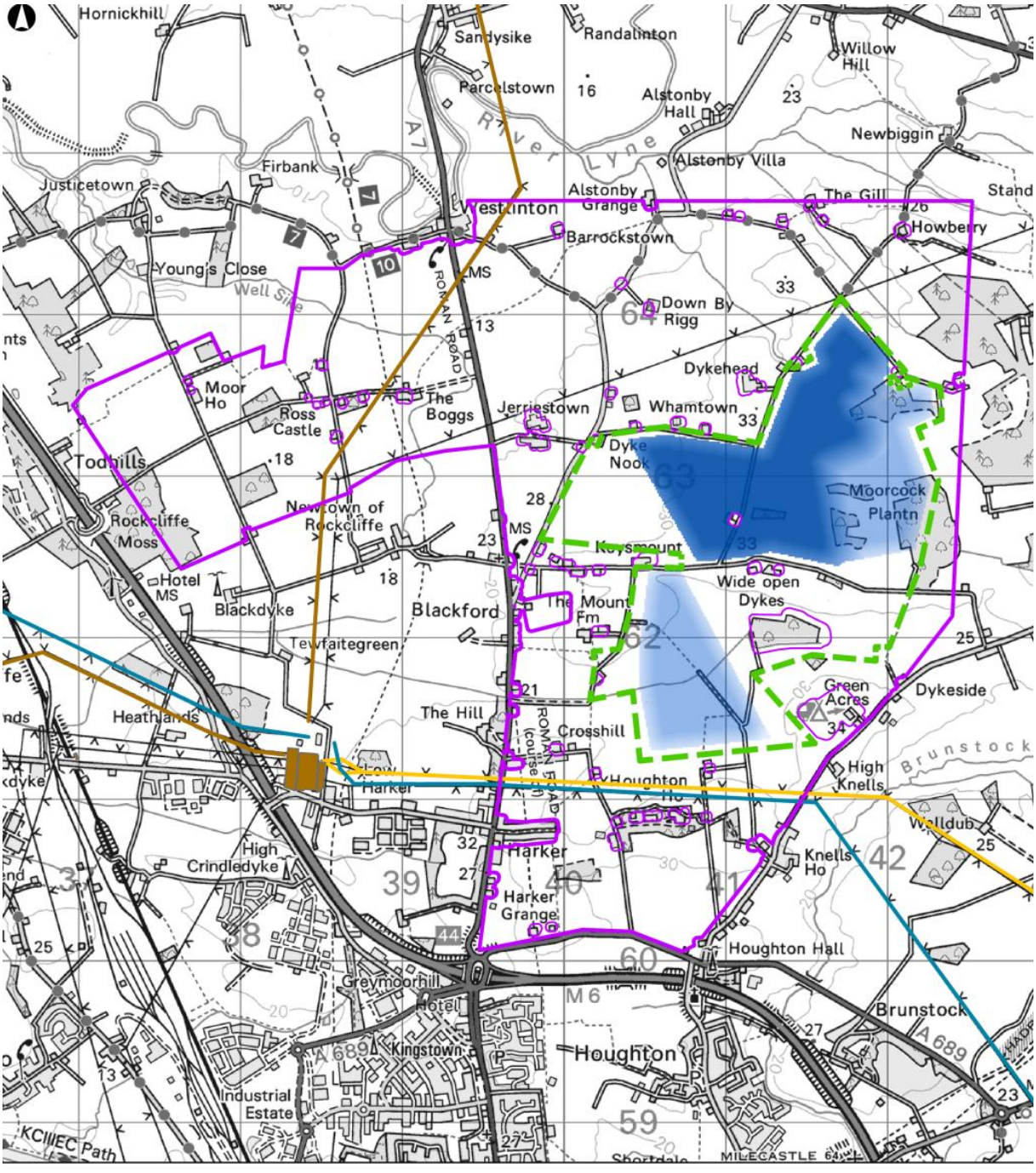
[45] National Grid. Technical Guidance Note 287. Third-party guidance for working near National Grid Electricity Transmission Equipment

[46] Engineering Recommendations (EREC). L44. Issue 2 (March 2025). Separation between Wind Turbines and Overhead Lines: Principles of Good Practice

10.3.4 The graduated swathe is larger than the actual proposed footprint of the substation (e.g. 720 x 400m) to provide flexibility to allow the design, layout and configuration to be delivered within it.

10.3.5 The graduated swathe for the new Carlisle substation is shown in **Figure 10-1**.

Figure 10-1 – New Carlisle Substation Graduated Swathe Option A, north of Carlisle



Emerging Preferred Substation Siting Zone - Option A

Substation Siting Area Option A

Existing 132kV OHL

Existing 275kV OHL

Existing 400kV OHL

Harker Substation Site

Substation Graduated Swathe – Option A

Higher Likelihood

Lower Likelihood

Substation footprint within graduated swathe is approximately 288,000m²

400m

720m

Substation footprint in map scale

Kilometers 0 10 20

Metres 0 250 500 1,000

Coordinate System: British National Grid

Credits:
Esri UK, Esri, TomTom, Garmin, FAO, METI/NASA, USGS
Contains OS data © Crown copyright and database right 2025

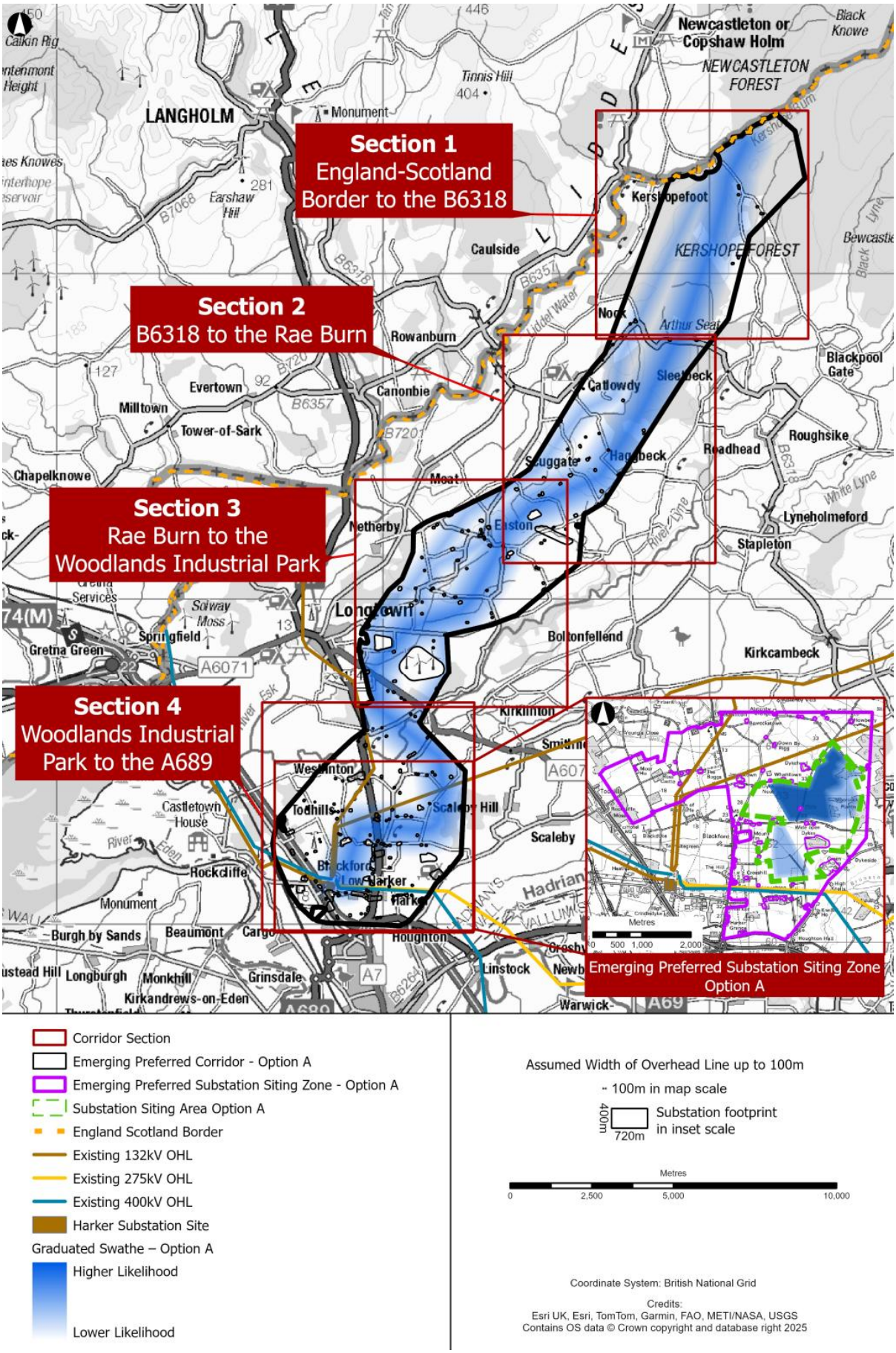
Route corridor

10.3.6 The graduated swathe for the emerging preferred route corridor is shown in **Figure 10-2**. The description of the corridor is split into four parts, each covering an approximately 6.5km wide and 7km long section of the corridor. The sections of emerging preferred route corridor, described from north to south, are as follows:

- Section 1: England-Scotland border to the B6318;
- Section 2: B6318 to the Rae Burn;
- Section 3: Rae Burn to Woodlands Industrial Park; and
- Section 4: Woodlands Industrial Park to the A689.

10.3.7 The four sections are shown in **Figure 10-3** to **Figure 10-6**. Where there are features within an area of overlap of the sections (shown as red boxes in the figures), they are described in the first section in which they appear.

Figure 10-2 – Route corridor Graduated Swathe Option A, north of Carlisle



Section 1: England-Scotland border to the B6318

10.3.8 Section 1, shown in **Figure 10-3**, commences at the England-Scotland border. The Kershope Bridge SSSI is located in Scotland and immediately to the north of the border. The graduated swathe excludes Kershope Bridge SSSI and a buffer zone of 250m from its boundary.

10.3.9 Section 1 is largely occupied by Kershope Forest, which is characterised by rugged terrain and extensive coniferous plantations forming part of the commercial forestry zone. The local landscape features steep undulations and limited access. Fields are irregular and enclosed by dense forest edge and stone walls, requiring specific design considerations for foundation construction and vegetation clearance.

10.3.10 As shown in **Figure 10-3**, in developing the graduated swathe two potential overhead line route options have been identified within Kershope Forest within Section 1. These would follow a north-east to south-west alignment routing through forestry plantation or using it to backcloth infrastructure. There are small sections of Priority Habitat within the area between the two overhead line options identified; the graduated swathe has been defined to avoid this area. The western overhead line route option within Section 1 would avoid areas of Priority Habitat. Based on information gathered from desktop surveys, the eastern overhead line route option within Section 1 would be routed within close proximity to areas of Priority Habitat Grass Moorland and Priority Habitat Blanket Bog, which are considered irreplaceable habitat; field surveys would be carried out in next stage of design to confirm the extent of Blanket Bog and Grass Moorland within these areas and inform the design of the overhead line route.

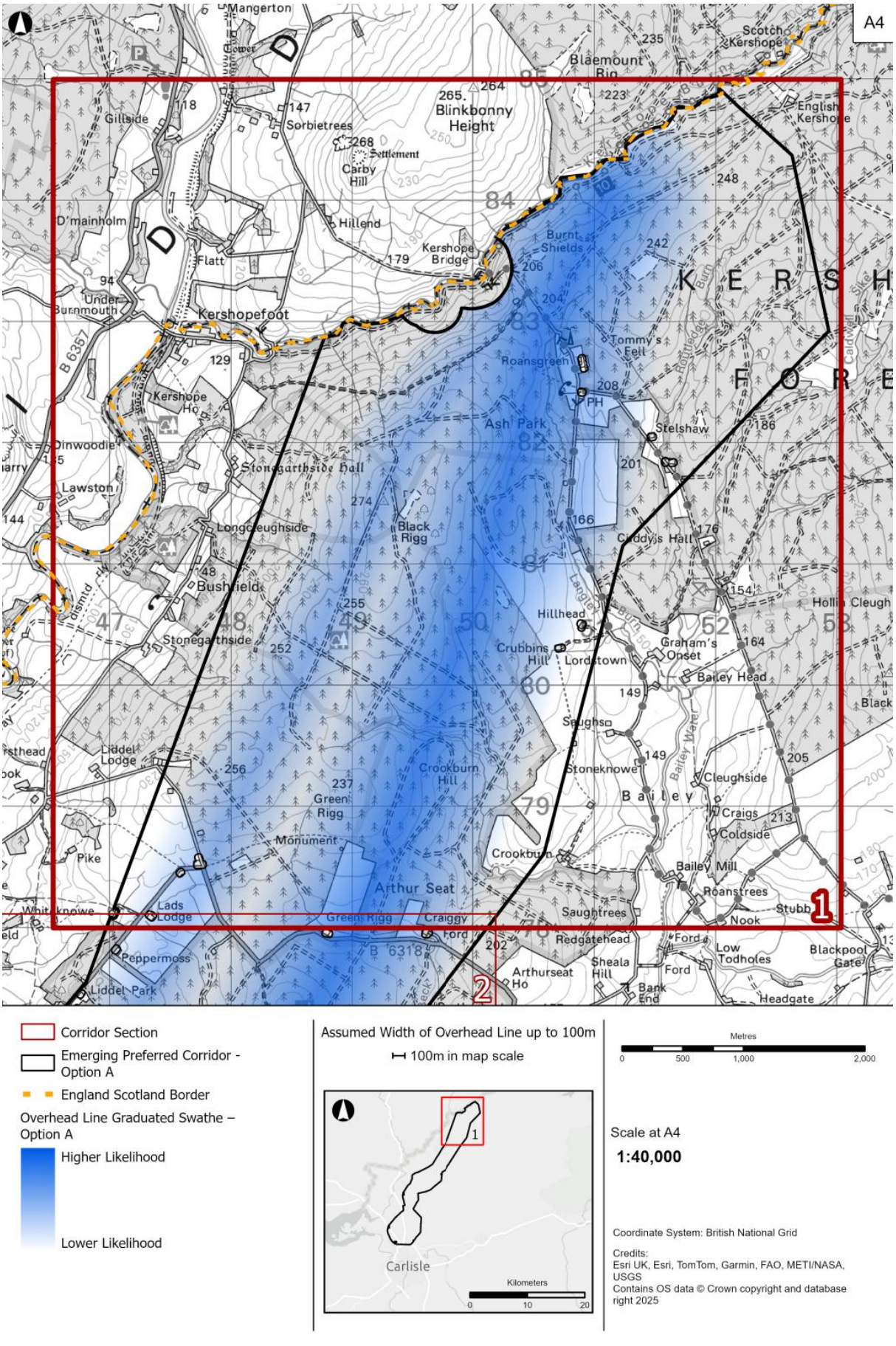
10.3.11 Few isolated residential properties are present within Section 1. The graduated swathe has been defined to avoid these properties and a buffer zone of 25m from their boundary.

10.3.12 There are no areas of ancient woodland within Section 1.

10.3.13 There is one Grade II Listed Building (Monument South of Green Rig, List Entry Number: 1335643) within Section 1, located approximately 700m to the north of the B6318. The overhead line would seek to avoid this asset.

10.3.14 Section 1 terminates in proximity to the B6318 which bisects the corridor from east to west.

Figure 10-3 – Section 1 Graduated Swathe (England-Scotland border to the B6318) Option A, north of Carlisle



Section 2: B6318 to the Rae Burn

10.3.15 Section 2, shown in **Figure 10-4**, commences in proximity to the B6318.

10.3.16 As shown in **Figure 10-4**, in developing the graduated swathe two potential overhead line route options have been identified within Section 2. Both these options would follow a north-east to south-west alignment routing through large-scale upland forested land (Kershope Forest), then transitioning into a more open rural lowland landscapes, comprising improved pasture and arable farmland with wooded river valleys. Fields are demarcated by dry stone walls and intersected by shallow watercourses and unsealed farm access tracks. The overhead line would weave through gentle ridgelines and low-lying valleys, gradually climbing in elevation as it approached the southern end of Section 2.

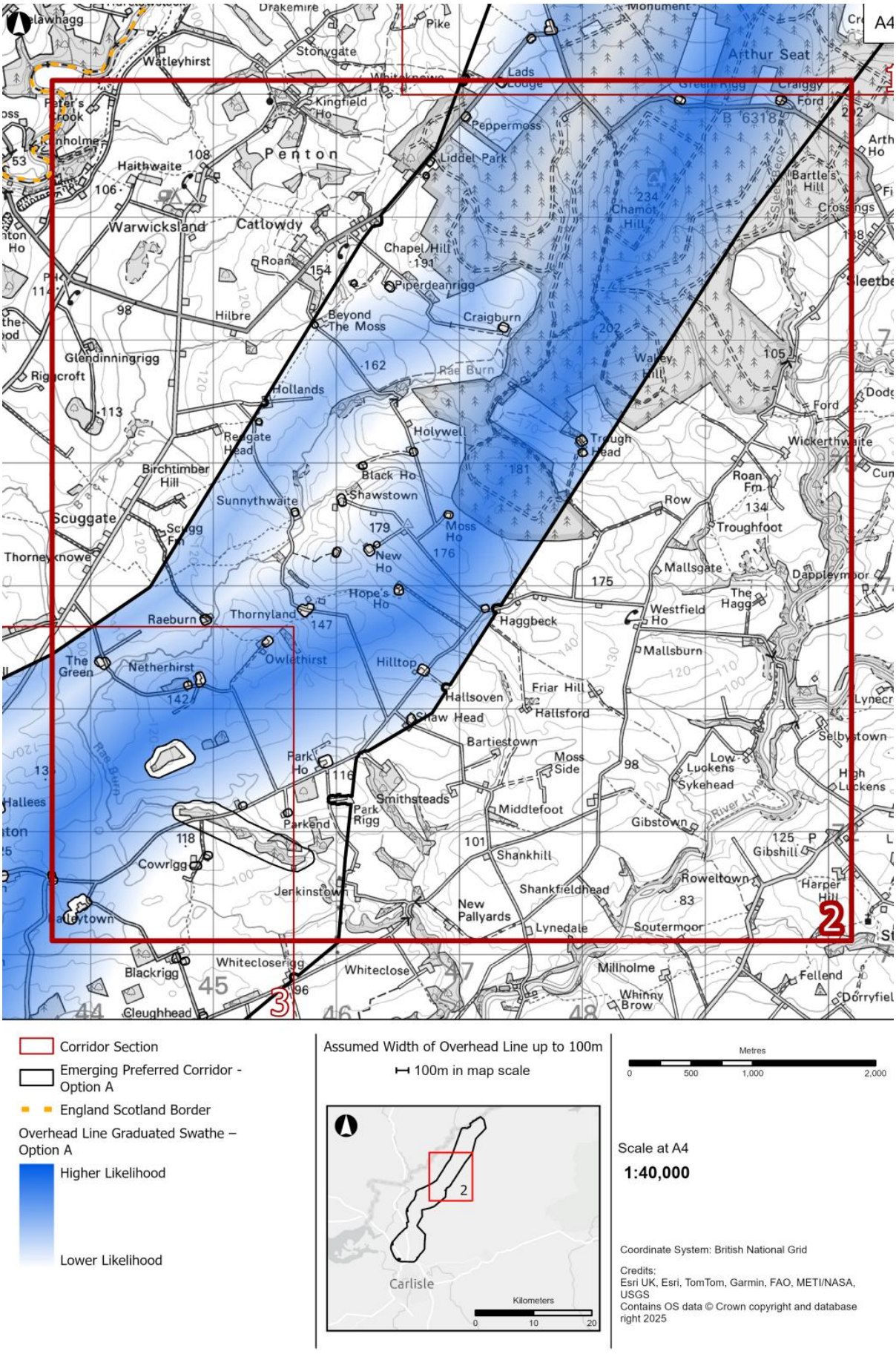
10.3.17 There are isolated residential properties located within the central area of Section 2 between the two overhead line options identified. The two overhead line options have been defined to avoid these properties including a buffer zone of 25m from their boundary.

10.3.18 There are few areas of Priority Habitat (deciduous woodland) scattered through Section 2. The overhead line would seek to avoid or limit incursion within these areas where possible. It would also limit incursion across the smaller scale, irregular landscape pattern interspersed with wooded watercourses.

10.3.19 There is one Grade II Listed Building (Thornyland Qaker Meeting House and Attached Stable, List Entry Number: 1087511) located within the central part of Section 2 and approximately 4.5m to the south of the B6318. The overhead line would seek to avoid this asset.

10.3.20 Section 2 terminates in proximity to the Rae Burn which crosses the corridor from east to west. There are two areas of ancient woodland within the southern end of Section 2, in proximity to the Rae Burn. The graduated swathe has been defined to avoid these areas and a buffer zone of 50m from their boundary.

Figure 10-4 – Section 2 Graduated Swathe (B6318 to the Rae Burn) Option A, north of Carlisle



Section 3: Rae Burn to the Woodlands Industrial Park

10.3.21 Section 3, shown in **Figure 10-5**, commences in proximity to the Rae Burn which crosses the corridor from east to west.

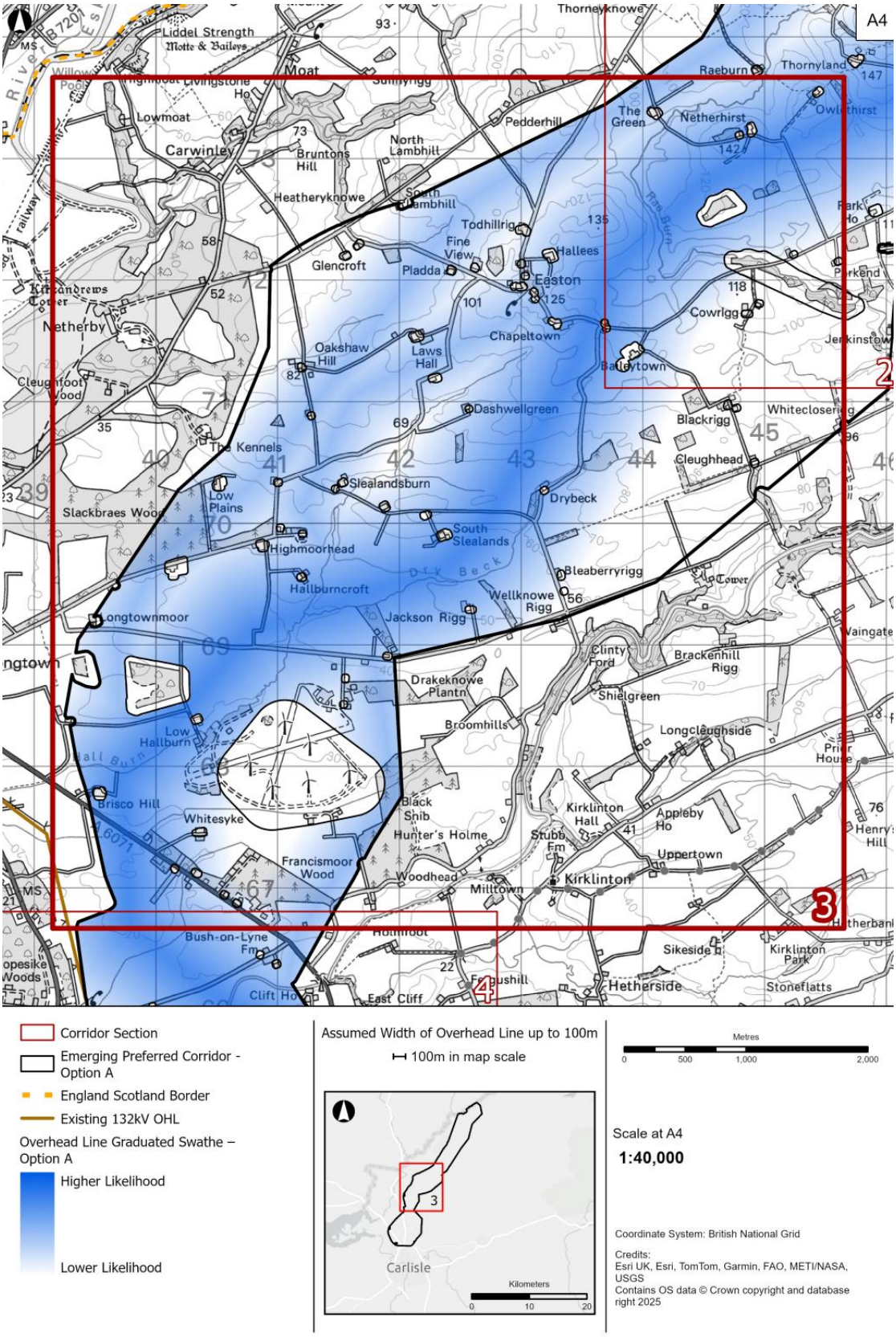
10.3.22 The northern part of Section 3 predominantly consists of mixed farmland interspersed with small areas of Priority Habitat (deciduous woodland). The northern part of Section 3 includes two areas of ancient woodland, namely Raeburn Wood (located to the north of the settlement of Cowrigg and adjacent to the Rae Burn) and Corrylees Wood (located approximately 200m to the north of the Rae Burn). It also includes few residential properties and settlements, such as the settlements of Easton and of Cowrigg.

10.3.23 As shown in **Figure 10-5**, three potential overhead line route options have been identified within the northern part of Section 3. The graduated swathe for these options has been defined to avoid areas of ancient woodland (and a buffer zone of 50m from their boundary) and residential properties and settlements (and a buffer zone of 25m from their boundary), and to provide the most direct route for the overhead line with no sharp the changes in direction in line with **Holford Rule 3**. There are areas within the northern part of Section 3 and in proximity to the eastern boundary of the corridor that include key constraints, such as an area of ancient woodland (Raeburn Wood) and scattered residential properties and settlements (the settlement of Cowrigg). Crossing these areas and avoiding key constraints would have resulted in a longer overhead line route option with additional changes in direction; therefore, these areas have been avoided.

10.3.24 The overhead line would then curve gently to follow a predominantly north to south alignment, seeking to avoid the Hallburn Wind Farm and an area of ancient woodland to the north-west of Hallburn Wind Farm. As shown in **Figure 10-5**, two overhead line route options have been identified, to the east of and to the west of Hallburn Wind Farm respectively. As indicated in **Section 10.2**, following best practice guidance, the overhead line would seek to maintain a separation distance from the Hallburn Wind Farm of up to three times the diameter of the turbine rotor. On this basis, at this stage, the graduated swathe has been developed to avoid the Hallburn Wind Farm and a buffer zone of three times the diameter of the turbine rotor; wind turbine clearances around the Hallburn Wind Farm will require detailed consideration at the later stages of design. The graduated swathe has been developed to avoid the area of ancient woodland to north-west of Hallburn Wind Farm and a buffer zone of 50m from its boundary.

10.3.25 South of Hallburn Wind Farm, the overhead line would be routed to the west of Woodlands Industrial Park and would require a crossing of the A6071. The A60701 bisects the corridor from north-west to south-east and is located immediately to the south of Woodlands Industrial Park. Section 3 terminates in proximity to Woodlands Industrial Park.

Figure 10-5 – Section 3 Graduated Swathe (Easton to the River Lyne) Option A, north of Carlisle



Section 4: Woodlands Industrial Park to the A689

10.3.26 Section 4, shown in **Figure 10-6**, commences in proximity to Woodlands Industrial Park.

10.3.27 Immediately to the south of Woodlands Industrial Park, the overhead line would require a crossing of the River Lyne. Where the overhead line crosses the River Lyne, careful structure placement and clearance will be essential to minimise impact to riparian zones.

10.3.28 After crossing the River Lyne, the overhead line would route through open farmland and low-lying pastureland dominated by agricultural use, following a north-east to south-west alignment.

10.3.29 The overhead line would then gently curve towards the south and it would cross an existing 132 kV overhead line, before terminating at the emerging preferred Siting Area for this option (CSZ4.C). While no detailed engineering design has been undertaken at this stage, a crossing of the existing 132 kV overhead line is considered feasible and can typically be managed through standard design measures (as set out in **Chapter 7**). These may include selecting taller towers to achieve compliant vertical clearances, aligning the crossing point at the mid-span of the lower-voltage line to maximise separation, or, in some cases, modifying the lower-voltage line to reduce the crossing span height.

10.3.30 There are few areas of Priority Habitat (deciduous woodland) that are scattered through Section 4. The overhead line would avoid or limit incursion within these areas where possible.

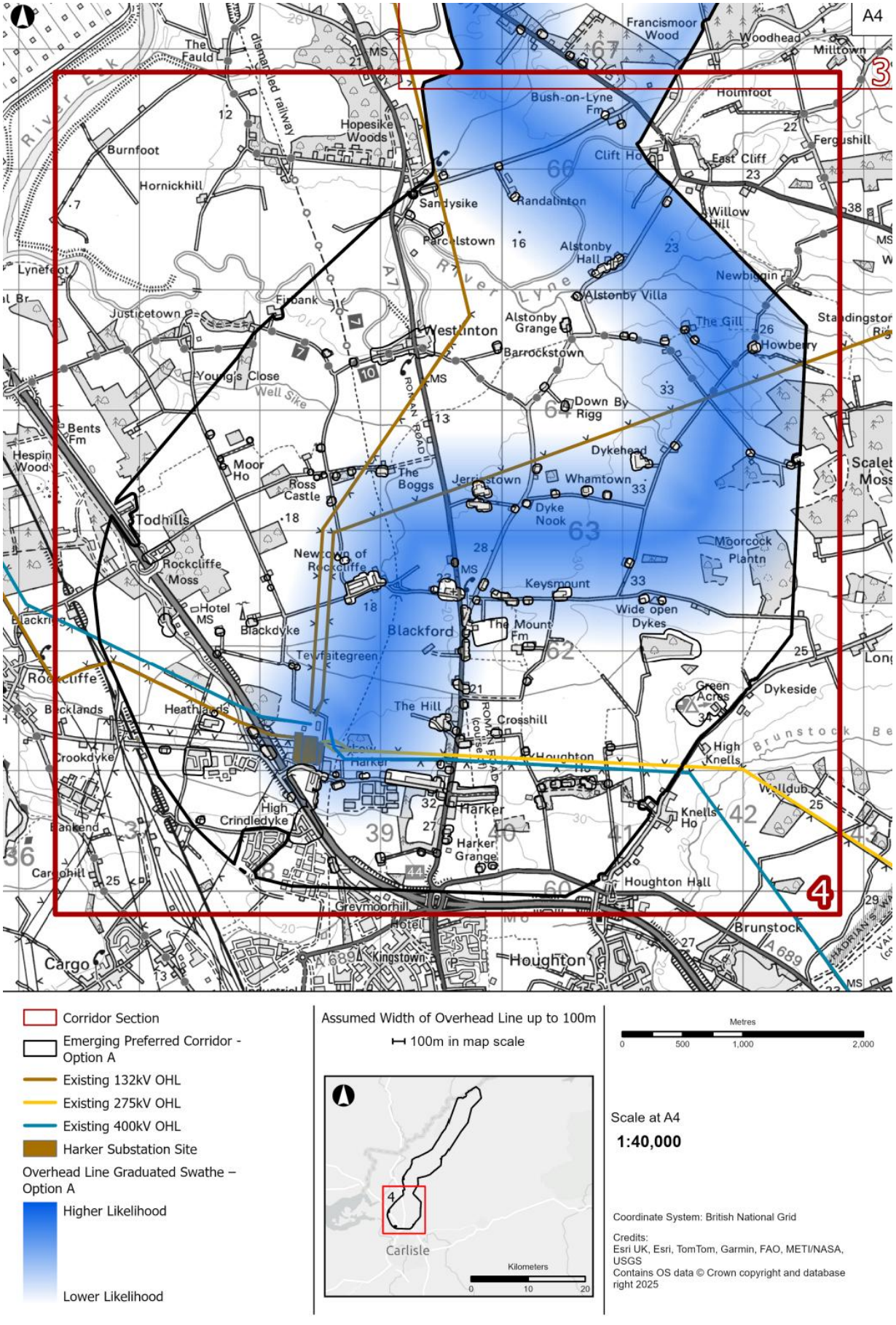
10.3.31 There is one area of ancient woodland (Mampus Wood) within Section 4 and in proximity to the emerging Siting Area for this option (CSZ4.C). There are a number of residential properties and settlements within Section 4, including the settlements of Westlinton and of Blackford. The graduated swathe has been defined to avoid areas of ancient woodland (and a buffer zone of 50m from their boundary) and residential properties and settlements (and a buffer zone of 25m from their boundary), and to provide the most direct route for the overhead line with no sharp the changes in direction in line with **Holford Rules 3**.

10.3.32 There are areas within the western part of Section 4 that include key constraints, such as areas of priority habitat (deciduous woodland), scattered residential properties and settlements (the settlement of Westlinton). Crossing these areas and avoiding key constraints would have resulted in a longer overhead line route with additional changes in direction; therefore, these areas have been avoided in the development of the graduated swathe.

10.3.33 The overhead line connection between Siting Area CSZ4.C and existing Harker substation initially follows an east to west alignment which will require a crossing of the A7 and of the NWEP. The overhead line will be routed so that towers and associated infrastructure avoid the NWEP. The overhead line would then curve to follow a north to south alignment and would terminate at the existing Harker substation.

10.3.34 Section 4 terminates in proximity to the A689.

Figure 10-6 – Section 4 Graduated Swathe (Woodlands Industrial Park to the A689) Option A, north of Carlisle



Option B, south of Carlisle

New Carlisle Substation

10.3.35 Siting Area CSZ9.A (the single Siting Area within Siting Zone CSZ9) was identified as the emerging preferred location through the comparative appraisal as set out in **Chapter 9**.

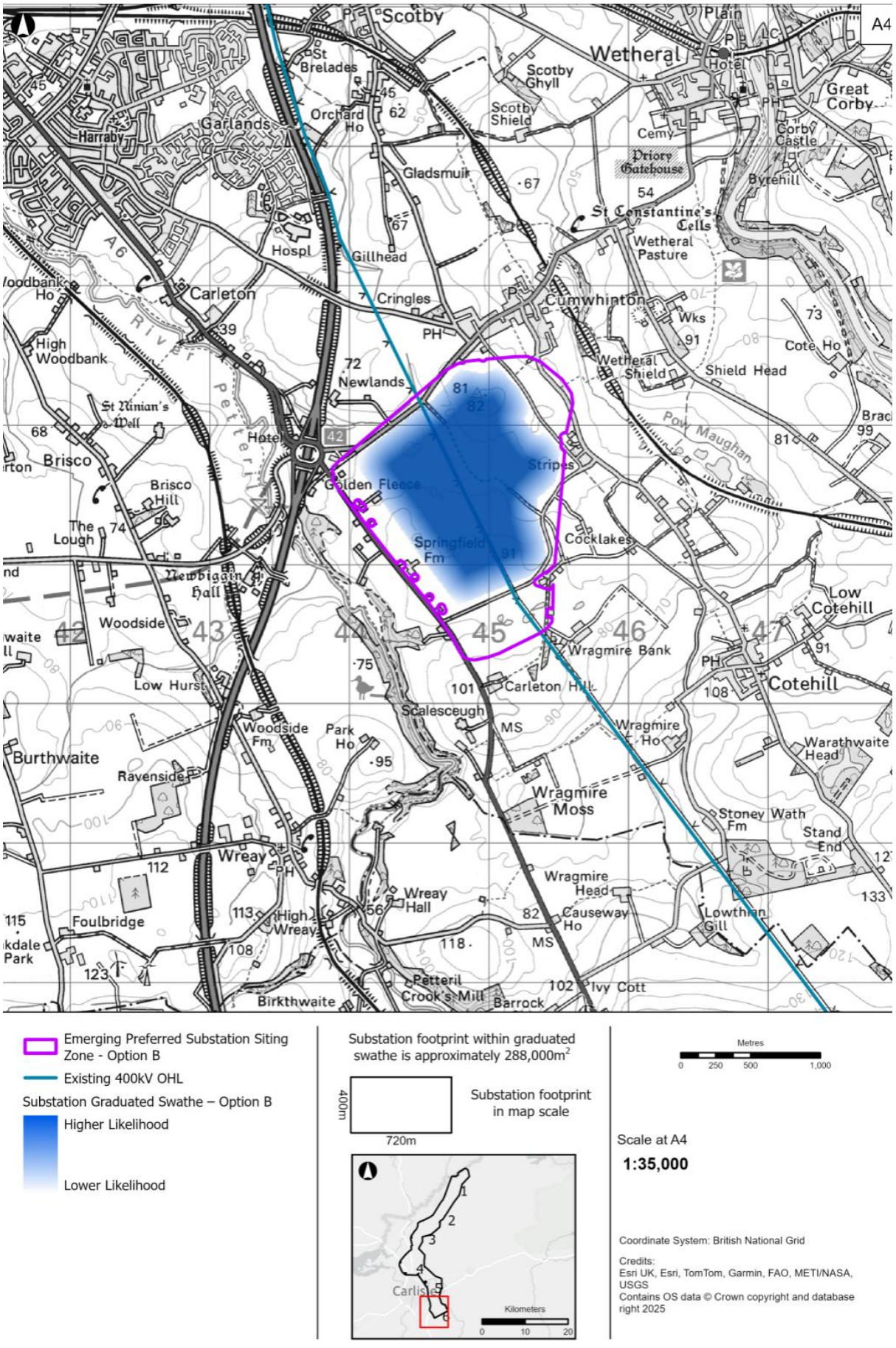
10.3.36 Within the Siting Area emerging as preferred (CSZ9.A), outline potential substation layouts were developed by engineering specialists and reviewed by the environment specialists. This Siting Area largely avoids environmental constraints. Existing infrastructure, such as the M6 and the A6 (located in close proximity to the boundary of the Siting Area) and the existing 400 kV Harker-Hutton line, already influence the character of the area and are considered features of lower sensitivity to change. The Siting Area comprises predominantly arable/grazing land with hedgerows, grassland, and individual trees, which could be subject to habitat loss, fragmentation; however, such impacts are considered manageable with appropriate mitigation. There are technical constraints that need to be considered in the developing design and layout of the substation. For example, the existing 400 kV Harker-Hutton line runs through Siting Area; depending on the substation position and orientation, there may be a direct interface with the existing overhead line infrastructure. This could be managed through construction sequencing and outage, but a diversion of the existing overhead line may be required.

10.3.37 The area identified as the most likely location for the infrastructure in CSZ9.A provides a degree of separation from the residential properties which fringe the A6 to the west and avoids the smaller scale field patterns and properties to the north-east.

10.3.38 The graduated swathe is larger than the actual proposed footprint of the substation (e.g. 720 x 400m) to provide flexibility to allow the design, layout and configuration to be delivered within it.

10.3.39 The graduated swathe for the New Carlisle substation (Option B) is shown **Figure 10-7**.

Figure 10-7 – New Carlisle Substation Graduated Swathe Option B, south of Carlisle



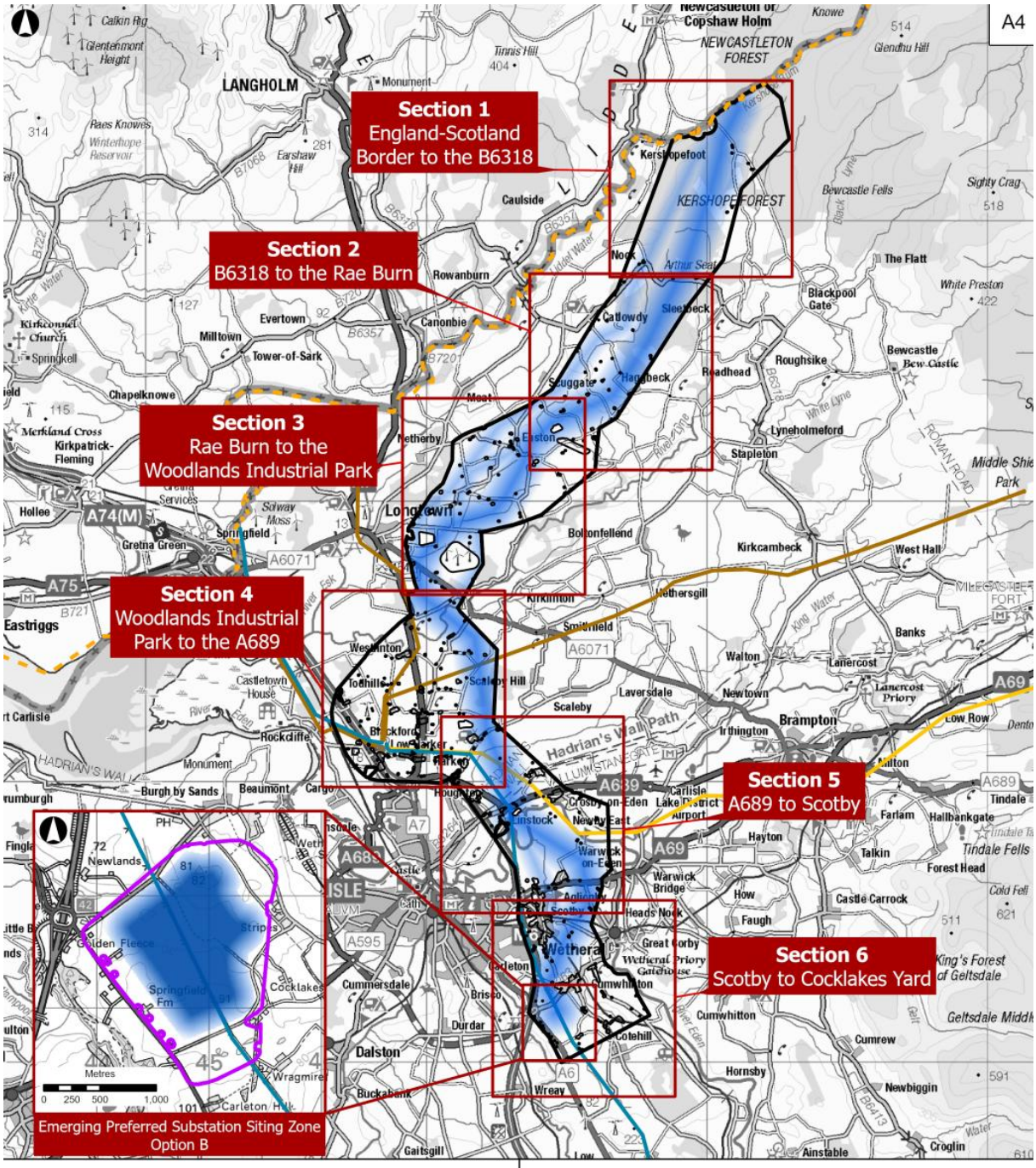
Overhead line corridor

10.3.40 The graduated swathe for the emerging preferred route corridor is shown in **Figure 10-8**. The description of the corridor is split into six parts, each covering an approximately 6.5km wide and 7km long section of the corridor. The sections of emerging preferred route corridor, from north to south, are as follows.

- Section 1: England to Scotland border to the B6318
- Section 2: B6318 to the Rae Burn
- Section 3: Rae Burn to the Woodlands Industrial Park
- Section 4: Woodlands Industrial Park to the A689
- Section 5: A689 to Scotby
- Section 6: Scotby to Cocklakes Yard

10.3.41 The graduated swathe for the emerging preferred route corridor within Sections 1 to 3 for Option B is the same as for Option A. Therefore, Section 4 to Section 6 only are described below and are shown **Figure 10-9** to **Figure 10-11**.

Figure 10-8 – Route corridor Graduated Swathe. Option B, south of Carlisle



Section 4: Woodlands Industrial Park to the A689

10.3.42 Section 4, shown in **Figure 10-9**, commences in proximity to Woodlands Industrial Park.

10.3.43 Immediately to the south of Woodlands Industrial Park, the overhead line would require a crossing of the River Lyne. Where the overhead line crosses the River Lyne, careful structure placement and clearance will be essential to minimise impact to riparian zones.

10.3.44 After crossing the River Lyne, the overhead line would route through open farmland and low-lying pastureland dominated by agricultural use, following a north-east to south-west alignment.

10.3.45 The overhead line alignment would then gently curve towards the south, and it would cross the existing 132 kV Harker Spadeadam overhead line.

10.3.46 There is one area of ancient woodland (Mampus Wood) within Section 4 and in proximity to the emerging Siting Area for this option (CSZ4.C). There are a number of residential properties and settlements within Section 4, including the settlements of Westlinton and of Blackford. The graduated swathe has been defined to avoid areas of ancient woodland (and a buffer zone of 50m from their boundary) and residential properties and settlements (and a buffer zone of 25m from their boundary), and to provide the most direct route for the overhead line with no sharp the changes in direction in line with **Holford Rule 3**.

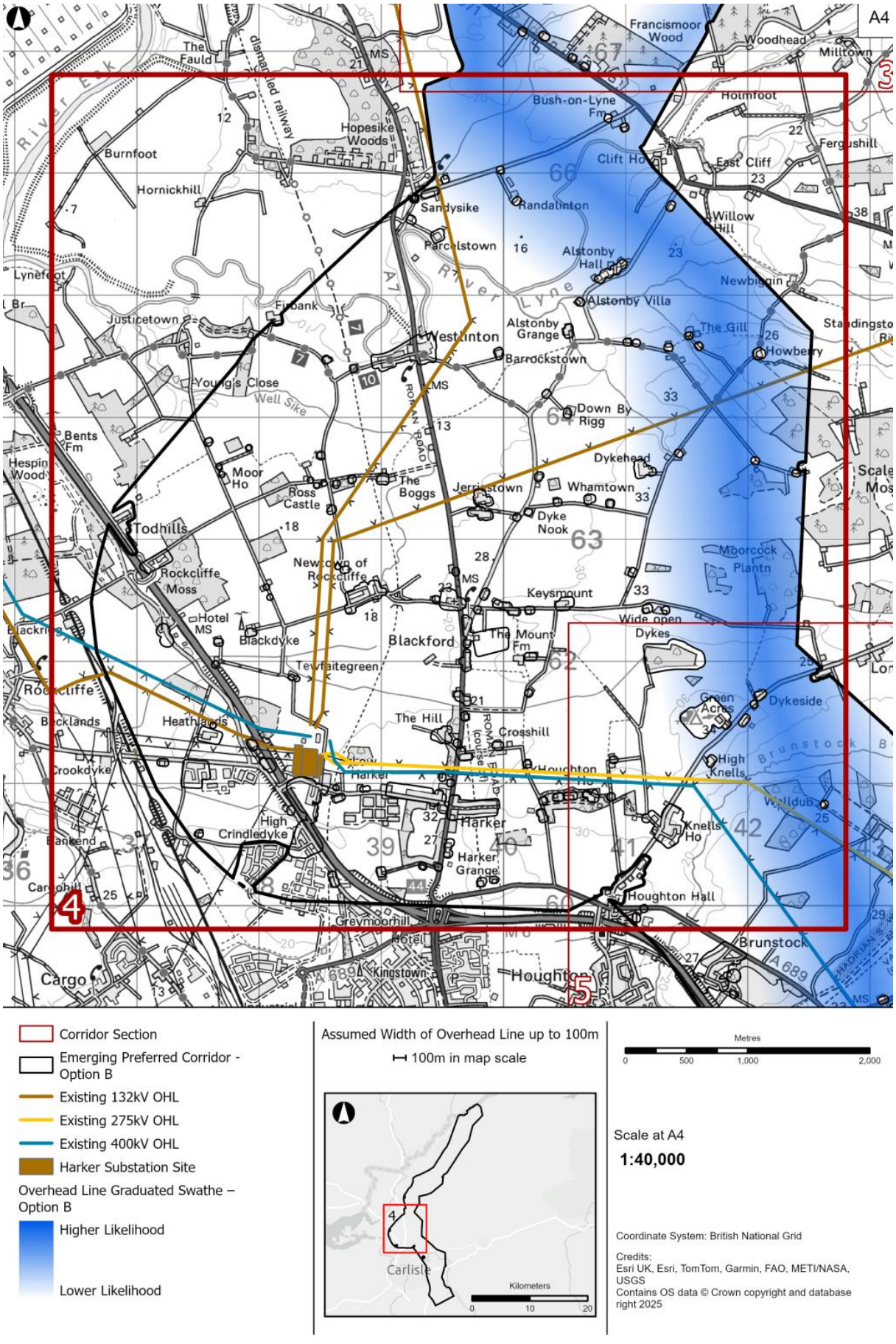
10.3.47 The overhead line would then be routed through Hadrian's Wall WHS buffer, in an area which has been identified in WHS Capacity Assessment Technical Note (**Appendix A**) to potentially have the capacity to accommodate a new overhead line.

10.3.48 Within the Hadrian's Wall WHS buffer, the overhead line would cross an existing 275 kV overhead line. While no detailed engineering design has been undertaken at this stage, a crossing of this overhead line is considered feasible and can typically be managed through standard design measures.

10.3.49 There are areas within the western part of Section 4 that include key constraints, such as areas of priority habitat (deciduous woodland), scattered residential properties and settlements (the settlement of Westlinton). Crossing these areas and avoiding key constraints would have resulted in a longer overhead line route with additional changes in direction; therefore, these areas have been avoided in the development of the graduated swathe.

10.3.50 Section 4 terminates in proximity to the A689.

Figure 10-9 – Section 4 Graduated Swathe (Woodlands Industrial Park to the A689) Option B, south of Carlisle



Section 5: A689 to Scotby

10.3.51 Section 5, shown in **Figure 10-10**, commences in proximity to the A689 within Hadrian's Wall WHS buffer zone.

10.3.52 The overhead line would be routed south through Hadrian's Wall WHS and buffer, in an area which has been identified in WHS Capacity Assessment Technical Note (**Appendix A**) as potentially least sensitive to change through the introduction of a new overhead line. As set out in **Chapter 7 (paragraph 7.8.17)** although the introduction of an overhead line has the potential to result in impacts to the setting of the WHS, the overhead line would not sever views and instead partially interrupt views from the Wall, and it would still be possible to understand its positioning as a Frontier, engineering, and construction (which are Attributes of OUV). An overhead line would also not sever any views or interrelationships between the Wall and designated assets to the south of the Wall, as there are no assets (such as temporary forts and marching camps) recorded in this area. Finally, an overhead line would not alter the prominence of the Wall, which survives as below ground archaeological remains in this area, while the topography which falls to the south, and the valley of the River Eden, would also help to backcloth the pylons. Furthermore, a number of overhead lines already cross the Wall in this area, while other elements of modern infrastructure including main roads, as well as large industrial scale farmsteads, give the area a more urban/industrial character.

10.3.53 South of Hadrian's Wall WHS the swathe would cross a narrow strip of land constrained between residential plots. The overhead line would then cross the River Eden which is designated as a SAC. This crossing may give rise to direct habitat loss and disturbance to a Coastal Floodplain Grazing Marsh Priority Habitat. Field surveys will be carried out in next stage of design to confirm extent of these habitats and inform the design of the overhead line route.

10.3.54 The Grade II* listed Linstock Castle (NHLE 1119608) is situated in proximity to the River Eden. The asset may have originally been positioned to command views over the River Eden, as well as be a prominent feature in the landscape. The overhead line would be routed within relatively close proximity (within 300m) from this asset. Further assessment will need to be carried out at later stages of design to understand impacts of an overhead line on the settings of this asset and guide the design of the route alignment.

10.3.55 Eden Grove Grade II listed property (NHLE 1087696) is situated on the river terrace of River Eden. The overhead line would be routed within 900m from this asset. Further assessment will need to be carried out at later stages of design to understand impacts of an overhead line on the settings of this asset and guide the design of the route alignment.

10.3.56 As shown in **Figure 10-10**, south of the River Eden two potential overhead line alignment options have been identified, which avoid the village of Aglionby and Carlisle Golf Club. The two overhead line route options cross the southern boundary of the Hadrian's Wall WHS buffer in proximity to the village of Aglionby.

10.3.57 The overhead line route option to the east of the village of Aglionby and of Carlisle Golf Club, crosses an area of deciduous woodland. Careful routing would be required within this area to avoid or minimise impact on this constraint. This overhead line route option would avoid oversailing the Gas Governor (Gas Gov) compound located approximately 400m to the east of Carlisle Golf Club. Oversailing or routing directly above a gas governor station is generally avoided due to safety and operational risks, including

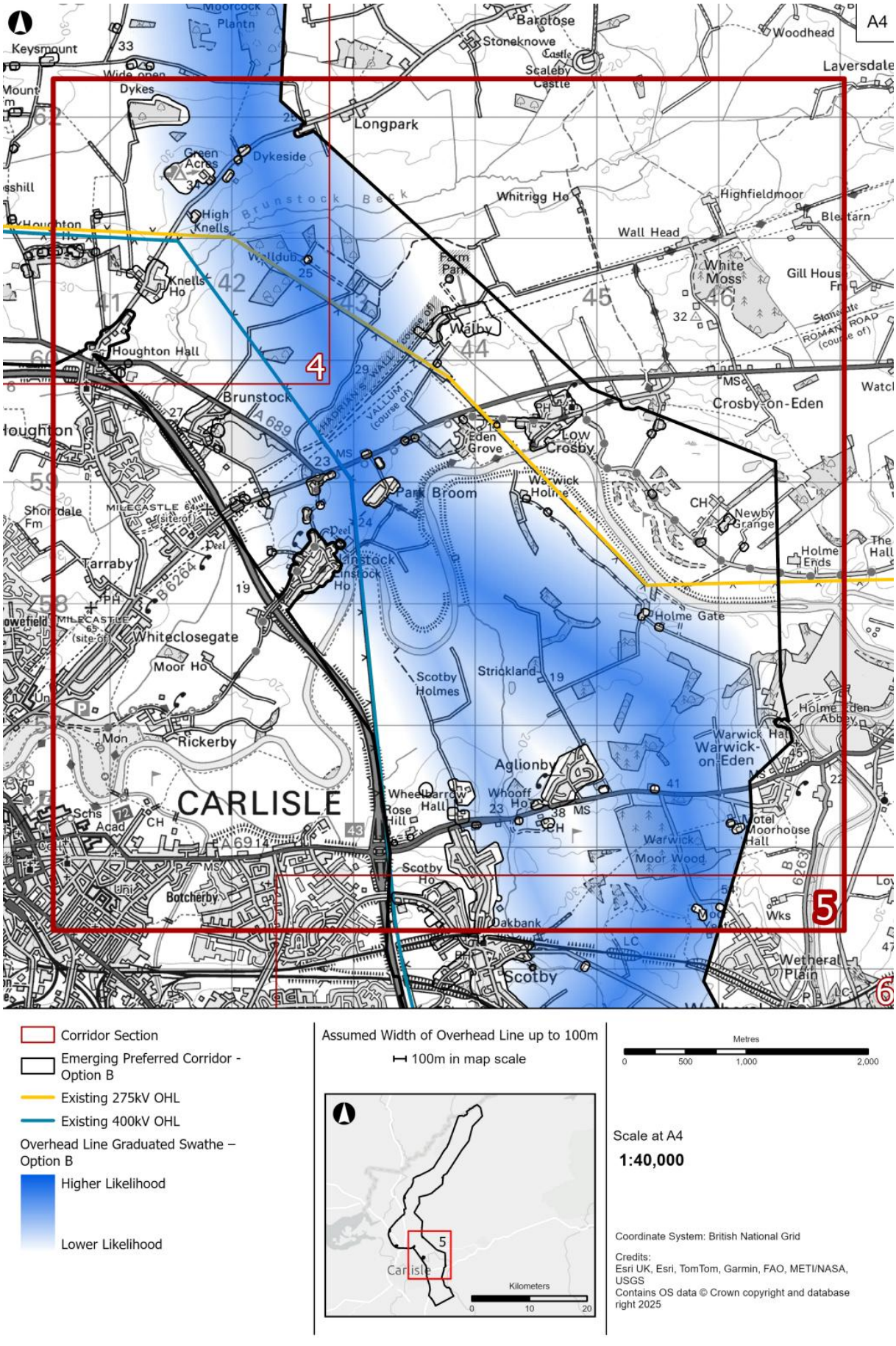
potential hazards during maintenance, access restrictions, and the need to maintain safe clearances in accordance with utility and asset owner requirements.

10.3.58 The overhead route option to the west of village of Aglionby and of Carlisle Golf Club, would cross a narrow strip of land constrained between the village of Scotby and Aglionby. Within this area the overhead line would be routed to avoid the existing NWEP. Further assessment would be required at the later stages of establish detailed clearance requirements around the pipeline.

10.3.59 There are areas within the eastern part of Section 5 that include key constraints, such as areas of priority habitat (Coastal and floodplain grazing marsh), scattered residential properties and villages (the settlement of Brunstock, of Linstock and of Scotby). The graduated swathe has been developed to avoid these areas. There are areas within the western part of Section 5 that include key constraints, such as areas of priority habitat (Coastal and floodplain grazing marsh), scattered residential properties and villages (the settlement of Walby and of Crosby on-Eden), and golf courses (Eden Golf Course). The graduated swathe has been developed to avoid these areas.

10.3.60 Section 5 terminates in proximity to the settlement of Scotby.

Figure 10-10 – Section 5 Graduated Swathe (A689 to Scotby) Option B, south of Carlisle



Section 6: Scotby to Cocklakes Yard

10.3.61 Section 6, shown in **Figure 10-11**, commences in proximity to the village of Scotby.

10.3.62 In proximity to the settlement of Scotby, the overhead line would cross two existing railway lines. The Carlisle-Settle Railway, is designated as a conservation area; the overhead line would cross a small section of this area. Further assessment will need to be carried out at later stages of design to understand impacts of an overhead line on the conservation area and guide the design of the route alignment.

10.3.63 South of the village of Scotby the overhead line would follow a predominantly north to south alignment, parallel to the existing 400 kV Harker-Hutton line.

10.3.64 The overhead line would be routed to the west of the village of Cumwhinton, within an area dominated by pastureland and arable fields with interspersed hedgerows. Around Cumwhinton the overhead line would cross Brammleton Road, Cumwhinton Road and the B6263.

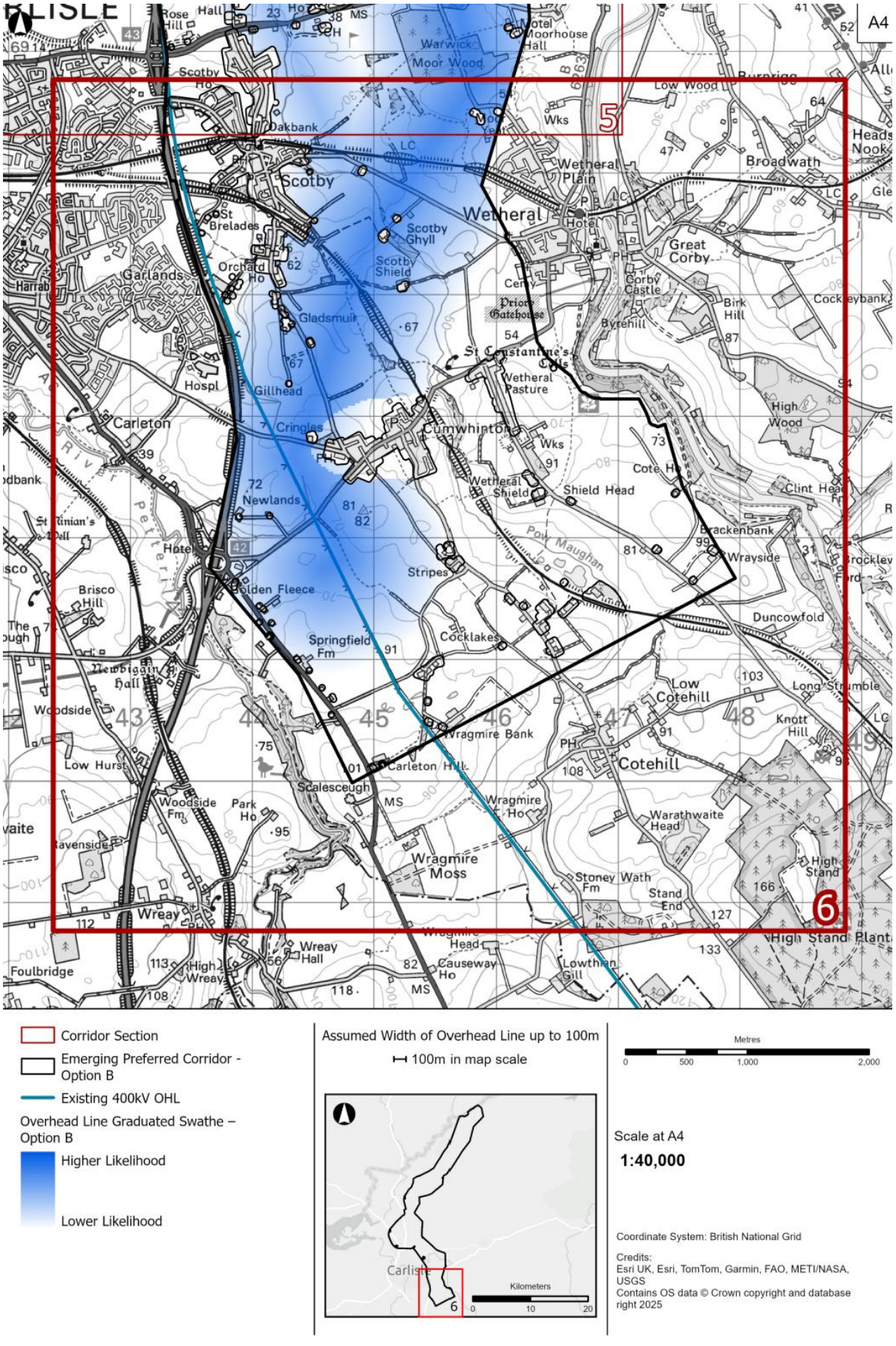
10.3.65 The overhead line would avoid the (employment and green infrastructure) allocation in the emerging St. Cuthbert's Garden Village Local Plan.

10.3.66 The overhead line would terminate at the emerging preferred Siting Area for this option (CSZ9.A) which is immediately to the south-west of the settlement of Cumwhinton. CSZ9.A is situated in a relatively unconstrained agricultural zone with good vehicle access due to proximity to the A7 and the M6 and flat topography. The Harker Hutton line bisects CSZ9.A and the connection to the existing network will be via a connection from CSZ9.A to the Harker-Hutton line.

10.3.67 There are areas within the south-eastern eastern part of Section 6 that include key constraints, such as Cotehill Pastures and Ponds SSSI, areas of priority habitat (deciduous woodland), scattered residential properties and villages (the settlement of Wetheral Pasture and of Wetheral Shield). The graduated swathe has been developed to avoid these areas.

10.3.68 Section 6 terminates in proximity to Cocklakes Yard.

Figure 10-11 – Section 6 Graduated Swathe (South of Scotby to New Carlisle substation) Option B, south of Carlisle



10.4 Alignment of the Graduated Swathe for the Proposed Development with the Scottish section of the Project

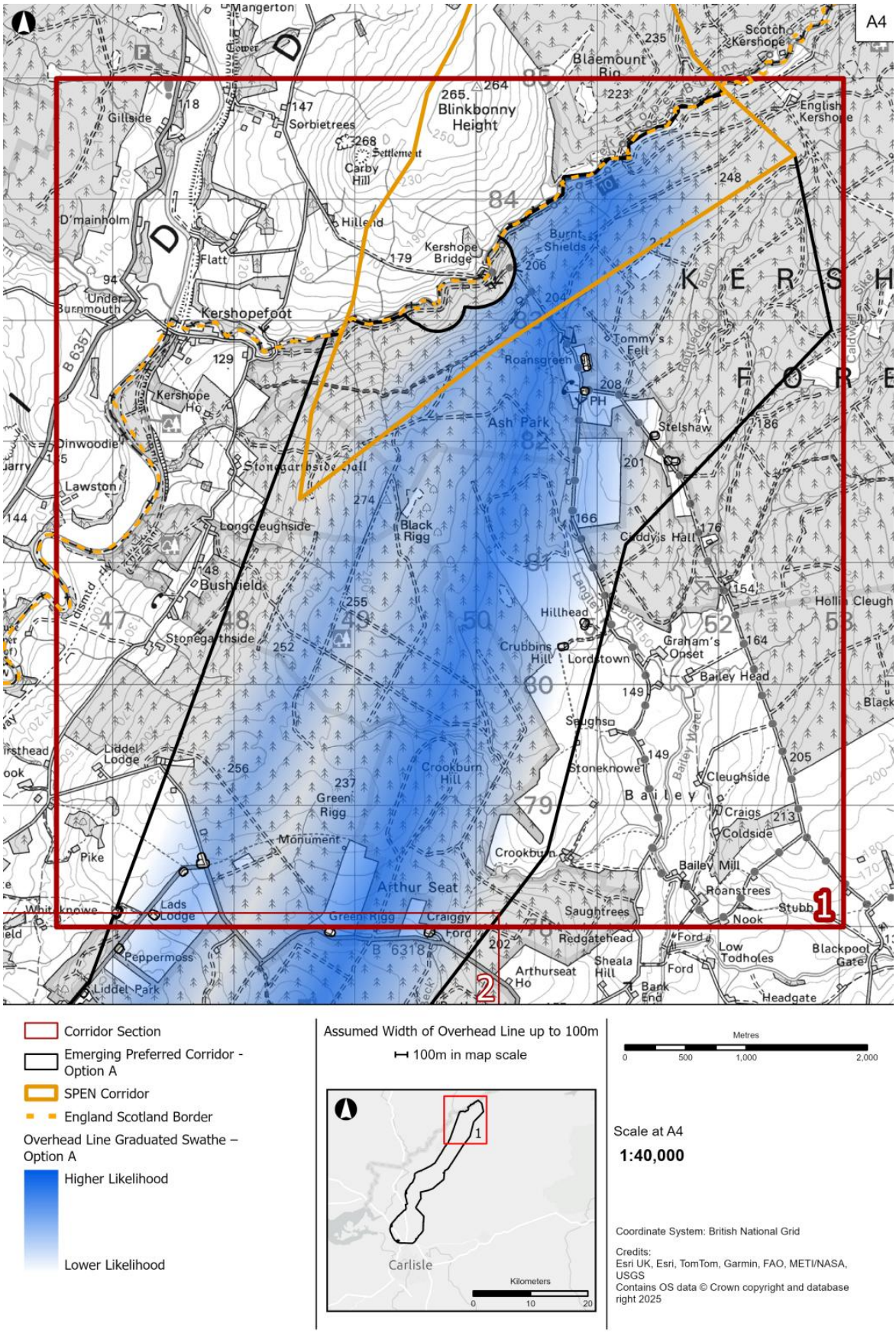
10.4.1 As described in **Section 9.7 (paragraphs 9.7.7 to 9.7.8)** a review was undertaken of the alignment between the Proposed Development and the Scottish section of the Project following the selection of the emerging preferred route corridor options. This review demonstrated that, following separate and independent appraisals, there was alignment between the emerging preferred options for both parts of the Project.

10.4.2 **Figure 10-12** shows the point of alignment between the graduated swathe at the England-Scotland border for both Option A and B of the Proposed Development, and the proposed route for the Scottish section of the Project[47]. Due to the different approach to appraisals undertaken, the Scottish section of the Project is shown as a corridor boundary as a graduated swathe was not prepared for the Scottish section.

10.4.3 The graduated swathe for the Proposed Development represents the current thinking on where the Proposed Development's infrastructure may be located. This will be informed by feedback received during Stage 1 consultation. The graduated swathe for the Proposed Development remains subject to finalisation of the routing work undertaken by SP Energy Networks for the Scottish section of the Project, and consideration of the most appropriate route alignment within the emerging preferred corridors identified by SP Energy Networks and National Grid.

[47] SP Energy Networks, March 2025. Cross Border Connection: Routeing and Siting Consultation Update. . Available online at: Routeing and Siting Update

Figure 10-12 – Alignment of the Proposed Development with the Scottish section of the Project



10.5 Summary of the Graduated Swathe

10.5.1 The graduated swathe represents the current thinking on where the Proposed Development's infrastructure is more likely to be located based on the current appraisal of constraints that have been identified. This will be further informed by feedback received during Stage 1 consultation (as part of Step 9), so there is potential for the current indicated preference to move within the graduated swathe. In some instances, feedback may indicate that the preference should be to find a pathway through areas currently being shown as less preferable.

11. Summary and Next Steps

11.1 Summary of Options Identification and Selection Process (Stage 2)

11.1.1 A detailed Options Identification and Selection Process (Stage 2) (as defined in **Chapter 4**) has been undertaken to identify:

- the emerging preferred corridors and graduated swathe for a new 400 kV overhead line electricity transmission connection between the new Carlisle substation and the England-Scotland border;
- the emerging preferred Siting Areas for the new Carlisle substation; and
- the connection between the new Carlisle substation and the existing network..

11.1.2 Five route corridor options (Core Route Corridors 1 to 5) were identified north of the Carlisle. These are referred to as 'Core Route Corridors'.

11.1.3 An additional ten route corridor options were identified that extended the Core Route Corridors 1 to 5 further south through additional segments that would cross the Hadrian Wall's WHS and associated buffer and extend to the south-east of Carlisle.

11.1.4 These route corridors were appraised, as described in **Chapter 7**.

11.1.5 Indicative comparative costs were then estimated for the route corridor options identified, noting that some corridors had different options depending on the segments preferred within those corridors (**Chapter 8**).

11.1.6 The route corridors were comparatively appraised against each other to allow for the identification of an emerging preferred route corridor (**Chapter 9**).

11.1.7 The strategy at this early stage of development, was to identify two emerging preferred options for each component of the Proposed Development for the purpose of the Stage 1 consultation, as follows:

- one substation site option and one route corridor option north of Carlisle (Option A); and
- one substation site option and one route corridor south of Carlisle (Option B).

11.1.8 Option A would provide a route corridor wholly to the north of the Hadrian's Wall WHS and a substation to the north of Carlisle, which would contribute to meeting the regional need. Option A would not cross Hadrian's Wall WHS. However, other projects would inevitably be required to cross Hadrian's Wall WHS to meet the overall regional need.

11.1.9 Option B would provide a route corridor crossing Hadrian's Wall WHS and a substation south of Carlisle. Option B would contribute to addressing the requirement to cross Hadrian's Wall WHS as part of meeting the regional need.

11.1.10 This approach will maintain future flexibility for considering the Proposed Development, as part of a network of projects to achieve the required reinforcement of the electricity transmission system.

11.1.11 The emerging preferred route corridors are shown in **Figure 9-1** (Option A) and **Figure 9-2** (Option B) and described below.

11.1.12 The selected emerging preferred route corridor to the north of Carlisle (Option A) is Core Route Corridor 4 using segment 4a at its northernmost extent. From north to south, the emerging preferred route corridor north of Carlisle would extend from the England-Scotland border through Kershopefoot Forest, following predominantly a north-east to the south-west alignment (segment 4c). It would then pass through areas of rolling countryside then transitioning into a more open rural landscape (segment 4d, 2c, 1c). It would cross the A6071 and pass in proximity to the Hayburn Wind farm and Woodlands Industrial Park (segment 1d). The route would cross the River Lyne and the existing 132 kV Harker Spadeadam overhead line before terminating at the emerging preferred site for the new Carlisle substation north of Carlisle in CSZ4.C (segment 1e).

11.1.13 Core Route Corridor 4 using segment 4a was considered the preferred environmental and technical option, with landscape and ecology constraints being particular determining factors in the selection. Core Route Corridor 4 would be within a sparsely settled landscape, which could better accommodate overhead lines, and it would be further from ecological designated sites. It was also identified as the option with fewer technical constraints in terms of overhead lines, particularly in the northern part of the corridor. Although it would provide a more expensive option based on the indicative cost of providing the overhead line due to increased length, compared to some of the other options, this option was identified to have less environmental and socio-economic impact as well as be less technically complex.

11.1.14 The emerging preferred route corridor to the south of Carlisle (Option B) comprises the base alignment of Option A and additional segments that cross the WHS buffer and extend to the south-east of Carlisle (segments 5a, 5c and 5d). Continuing from the southern extent of the Core Route Corridor 4, the emerging preferred route corridor to the south of Carlisle (Option B) would then cross the Hadrian's Wall WHS and buffer (segment 5a). This is an area where the Hadrian's Wall World Heritage Site Capacity Assessment (WHSCA) concluded that the monument is potentially least sensitive to change through the introduction of a new OHL, as described in the WHS Capacity Assessment Technical Note included in Appendix A. The route would also cross an existing National Grid 275 kV overhead line and the River Eden (segment 5a), and then run broadly in parallel with the existing 400 kV Harker-Hutton line, offering the opportunity for close parallel alignment (segment 5c and 4d). The route would terminate at the emerging preferred site for the new Carlisle substation south of the Hadrian's Wall WHS in CSZ9.A (segment 5d).

11.1.15 Core Route Corridor 4 plus segments 5a, 5c and 5d was selected as it would provide a route which would connect to a substation location with fewer environmental, socio-economic and technical constraints than the other options.

11.1.16 Four substation Siting Zones to the north of Carlisle and five substation Siting Zones to the south of Carlisle were identified. A total of 19 Siting Areas were identified within the Siting Zones and appraised using the environmental, socio-economic and technical criteria defined in **Chapter 5**. CSZ4.C, to the north of Hadrian's Wall WHS and approximately 1.7km to the east of Harker, was selected as the emerging preferred Siting Area to the north of Carlisle. CSZ4.C performed favourably across the broadest range of the environmental, socio-economic, and engineering aspects, in particular for landscape and visual, historic environment, transport and geotechnical considerations. The landscape context with existing energy infrastructure and the better accessibility via the A7 resulted in this Siting Area being identified as a more preferable option.

Specifically, the northern part of CSZ4.C was identified as the preferred location within the Siting Area, as this part of the site had fewer constraints and a lower potential for impacts.

11.1.17 CSZ9.A to the south of the Hadrian's Wall WHS and bisected by the Harker-Hutton line, was selected as the emerging preferred Siting Area to the south of Carlisle. CSZ9.A provided fewer constraints than the other Siting Areas. There would be limited landscape and visual impacts, and fewer historic environment and ecology constraints. There would be better accessibility, via the A6, than the other options and better opportunities for civil engineering and technical considerations to locate the substation within the Siting Area. Whilst the potential for geotechnical constraints were identified, these were not considered to outweigh the other environmental and engineering benefits of CSZ9.A.

11.1.18 The emerging preferred route options (Option A and Option B) were selected to avoid, where possible, potential impacts to areas with the highest amenity value in alignment with **Holford Rules 1** and **2**, as well as finding a direct path in alignment with Holford Rule 3. Overall, the emerging preferred route corridors and Siting Areas (Option A and Option B) are considered to offer the optimum balance between environmental, technical, and socio-economic and cost considerations.

11.1.19 Following the identification of the emerging preferred corridor, a graduated swathe was developed for the two emerging preferred Options A and B. The graduated swathe is a way of showing the areas within the emerging preferred corridor where the required infrastructure for the Proposed Development is considered more or less likely to be located. The graduated swathe is shown with a colour shading, with the darker shading indicating National Grid's emerging view of where infrastructure would be better located based on the work undertaken to date. Darker shading indicates more likely locations, whilst lighter shading indicates less likely locations.

11.1.20 The use of the graduated swathe is intended to emphasise the preliminary nature of judgements made to date in respect of infrastructure locations within the emerging preferred corridor. This will be informed by feedback received during Stage 1 consultation and, therefore, there is the potential for the final design of the Proposed Development to extend beyond the graduated swathe. This will be fully considered through the development of the Proposed Development, whilst maintaining the principles used to develop the current graduated swathe, for instance, the avoidance of areas of highest constraint and amenity.

11.2 Stage 1 Consultation (Step 9 of Stage 2)

11.2.1 This feedback will be fully considered through the development of the Proposed Development, whilst maintaining the principles used to develop the current graduated swathe, such as the avoidance, where practicable, of areas of highest constraint and amenity.

11.2.2 This report will be used as part of the Stage 1 consultation and engagement with key stakeholders, including landowners and the public. The Stage 1 consultation will take place in October 2025.

11.2.3 During the Stage 1 consultation, feedback will be gathered from consultation events, feedback forms and emails on the preferences identified in this report and on the graduated swathe, which highlights where Project infrastructure is more or less likely to be located.

11.2.4 The emerging preferred route corridors and substation Siting Areas identified in this report, in conjunction with the other elements of the Options Identification and Selection Process (Stage 2), will be kept under review throughout the development of the Proposed Development.

11.3 Analysing Stage 1 Consultation Feedback

11.3.1 The feedback from non-statutory consultation will inform the further development of the Proposed Development. Where there is more than one potential alignment option, Stage 1 consultation responses and further assessment can influence the final selection of the preferred alignment. This will be addressed at the next stage of the Proposed Development. Feedback received during Stage 1 consultation will also be summarised within a consultation report during the next stage of the Proposed Development.

11.3.2 Information from surveys undertaken to obtain baseline data and ongoing design studies will also inform the development of the Proposed Development.

11.4 Post Stage 1 consultation

11.4.1 Following the completion of Stage 1 consultation, including the analysis of consultation feedback, National Grid will progress the Defined Proposal and Statutory Consultation Stage (Stage 3) in the National Grid Approach to Consenting. As part of this, the Proposed Development will be subject to a statutory EIA, consultation, and integrative design development prior to submission of the application for a DCO.

Appendix A Hadrian's Wall World Heritage Site Capacity Assessment

nationalgrid

AECOM ARUP

The Great Grid Partnership

Hadrian's Wall World Heritage Site Capacity Assessment

Technical Note – Cross Border Connection

28th August 2025

Document Reference: 07957-GGP-ENV-NOT-0001

Quality Information

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Executive Summary

This Technical Note presents a World Heritage Site Capacity Assessment (WHSCA) to support development of the Cross Border Connection ('the Proposed Development'), which proposes the construction of a new 400kV double circuit from the Scottish border to the Carlisle area, and the construction of a new 400kV substation to facilitate connection to the existing network and future network developments. The study area for the Corridor Preliminary Routing and Siting Study (CPRSS) for Proposed Development includes elements of the Hadrian's Wall component of the UNESCO Frontiers of the Roman Empire World Heritage Site ('the WHS' or 'the property'; UNESCO World Heritage List nomination reference 430ter: Frontiers of the Roman Empire – UNESCO World Heritage Centre), its buffer zone and setting. The WHSCA reviews the implications for the CPRSS, with reference to the extent to which the WHS and its buffer zone include areas of lower sensitivity – due to aspects of character, designation, conservation, levels of tourism activity or the presence of existing infrastructure such as OHLs, railways and motorways and other roads – which may have a relatively greater capacity to absorb change while avoiding or, where this is not possible, minimising impacts on the Outstanding Universal Value (OUV), integrity and authenticity of the WHS.

The scope of the WHSCA aligns with the Screening stage of Heritage Impact Assessment (HIA) as set out in UNESCO's Guidance and Toolkit for Impact Assessment in a World Heritage context (UNESCO 2022). The Proposed Development WHSCA Study Area comprises the WHS, the WHS buffer zone, and a 3km area surrounding the WHS buffer zone. Analysis of the capacity for change within the Proposed Development WHSCA Study Area has considered attributes of the OUV, integrity and authenticity of the WHS; potential impacts; legislative and policy requirements; the state of preservation (in relation to the extent of survival) of archaeological remains of the Wall; historic landscape character; the presence of existing OHL and transport infrastructure corridors; contemporary landscape character; and socio-economic aspects (levels of tourism activity). Construction, operation and decommissioning of a new 400Kv OHL on lattice towers has been assumed as a worst-case basis for assessment of the capacity to absorb change. The WHSCA has been compiled using desk-based techniques supported by a site visit to assess the impact of existing infrastructure within the WHS buffer zone and view the condition of the components of the WHS in the landscape. Assessments have been based on professional judgement, having regard to the OUV of the WHS and relevant legislation, policy and best practice.

The WHSCA has identified six Zones of varying sensitivity to change while avoiding or, where this is not possible, minimising impacts on relevant attributes of the OUV of the WHS, its integrity and authenticity; these have been classified as either Red, Amber or Green to provide a high-level sensitivity / capacity weighting. The Red / Amber / Green sensitivity rating was used to inform assignment of a sensitivity rating in line with the classification values defined for the CPRSS for the Proposed Development, which range from 0 – Areas with no identified constraint, to 5 – Very High potential for the Proposed Development to be constrained: areas within the WHS and its buffer zone have generally been assigned an overall CPRSS Classification Value of 5 (Very High potential for the Proposed Development to be constrained), while areas identified by the WHSCA that are potentially less sensitive are assigned a CPRSS Classification Value of 4 (High potential to constrain the Proposed Development).

One Red Zone has been identified, which is considered to be highly sensitive to change, and to have very high potential to constrain the Proposed Development due to the potential for adverse impacts on attributes of the WHS, its integrity and authenticity. This Zone contains the greatest number of component features of the WHS north and south of the Wall, and as a result an OHL line in this area would have the potential to interrupt views and potentially disrupt intervisibility and understanding of the component parts and their interrelationships.

Two Amber Zones and three Green Zones are less sensitive to change and have more potential to absorb change while avoiding or minimising impacts on relevant attributes of the OUV of the WHS, its authenticity and integrity. However, these Amber and Green Zones still have a high potential to constrain the Proposed Development. The Green Zones are considered to be the least constrained due to aspects such as topography, the absence of components of the WHS, and/or distance from the WHS. The presence of substantial existing infrastructure in some of the Amber and Green Zones (including existing OHLs, roads, railway lines, and settlements) has partially degraded the setting of the WHS in these Zones. When combined with the presence of landscape features, including extensive hedgerows and woodland, these Zones have more potential to absorb change.

This WHSCA considers the relative sensitivity to change of parts of the Hadrian's Wall WHS, its buffer zone and setting, within the Study Area. It accepts that the WHS is of the highest importance nationally and internationally, as well as being of heightened sensitivity. Therefore, the rating and colour coding ascribed to parts of the WHS, its buffer zone and its setting are expressions of relative sensitivity. Thus, an area described as having a greater capacity to accommodate change in this assessment may still be of high importance and high sensitivity to change in overall terms. Such sensitivity to change and ability to accommodate change as assessed in this report are matters of expert judgement [different experts may arrive at differing views, although it is considered that the conclusions expressed here are sound and objectively justified].

The results of the WHSCA should be viewed as a starting point for an iterative process of HIA, in line with the 2022 UNESCO Guidance, undertaken in tandem with a further examination of the suitability of the Zones to accommodate new transmission infrastructure. It should be noted that there is high potential for buried archaeological remains to survive even in areas where the WHS components have little or no surface expression. It should also be noted that this WHSCA focuses on the components of the inscribed WHS alone and other heritage constraints may exist which may influence routing and siting studies, and which are not considered in this WHSCA.

While this WHSCA assumes that a new OHL on lattice towers will be required, it is recommended that development of the Cross Border Connection should also consider whether the Proposed Development can contribute to the rationalisation of OHLs in the Proposed Development WHSCA Study Area and surrounding landscape. This aspect may contribute to reducing the current negative impacts of existing OHLs on the WHS and provide positive changes to the attributes and settings that contribute to its OUV, its integrity and authenticity.

1. Introduction

1.1. Status

1.1.1. This Technical Note presents a World Heritage Site Capacity Assessment (WHSCA) to support development of the Cross Border Connection ('the Proposed Development'), which proposes the construction of a new 400kV double circuit from the Scottish border to the Carlisle area, and the construction of a new 400kV substation to facilitate connection to the existing network and future network developments.

1.1.2. The study area for the Corridor Preliminary Routing and Siting Study (CPRSS) for the Proposed Development (see Figure 1 in **Appendix E**) includes elements of the Hadrian's Wall component of the UNESCO Frontiers of the Roman Empire World Heritage Site ('the WHS' or 'the property'[1]; UNESCO World Heritage List nomination reference 430ter: Frontiers of the Roman Empire – UNESCO World Heritage Centre), its buffer zone and setting (Figure 2 in **Appendix E**). The WHSCA reviews the implications for the CPRSS, with reference to the extent to which the World Heritage Site (WHS) and its buffer zone include areas of lower sensitivity – due to aspects of character, designation, preservation (in relation to extent of survival), levels of tourism activity or the presence of existing infrastructure such as OHLs, railways and motorways and other roads – which may have a relatively greater capacity to absorb change while avoiding or, where this is not possible, minimising impacts on the Outstanding Universal Value (OUV), integrity and authenticity of the WHS.

1.1.3. The purpose of the WHSCA is to support and inform the CPRSS for the part of the Proposed Development that is to be delivered south of the Anglo-Scottish border by NGET. The WHSCA will contribute to starting to identify and understand the constraints associated with the attributes of OUV of the WHS, its integrity and authenticity, and how these need to be taken account of, within the property, its buffer zone and within its setting. The WHSCA is an iterative document and incorporates preliminary amendments to address comments received from Historic England; further updates will be considered for inclusion in future revisions following more detailed review of Historic England's comments.

> *This WHSCA considers the relative sensitivity to change of parts of the Hadrian's Wall WHS, its buffer zone and setting, within the Study Area. It accepts that the WHS is of the highest importance nationally and internationally, as well as being of heightened sensitivity. Therefore, the rating and colour coding ascribed to parts of the WHS, its buffer zone and its setting are expressions of relative sensitivity. Thus, an area described as having a greater capacity to accommodate change in this assessment may still be of high importance and high sensitivity to change in overall terms. Such sensitivity to change and ability to accommodate change as assessed in this report are matters of expert judgement [different experts may arrive at differing views, although it is considered that the conclusions expressed here are sound and objectively justified].*

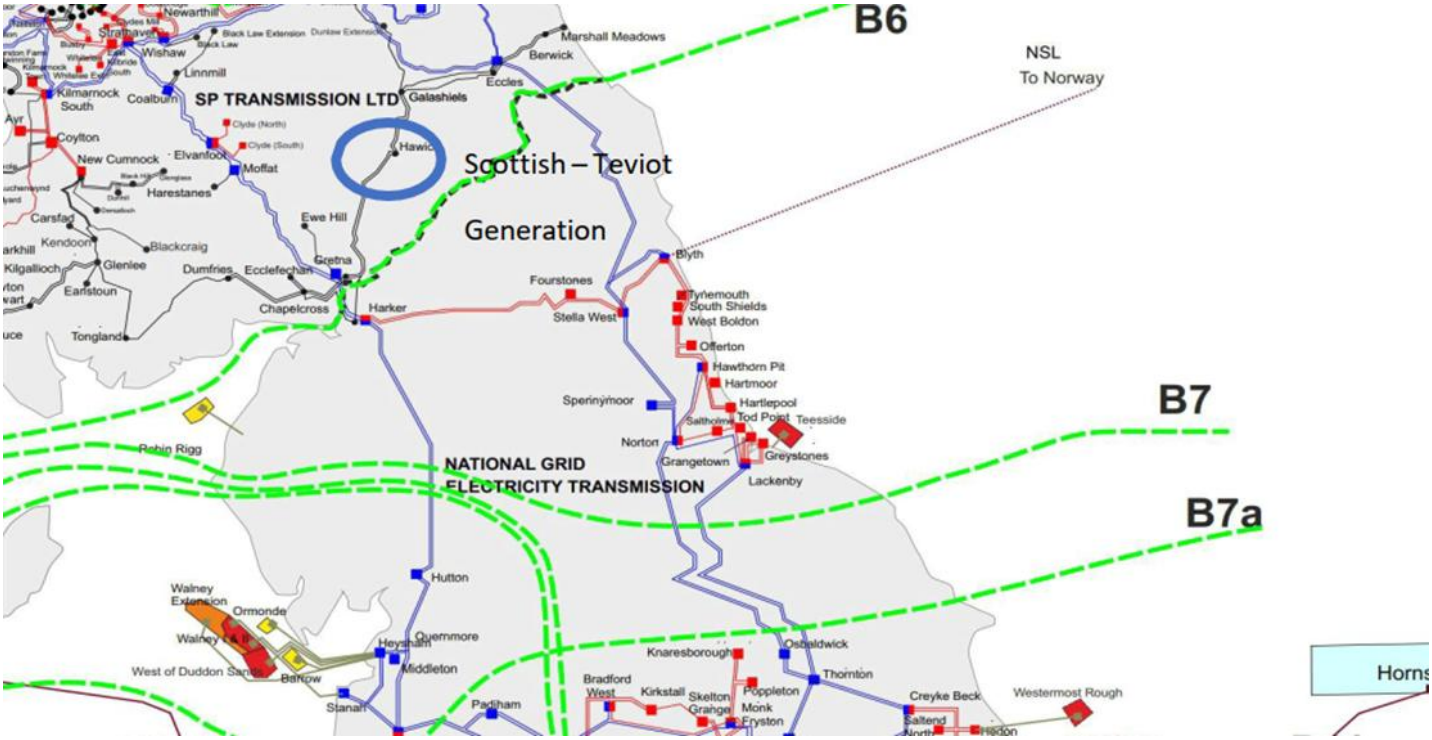
1.1.4. This TN does not make any decisions or recommendations on route identification. Its purpose is to provide technical input from an early stage. The scope of the WHSCA aligns with the Screening stage of Heritage Impact Assessment (HIA) as set out in UNESCO's Guidance and Toolkit for Impact Assessment in a World Heritage context (UNESCO 2022) (see section 2.2 below).

1.2. Background

Background to the Proposed Developments

1.2.1. NGET is required to comply with the transmission system Security and Quality of Supply Standard (SQSS) standards. These standards include facilitating connection of generation and demand, resolving capacity shortfalls across system boundaries, and avoiding significant interruption to supply in fault conditions. The figure below shows the transmission system boundaries in the north of England and south of Scotland. The Proposed Developments arise from SQSS requirements as described below.

1 The terms 'World Heritage property', 'Property/property', and 'World Heritage Site' are analogous and used interchangeably in UNESCO documentation.



1.2.2. The Proposed Development involves the construction of a new 400kV double circuit from the Scottish border to the Carlisle area, and the construction of a new 400kV substation to facilitate the connection of the Proposed Development to the existing network and future network developments. The Proposed Development will increase the overall transmission capacity across the B6 boundary and facilitate the connection of the Teviot Generation Group to the transmission system. NGET will deliver the section of line between Carlisle and the Anglo-Scottish border. In line with the principle that overhead lines should be the strong starting presumption for electricity networks, as set out in the National Policy Statement for Electricity Networks Infrastructure (EN-5), the initial technological assumption is that the Proposed Development will require construction of a new overhead line supported on steel lattice towers.

2. Methodology

2.1. Study Area

2.1.1. The Proposed Development WHSCA Study Area comprises the WHS and its WHS buffer zone to the east and northwest of Carlisle, between Banks and the Solway Firth, extended where appropriate to include areas where professional judgment indicates that the contribution to the significance and OUV of the WHS made by its setting may be affected (see Figure 3 in **Appendix E**). In consultation with Historic England[2], it was agreed that the buffer zone represents the minimum setting of the WHS, and in some areas the setting of the monument may extend beyond the buffer zone. These areas have, however, not been defined, and as a result, professional judgement has been used to identify areas where it is considered that the setting of the WHS extends outside of the buffer zone, with a 3km limit beyond the buffer zone applied as the maximum extent of the the Proposed Development WHSCA Study Area, based on established practice on comparable energy transmission projects. A 3km study area, beyond the WHS Buffer Zone, is deemed to be a sufficient study area, considering elements such as local topography and vegetation coverage, to ensure that the full extent of the setting of the WHS is captured by the WHSCA. Comparable schemes, such as the North Humber to High Marnham, Yorkshire GREEN and the Bramford to Twinstead Reinforcement OHL Schemes, have also used a 3km study area to identify designated heritage assets of the highest significance[3] and their settings that may be impacted by these schemes. This also takes into account the likely height of the proposed pylons, which for a 50m tall pylon would appear to be *c.*1cm high at a distance of 3km, meaning that no designated heritage assets beyond a distance of 3km are likely to experience significant visual effects on or from within their setting.

2.2. Identification of capacity for change within the WHS and the Proposed Development Study Area

2.2.1. Analysis of the capacity for change within the WHS and the Proposed Development Study Area has considered the following aspects of the WHS and its buffer zone and setting:

- Values and attributes of the OUV of the WHS, including its integrity and authenticity;
- Potential impacts;
- Legislative and policy requirements;
- State of preservation (extent of survival) of archaeological remains of the Wall;
- Historic landscape character;
- Existing OHL and transport infrastructure corridors;
- Contemporary landscape character; and
- Socio-economic aspects – levels of tourism activity.

2.2.2. All assessments are based on professional judgement, having regard (where relevant) to the Outstanding Universal Value (OUV) of the WHS and relevant legislation, policy and best practice.

Identification of values / attributes and potential impacts

2.2.3. UNESCO and the Advisory Bodies to the World Heritage Committee (ICCROM, ICOMOS and IUCN) have issued guidance for assessing impacts from projects that could potentially affect World Heritage Sites: Guidance and Toolkit for Impact Assessment in a World Heritage context (https://whc.unesco.org/en/guidance-toolkit-impact-assessments/) (UNESCO, 2022). The Guidance explains how impact assessments can be used to protect the OUV of World Heritage properties and provides a framework for impact assessment where development is proposed which may affect the OUV of a WHS. The accompanying Toolkit includes step-by-step approaches to identifying and evaluating impacts on one or more Attributes of OUV and provides a template to enable data and analysis to be summarised in a table so that conclusions can be presented clearly (this may be adapted as appropriate on a case-by-case basis).

2 Teams meeting 17th April 2025

3 The NPPF Glossary defines Significance (for heritage policy) as follows: *The value of a heritage asset to this and future generations because of its heritage interest. The interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting. For World Heritage Sites, the cultural value described within each site's Statement of Outstanding Universal Value forms part of its significance*.

2.2.4. The WHSCA aligns with the screening stage of the HIA process as set out in the 2022 UNESCO Guidance, section 6.4:

> "Screening involves consideration of the type, size and characteristics of the proposed action; the sensitivity of the receiving environment; and the types of likely impacts (Figure 6.4). It is not only large development projects, or proposed actions near a World Heritage property, that need impact assessment. As World Heritage properties are of international importance, any proposed action that may affect the property's OUV should require an impact assessment, regardless of its size or location – within the property, its buffer zone or wider setting […]. A series of smaller proposed actions, while not needing impact assessment on their own, may also need to be checked for their indirect and cumulative impacts on a World Heritage property.
>
> "The screening analysis should consider whether the proposed action could affect the values and attributes that underpin OUV (see Section 3.2). Understanding a World Heritage property should therefore begin with an analysis of its Statement of Outstanding Universal Value (SOUV) to identify its values and attributes. Tool 1 provides a structured approach to identifying values and attributes based on an SOUV."

Identification of values and attributes

2.2.5. The values and attributes of the WHS have been considered with reference to the 2022 UNESCO Guidance and Toolkit, Tool 1, Values and Attributes to provide a clear understanding of how the landscape across and beyond the WHS contributes to its OUV. This will include consideration of values relating to each of the attributes derived from the SOUV, including the contribution made by the WHS's setting, including its buffer zone, to each of the attributes of OUV and their values, their integrity and authenticity, and the ability to appreciate those attributes. This will ensure consideration of values at the appropriate level of recognition (OUV / national / local) in terms of their contribution to / support of attributes of OUV and support the screening in or out of relevant attributes.

Identification of impacts

2.2.6. Potential impacts from each of the aspects of the Proposed Development have been considered with reference to the 2022 UNESCO Guidance and Toolkit, Tool 2, Identifying Potential Impacts.

2.2.7. The WHSCA considers the potential for the various aspects or elements[4] of the Proposed Development to impact on:

- Each of the attributes of the WHS's OUV, the values they express and the way they demonstrate how the criteria for inscription have been justified;
- The integrity of the WHS;
- The authenticity of the WHS;
- The contribution made by the WHS's setting, including its buffer zone, to each of the attributes of OUV and their values, their integrity and authenticity, and the ability to appreciate those attributes, and to the maintenance of their integrity and authenticity;
- The significance[5] of the WHS; and
- The contribution made by the WHS's setting, including its buffer zone, to its significance and the ability to appreciate it.
-

2.2.8. Relevant elements or aspects of the Proposed Development considered in the WHSCA include selection of technology (as noted in section 1.2 of this document, the initial technological assumption is for overhead line supported on steel lattice towers) and tower height. The WHSCA considers potential sources of impact arising during construction (including access and laydown requirements, erection of towers, stringing of the line), operation (maintenance, repair and overhaul) and decommissioning / removal of existing OHL (where relevant). It should be noted that no detailed information is available at this stage of the Proposed Development, with the assessment examining the scheme at a strategic level. Potential impact sources are considered during

4 Aspects of the Proposed Development would equate to 'elements of the proposed action' in the terminology applied in the UNESCO Guidance and Toolkit.

5 The NPPF Glossary defines Significance (for heritage policy) as follows: *The value of a heritage asset to this and future generations because of its heritage interest. The interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting. For World Heritage Sites, the cultural value described within each site's Statement of Outstanding Universal Value forms part of its significance*.

construction, operation and decommissioning phases of the Proposed Development, details of which will develop as the scheme advances.

2.3. Review of legislative requirements

2.3.1. The requirements for the treatment of World Heritage Sites, as assets of the highest sensitivity, go to section 104 of the Planning Act 2008, and the provisions of the Overarching National Policy Statement for Energy (NPS EN-1) and the National Policy Statement for Electricity Networks (NPS EN-5), and the references in these policy documents to the Holford Rules and the Horlock Rules. The WHSCA includes a review of these requirements insofar as they relate to the capacity of the WHS and its buffer zone to accommodate change, including a new crossing of the WHS by an energy transmission line.

2.4. Archaeological remains of the Wall

2.4.1. The state of preservation (extent of survival) of designated and non-designated sections of the Wall itself is a consideration in determining the relative sensitivity to change of the WHS and its buffer zone and setting. The WHS includes well-preserved sections, and less well-preserved sections of the Roman frontier. There are also reconstructed sections of Wall, some more sensitively accomplished than others. In order to understand the extent to which less well-preserved sections (those that have less above ground survival and are therefore less readily recognizable / interpretable) and, arguably, some reconstructed sections, can be held to be less sensitive to change, both aspects were examined.

2.4.2. In the first instance, NHLE list descriptions for relevant scheduled monuments that comprise the WHS were reviewed. Non-designated sections of the Wall that are not included within the WHS designation were also identified and mapped using GIS. Condition (in terms of state of preservation) records for all mapped components were reviewed (as available), to help inform understanding of their sensitivity to change.

2.5. Historic landscape character

2.5.1. The historic landscape character within the WHS is variable. Existing National Character Area descriptions, local authority historic landscape characterisation studies, National Park designations, and management plans were reviewed as a framework for consideration of the sensitivity to change of differing historic landscape character types and sub types. Areas of differing sensitivity identified in relevant existing character area descriptions were mapped, where appropriate, using GIS.

2.6. Existing transport and transmission infrastructure

2.6.1. The WHS and its buffer zone is already traversed in a number of areas by major infrastructure including OHLs, railways, major roads, and motorways. Much of the existing infrastructure was constructed before designation of the WHS and definition of its buffer zone. While the presence of this existing infrastructure does not create a precedent that new infrastructure will not give rise to harm, it may result in a reduced sensitivity to change, subject to routing and siting guided by HIA in line with the UNESCO guidance and toolkit (2022).

2.6.2. The extent to which areas where there is existing infrastructure can be held to be less sensitive to change was examined. In the first instance, existing OHL and transport infrastructure corridors, defined based on a 100m buffer for OHLs, and a 10m buffer for other existing infrastructure such as major roads (i.e. the M6, other roads, and rail links) were mapped using GIS.

2.7. Contemporary landscape character

2.7.1. The landscape character within and adjacent to the WHS buffer zone was mapped using published Landscape Character Assessments and by on site, high-level, surveys. Key characteristics and features were identified with a particular consideration of areas where the WHS specifically contributes to the character of the landscape. Key viewpoints identified in the WHS Interpretation Framework were used along with analysis of the visual characteristics present within the various landscape character areas to how these relate to the WHS. The results of the landscape and visual analysis were considered to aid understanding of areas of reduced sensitivity with respect to the WHS and have provided an evidence base to inform the WHSCA.

2.8. Socio-economic aspects: levels of tourism activity

2.8.1. The WHS is a destination for tourism, generated by the fame of the Wall itself and the presence of the Hadrian's Wall Path National Trail. This in turn supports the presence of tourism-related businesses such as secondary attractions and visitor accommodation. Understanding the extent of tourism activity can usefully inform the consideration of area sensitivity. The WHSCA therefore includes a high-level review of the value of the WHS as a tourist attraction, including identification of key facilities.

2.9. Sources

2.9.1. The majority of the WHSCA has been conducted as a desk-based exercise entailing consultation of available

online sources, including data relating to the scheduled monuments that form the WHS from the National Heritage List for England, as well as published material relating to the history and development of the Wall and its management. The following sources were consulted:

- UNESCO World Heritage List:
  - Adopted Retrospective Statement of Outstanding Universal Value. Available at Frontiers of the Roman Empire - UNESCO World Heritage Centre
  - Maps – clarifications and adopted boundaries of the WHS and buffer zone. Available at Frontiers of the Roman Empire - Maps - UNESCO World Heritage Centre
  - Nomination file – 1986 nomination documents and descriptions. Available at whc.unesco.org/uploads/nominations/430ter.pdf
- National Heritage List for England:
  - Descriptions of individual scheduled components of the WHS. Available at: https://historicengland.org.uk/listing/the-list
- WHS Management Plans:
  - Hadrian's Wall Management Plan 2024-2029: description of the WHS and buffer zone; OUV and Values of the WHS; attributes of OUV; current Management Plan objectives, policies and actions. Available at: Management Plan - Hadrian's Wall Country
  - The Hadrian's Wall World Heritage Site Management Plan 2015-2019: Draft Statement of OUV (21st January 2015). Available at: bln-dr980411082-20150203143628
  - Frontiers of the Roman Empire World Heritage Site - Hadrian's Wall Management Plan 2008-2014: Values and Significance of Hadrian's Wall; draft Statement of OUV (2012). Available at: 2008 -2014 Management Plan
  - Hadrian's Wall World Heritage Site Management Plan 2002-2007. Available at: https://whc.unesco.org/en/list/430/documents/
  - Hadrian's Wall World Heritage Site Management Plan July 1996. Available at: https://whc.unesco.org/en/list/430/documents/

2.10. Site visit

2.10.1. The desk-based elements of the study were informed by a site visit undertaken on 10th – 11th December 2024 to examine aspects of the Proposed Development WHSCA Study Area, including (but not limited to):

- The topography of the WHS;
- The setting of the WHS;
- Interactions and relationships between components of the WHS, including intervisibility and the kinetic experience of these;
- The state of preservation (extent of survival) and visibility of the archaeological remains of the Wall;
- The character of the historic and contemporary landscape within the Study Area; and
- The relative visibility of existing OHL and transport infrastructure corridors.

2.11. Sensitivity mapping

2.11.1. A sensitivity map was compiled as a series of separate GIS layers to illustrate the different elements of the assessment including:

- The setting of the WHS, including its buffer zone;
- The relative preservation (extent of survival) of the archaeological remains of the Wall;
- Historic landscape character;
- Existing OHL and transport infrastructure corridors;

- Contemporary landscape character; and
- Socio-economic aspects – levels of tourism.

2.11.2. This was then analysed to identify:

- Areas where existing OHL and transport infrastructure may be considered to increase capacity to absorb change;
- Areas where the state of preservation (extent of survival) of archaeological remains may be considered to increase capacity to absorb change; and
- Areas where historic landscape character is considered to be less sensitive to change.

Sensitivity Weighting

2.11.3. Areas or zones of varying capacity to absorb change identified by the WHSCA have been classified as either Red, Amber or Green to provide a high-level sensitivity / capacity weighting, based on the definitions in Table 1 below:

Table 1: Description Associated with Sensitivity Weighting

RED	**Highly sensitive to change – least potential to absorb change** RED zones would be those considered highly sensitive to change and to have least potential to absorb change without impacting attributes of the OUV of the WHS.
AMBER	**Sensitive to change – some potential to absorb change** AMBER zones would be those that, while still sensitive to change, would be considered to have some potential to absorb change while minimising impacts on attributes of the OUV of the WHS. Relevant factors in assigning an AMBER rating could include elements such as existing infrastructure, topography and the state of preservation (extent of survival) of the remains of the Wall, and presence/absence of key views/visual relationships.
GREEN	**Least sensitive to change – greatest potential to absorb change** GREEN zones would be considered the least sensitive to change and to have the greatest potential to be able to absorb change while avoiding or, where this is not possible, minimising impacts on attributes of the OUV of the WHS. Relevant factors in assigning a GREEN rating could include elements such as existing infrastructure, topography, the state of preservation (extent of survival) of the remains of the Wall, and absence of key views/visual relationships.

2.11.4. The use of these high-level sensitivity weightings is intended to identify areas or zones within the Study Area where there is relatively greater or lesser sensitivity of the landscape, and greater or lesser potential to accept change (such as a new OHL, as the starting assumption) while avoiding or, where this is not possible, minimising impacts on OUV. The assignment of a sensitivity weighting is not an indication that installation of a new OHL would be possible without impacting attributes that convey the OUV of the WHS, its setting, integrity or authenticity. Rather, the sensitivity weightings serve to flag areas for avoidance during the initial stages of corridor preliminary routing and siting studies. Within these areas or zones, individual areas of sensitivity were further classified in multiple ways, including (but not limited to):

- Assessment of the sensitivity to change of individual attributes, and the sensitivity of those attributes to change resulting from different aspects or elements of the Proposed Development;
- Areas where there is potential for sensitivity to be avoided or minimised through design and routing; and
- Areas where there is little opportunity to avoid or to mitigate impacts on attributes of OUV.

2.11.5. The sensitivity analysis has considered potential impacts during all phases of the Proposed Development:

- Construction (temporary and permanent impacts);
- Operation (including inspection, maintenance and overhaul / repair); and
- Decommissioning.

2.11.6. All classifications were determined using professional judgement, whilst having regard to the OUV of the WHS and relevant legislation, policy and best practice.

2.12. Consultation with statutory advisors

2.12.1. National Grid provided Historic England with an overview of the Proposed Development as part of their wider quarterly stakeholder engagement meeting. An introductory discussion regarding the WHSCA was also held as part of a wider informal discussion with Historic England regarding development within World Heritage Sites which took place on 4th November 2024 via MS Teams. Discussion included the aims of the WHSCA, as well as an outline of the principles that would be considered in assessing the relative capacity of the WHS and its buffer zone to absorb change. During this meeting, Historic England recommended engagement with UNESCO and ICOMOS at the earliest possible stage in the Proposed Development, to provide them with the opportunity to comment on the proposed development and obtain their advice regarding possible impacts.

2.12.2. A follow-up discussion regarding protocols for notification of the World Heritage Committee under S.172 of the World Heritage Convention was held with Historic England via MS Teams on 19th December 2024.

2.12.3. Further discussions regarding the Proposed Development and the WHSCA methodology were held via MS Teams on 23rd May 2025 and 1st July 2025. Historic England comments on a draft WHSCA for the FSU1 project were received on 13th August. The Historic England comments validated the approach taken to identification of zones of sensitivity and provided detailed comments on the conclusions. Historic England's comments have been considered and preliminary amendments have been incorporated in this revision of this TN; further updates will be considered for inclusion in future revisions of this iterative document following more detailed review of these comments.

2.12.4. Future discussion with Historic England will be held as the design evolves iteratively.

2.13. Assumptions and limitations

2.13.1. This WHSCA has been prepared subject to the following assumptions and limitations.

Assumptions

- The substation siting is excluded from the WHS and its buffer zone in line with the Horlock Rules and is therefore not considered in the WHSCA.
- In line with the principle that overhead lines should be the strong starting presumption for electricity networks, as set out in the National Policy Statement for Electricity Networks Infrastructure (EN-5), the initial technological assumption is that the Proposed Development will require construction of a new overhead line supported on steel lattice towers.

Limitations

- The assessment has relied upon data and records provided by third parties, and therefore it has been assumed that this information is accurate and up to date at the time of reporting.

3. The World Heritage Site

3.1. Statement of Outstanding Universal Value

3.1.1. Hadrian's Wall was inscribed on the UNESCO World Heritage List in 1987. The inscription was revised in 2005 to become the transnational Frontiers of the Roman Empire WHS, initially in 2005 to include the Upper German-Raetian Limes in Germany, and then again in 2008 to include the Antonine Wall in Scotland.

3.1.2. The WHS is inscribed for its Outstanding Universal Value (OUV), defined as, "cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity" (UNESCO Operational Guidelines, paragraph 49). The Frontiers of the Roman Empire WHS is inscribed as a cultural Property under criteria (ii), (iii) and (iv) as defined in paragraph 77 of the Operational Guidelines:

(i) represent a masterpiece of human creative genius;

(ii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared; and

(iii) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history.

3.1.3. A retrospective Statement of Outstanding Universal Value (SOUV) for the WHS was adopted by UNESCO in 2016. The following sections reproduce relevant parts of the adopted SOUV for the Frontiers of the Roman Empire WHS. The SOUV explains the basis for the inscription in terms of the way in which the WHS meets the Criteria for inscription and the conditions of integrity and authenticity, and the protection and management systems that ensure its safeguarding. The following sections reproduce relevant parts of the adopted SOUV for the Frontiers of the Roman Empire WHS.

Brief Synthesis

"Running 130 km from the mouth of the River Tyne in the east to the Solway Firth, Hadrian's Wall was built on the orders of the Emperor Hadrian in AD 122 as a continuous linear barrier at the then northernmost limits of the Roman province of Britannia. The frontier extended a further 36km down the Solway coast as a series of intervisible military installations. It constituted the main element in a controlled military zone across northern Britain. The Wall was supplemented by the ditch and banks of the vallum, supporting forts, marching camps and other features in a wide area to the north and south, linked by an extensive road network. It illustrates an ambitious and coherent system of defensive constructions perfected by engineers over the course of several generations and is outstanding for its construction in dressed stone and its excellent use of the spectacular upland terrain through which it passed."

Criteria

3.1.4. The Frontiers of the Roman Empire WHS is inscribed as a cultural Property under criteria (ii), (iii) and (iv):

- (ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design.

"Criterion (ii): The extant remains of the fortified German Limes, Hadrian's Wall and Antonine Wall constitute significant elements of the Roman Frontiers present in Europe. With their forts, fortlets, walls, ditches, linked infrastructure and civilian architecture they exhibit an important interchange of human and cultural values at the apogee of the Roman Empire, through the development of Roman military architecture, extending the technical knowledge of construction and management to the very edges of the Empire. They reflect the imposition of a complex frontier system on the existing societies of the northwestern part of the Roman Empire, introducing for the first time military installations and related civilian settlements, linked through an extensive supporting network. The frontiers did not constitute an impregnable barrier, but controlled and allowed the movement of peoples: not only the military units, but also civilians and merchants. Hence, they triggered the exchange of cultural values through movement of soldiers and civilians from different nations. This entailed profound changes and developments in the respective regions in terms of settlement patterns, architecture and landscape design and spatial organization. The frontiers still today form a conspicuous part of the landscape.

- (iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared.

"Criterion (iii): As parts of the Roman Empire's general system of defense [sic] the German Limes, Hadrian's Wall and the Antonine Wall have an extraordinarily high cultural value. They bear an exceptional testimony to the maximum extension of the power of the Roman Empire through the consolidation of its northwestern frontiers and thus constitute a physical manifestation of Roman imperial policy. They illustrate the Roman Empire's ambition to dominate the world in order to establish its law and way of life there in a long-term perspective. They witness Roman colonization in the respective territories, the spread of Roman culture and its different traditions – military, engineering, architecture, religion management and politics – and the large number of human settlements associated with the defences which contribute to an understanding of how soldiers and their families lived in this part of the Roman Empire.

- (iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history.

"Criterion (iv): The fortified German Limes, Hadrian's Wall and the Antonine Wall are outstanding examples of Roman military architecture and building techniques and of their technological development, perfected by engineers over the course of several generations. They demonstrate the variety and sophistication of the Romans' responses to the specific topography and climate as well as to the political, military and social circumstances in the northwestern part of the Empire which spread all around Europe and thereby shaped much of the subsequent development in this part of the world."

Integrity

3.1.5. The statement of integrity relevant to the Hadrian's Wall component of the WHS in the adopted SOUV of the

Frontiers of the Roman Empire property is as follows:

"The inscribed components convey the extraordinary complexity and coherence of the Frontiers of the Roman Empire in northwestern Europe. Although some parts have been affected by land use change and natural processes, the integrity of the property is demonstrated through its visible remains and buried archaeological features. Their state of survival has been researched in many areas. Several areas of the frontier have been built over, but where significant archaeological remains have been proven to exist they have been included in the property.

"About four fifths of the line of Hadrian's Wall runs through open country. Within the central 45 km of its course, the remains are in an exceptionally good state of preservation, surviving as part of a landscape which still contains significant visible traces of the Roman military presence. Even outside this central zone, many individual sites are well-preserved."

Authenticity

3.1.6. The adopted SOUV describes the authenticity of the property relevant to the Hadrian's Wall component of the WHS as follows:

"The inscribed component parts have a high level of authenticity, with each having been verified through extensive study and research. The materials and substance of underground archaeological remains are well-preserved, as are upstanding and visible remains. The form and design of each representative part of the frontier and its associated structures are clear and comprehensible. Later development overlying parts of the frontier are treated as vertical buffer zones. There are a number of reconstructions of elements of the frontier such as forts and watchtowers. Reconstructions since 1965 are not considered as part of the serial property but also act as vertical buffer zones.

"The form and design of Hadrian's Wall, in particular its linear character, and its architectural and military elements are still easy to understand and its location and setting in the landscape can be clearly appreciated. Upstanding parts of the property have been conserved in accordance with the highest standards and are in a good state of repair."

Protection and Management

3.1.7. The adopted SOUV states the following with regards to protection and management of the Hadrian's Wall components of the property (statements regarding protection and management of other components of the property are omitted here for brevity and relevance):

"All parts of Hadrian's Wall within the World Heritage property are currently protected by designation under the 1979 Ancient Monuments and Archaeological Areas Act 1979 and through the Town and Country Planning Act 1990 and the Planning (Listed Buildings and Conservation Areas) Act 1990 that control planning and development in England. Hadrian's Wall is also covered by the guidance given in the National Planning Policy Framework 2024 and Planning Practice Guidance. Local Plans produced by the local planning authorities on the line of the Wall contain appropriate policies to protect the World Heritage property. The site benefits from other designations such as National Parks, National Landscapes and the Roman Wall Escarpment Site of Special Scientific Interest. Parts of the property are managed by eight different bodies for public access, but the vast bulk is in private ownership. The Hadrian's Wall Partnership Board brings together key national and local stakeholders and sets the strategy for the effective management of the property and oversees a network of specialist topic groups."

3.2. Hadrian's Wall WHS Management Plan

3.2.1. In line with the Operational Guidelines (Paragraph 108), the Hadrian's Wall WHS has had a Management Plan since 1996, with subsequent editions in 2002, 2008 and 2014. The current Hadrian's Wall Management Plan 2024-2029 is published by the Hadrian's Wall Partnership and is hosted on the Hadrian's Wall Country website (https://hadrianswallcountry.co.uk/management-plans/).

3.2.2. The Management Plan is not a statutory planning document, however, in England WHS Management Plans are an important and relevant matter under s104 of the Planning Act 2008, and are a material consideration in the planning process (Protection and Management of World Heritage Sites | Historic England). The following 2024-2029 Management Plan objectives and related policies relate to protection of the OUV of the WHS:

Objective 3: To protect the Outstanding Universal Value (OUV) of the World Heritage Site, using appropriate legislation, planning policy, guidance and management measures

Policy 3a: When considering proposals for development, local planning authorities should ensure that they protect or better reveal the significance of the OUV of the World Heritage Site, through the adoption and application of high standards of decision-making, that are consistent throughout the World Heritage Site.

- Action: The Management Plan should inform the development of Local Plans and other strategic or spatial planning documents and policies in the Hadrian's Wall area.

Action: Share best practice of planning and conservation issues, particularly amongst those engaged in management through the Planning system, through development of a dedicated web space of case studies, and a planning seminar every 3-5 years to disseminate these more widely.

Policy 3b: Local Authorities should assess development proposals for their impact on the OUV of the WHS. Development proposals which would cause significant harm to the OUV of the WHS should not normally be permitted, and all applications should be determined in accordance with the national and local planning policy.

- Action: Local Planning Authorities should consult with appropriate expert advisors and, where necessary, should require applicants to commission further information. This information should be proportionate to the development proposed, and should draw on UNESCO's Guidance and Toolkit for Impact Assessments in a World Heritage Context (HIA) and Historic England's advice and guidance.
- Action: Instigate a training programme, focussed on Local Authorities, on the OUV of Hadrian's Wall and the implications of managing this through the planning system.

Policy 3c: Legal protection of sites in the World Heritage Site should be reviewed in line with new discoveries and where possible, anomalies should be brought into line – taking into account the level of threat.

Policy 3d: Those managing assets under other consent regimes should take the OUV of the World Heritage Site into account.

3.2.3. The Local Authorities within which the WHS and its buffer zone lies (Northumberland County Council, Northumberland National Park Authority, Newcastle City Council, North Tyneside Council, South Tyneside Council and Cumberland Council) are members of the Hadrian's Wall Partnership, and Local Plans produced by the local planning authorities contain appropriate policies to protect the World Heritage property. Local development plans are important and relevant considerations for the purposes of the Planning Act 2008.

3.3. Attributes of OUV of the Hadrians Wall element of the WHS

3.3.1. "*Attributes are aspects of a property which are associated with or express the Outstanding Universal Value*" (World Heritage Resource Manual 'Preparing World Heritage Nominations' (Second edition, 2011) (https://whc.unesco.org/en/preparing-world-heritage-nominations/). Attributes flow from the Statement of OUV.

3.3.2. Attributes are not officially adopted by UNESCO and have no official standing, but they provide a checklist for those considering policies or planning activity that might affect the WHS (2024-2029 Management Plan). The UNESCO Guidance and Toolkit for Impact Assessment in a World Heritage context (UNESCO 2022) notes that assessments should, *"[…] address potential impacts on the attributes of the property which convey OUV, as well as other heritage/conservation values*" (ibid., p. 8: Principle 4).

3.3.3. The 2024-2029 Management Plan identifies the following 'Attributes' of the Hadrian's Wall component of the WHS (numbers added for ease of reference):

1. *Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].*
2. *In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.*
3. *Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.*
4. *The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.*
5. *The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.*
6. *The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.*
7. *The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.*

8. *The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.*

9. *Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.*

3.3.4. **Appendix B** provides an analysis of the values and attributes of the WHS (as identified in the 2024-2029 Management Plan) with reference to the 2022 UNESCO Guidance and Toolkit, Tool 1, Values and Attributes. This includes consideration of values relating to each of the attributes derived from the SOUV as presented in the 2024-2029 Management Plan, including the contribution made by the WHS's setting, including its buffer zone, and their integrity and authenticity[6]**, and the ability to appreciate those attributes. Based on this analysis, all attributes or OUV have been 'screened in' for consideration in the sensitivity analysis.**

Attributes of OUV of the transnational Frontiers of the Roman Empire World Heritage Site

3.3.5. In terms of the transnational property, the attributes of OUV were summarised at a whole property level for the purposes of the Third Cycle of Periodic Reporting[7], as follows below; these attributes are relevant to consideration of the impact of change within the Hadrian's Wall component of the WHS on the transnational WHS:

- *Artificial boundaries in the north-western provinces of the Roman Empire*
- *Military installations showing Roman military architecture and building techniques: walls, ditches, earthworks, fortlets, forts, fortresses, watchtowers*
- *Civilian settlements related to military installations and linked through an extensive supporting network*
- *Many remains survive as part of a landscape which still contains significant visible traces of the Roman military presence*
- *Extensive relict landscapes: combination of visible and buried remains*

3.4. The boundaries of the WHS

3.4.1. The Hadrian's Wall element of the Frontiers of the Roman Empire WHS ('the WHS') extends across the north of England from the Solway to the Tyne. The boundary of the inscribed WHS is defined as the parts of the frontier protected as scheduled monuments under the Ancient Monuments and Archaeological Areas Act 1979. These include surviving sections of the Wall itself, its milecastles, turrets and forts, the Vallum, signal towers, camps, and roads. In accordance with UNESCO recommendations, a buffer zone has been defined around it to provide additional protection (the buffer zone is discussed further below).

3.4.2. The boundaries of the WHS and of its buffer zone were endorsed by the UNESCO World Heritage Committee in 1997. Definitive maps and a database of components were formally adopted by UNESCO at their meeting in July 2012. The boundaries of the WHS within the Study Area are shown on Figure 2 in **Appendix E**.

3.4.3. The original nomination of Hadrian's Wall as a WHS included the Wall itself, its milecastles, turrets and forts, the Vallum, signal towers, camps, and the roads (including the Stanegate and its associated forts). The nomination also included the fort at South Shields (Arbeia) and the known milefortlets, towers and forts on the Cumbrian coast as far south as Ravenglass. The current boundaries of the WHS, which were not mapped in detail with the Site's original nomination in 1987, do not include all these elements in their entirety. The defined extent of the Site itself was agreed during the development of the first Hadrian's Wall Management Plan in 1996. This definition included as parts of the frontier those elements protected as scheduled monuments under the Ancient Monuments and Archaeological Areas Act 1979.

3.4.4. Some lengths of the Wall and of the other linear features, and some areas of the forts and other structures, are not scheduled and are therefore not formally included in the WHS but remain protected through the provisions of the Town and Country Planning Act 1990. However, such features and areas which are not covered by the WHS boundary may nevertheless contribute to the attributes of OUV of the WHS.

3.4.5. A further addition to the WHS made during the development of the first (1996) Management Plan was the

6 Integrity and Authenticity are conditions which a property must meet to be inscribed. The integrity and authenticity of the WHS are part of its OUV. Each of the attributes of OUV has integrity and authenticity.

7 https://whc.unesco.org/document/217715

outpost fort at Bewcastle, on the road known as the Maiden Way, which connects it to the Wall via the signal station at Robin Hood's Butt. The justification for this addition was that this fort was first built at the same time as Hadrian's Wall, and its history of occupation was closely associated with that of the Wall itself.

3.4.6. As can be seen in Figure 2 (**Appendix E**), to the east of Carlisle the scheduled monuments that comprise the WHS within the Study Area form a continuous linear feature. Further to the west there are gaps in the designation, particularly to the north of Carlisle and further to the west to the south of the Solway Firth.

3.5. The WHS buffer zone

3.5.1. Planning Practice Guidance (Historic environment Paragraph: 033 Reference ID: 18a-033-20190723 - GOV.UK) notes with regards to the protection of the setting of a World Heritage Site that, "*The UNESCO Operational Guidelines seek protection of "the immediate setting" of each World Heritage Site, of "important views and other areas or attributes that are functionally important as a support to the Property" and suggest designation of a buffer zone wherever this may be necessary. A buffer zone is defined as an area surrounding the World Heritage Site which has complementary legal restrictions placed on its use and development to give an added layer of protection to the World Heritage Site. The buffer zone forms part of the setting of the World Heritage Site*".

3.5.2. The buffer zone is not part of the inscribed World Heritage property, and is not in itself of Outstanding Universal Value (OUV); the purpose of the buffer zone is to signal the area around the WHS that is particularly sensitive to, and to provide an added layer of protection to the property through complementary legal restrictions placed on its use and development. Development in the buffer zone that could have an impact on the attributes of the OUV of the property would be regarded as an important and relevant matter in terms of the Planning Act 2008.

3.5.3. The 2024-2029 Management Plan includes the following Objective regarding the WHS boundaries and buffer zone:

Objective 2: To maintain appropriate boundaries of the World Heritage Site, encompassing those elements of the Roman frontier that reflect OUV of the WHS, and to document clearly those additional features that still fall outside the World Heritage Site.

3.5.4. The Management Plan would be regarded as an important and relevant matter in terms of the Planning Act 2008. The Management Plan is produced by the Hadrian's Wall Partnership, which includes Historic England (as statutory advisor for World Heritage Sites) and the Local Authorities within which the WHS and its buffer zone lies.

3.5.5. Given the purpose of the buffer zone in providing an added layer of protection to the property through complementary legal restrictions placed on its use and development, there is an assumption that development in the buffer zone is likely to have an adverse effect on the appreciation of the OUV of the property which, again, would be regarded as an important and relevant matter in terms of the Planning Act 2008.

3.5.6. Development Plans produced by the local planning authorities along the line of the Wall contain appropriate policies to protect the property. Within the Proposed Development WHSCA Study Area, the WHS buffer zone is shown in the Local Plan proposals maps for Cumberland, where the buffer zone is located in rural areas. Relevant Development Plan policies would be regarded as an important and relevant matter in terms of the Planning Act 2008 and include:

Cumberland Council – Allerdale Local Plan Part 1 Policy S28

> *"There is a presumption in favour of preserving the fabric, integrity and authenticity of archaeological sites that form part of Hadrian's Wall World Heritage Site. Development that would have a detrimental effect on archaeological remains and their setting will be refused […] Development that would have an adverse impact on Outstanding Universal Value [of the WHS] will be refused."*

Cumberland Council – Carlisle Local Plan Policy HE1

> *"New development will not normally be permitted on currently open land on the line of the [Hadrian's] wall […] Proposed development outside the boundaries of the buffer zone will, where appropriate, be carefully assessed for its effect on the site's Outstanding Universal Value, and any that would result in substantial harm will be refused."*

Definition of the buffer zone

3.5.7. A buffer zone for the WHS was proposed in the first Hadrian's Wall Management Plan in 1996 and endorsed by the World Heritage Committee in 1997. The 1996 Management Plan makes clear that the intention behind the proposed buffer zone was to define the setting of the WHS (English Heritage 1996, section 2.3 'The Setting / Buffer Zone') and includes a set of maps defining the 'Proposed extent of the World Heritage Site and its Setting'. It should be noted, however, that understanding about setting and how it contributes to OUV, and

related guidance has evolved since 1996 when the setting of the WHS was defined with the inclusion of a buffer zone.

3.5.8. The 1996 Management Plan states that in rural areas the proposed buffer zone, "*includes the whole of the continuous archaeological features comprised by the Wall and its associated remains*", and in the urban areas of Carlisle and Tyneside it is defined to protect, "*The general line of the frontier*" (English Heritage 1996, paragraphs 2.3.3 and 2.3.5). The 1996 Management Plan also notes that, "*For detached sites outside the defined Setting [the buffer] it will be necessary to consider for any application in their vicinity the effect that that application might have on the setting of the ancient monument*".

3.5.9. The boundaries of the WHS and its setting / buffer zone as defined in the 1996 Management Plan were endorsed at the 21st Session of the Bureau of the World Heritage Committee (Decision 21.BUR.IV.B.60) in 1997.

3.5.10. The second Management Plan (2002-2007) included clearer maps of the buffer zone. All subsequent Management Plans since 2008 have included a policy to the effect that, "*The boundaries of the Buffer Zone agreed for the 2002-07 Management Plan will remain unchanged for the period of this Management Plan*" (2024-2029 Management Plan, Policy 2c).

3.5.11. Definitive maps and a database of components of the Hadrian's Wall element of the WHS and its buffer zone were formally adopted by UNESCO at the 36th Meeting of the World Heritage committee in St Petersburg in July 2012 (WHC-12/36.COM/19).

3.5.12. A Draft Statement of Outstanding Universal Value submitted to the Committee in 2012 (**Appendix A.2**) included a Contributory Statement regarding the Hadrian's Wall component of the WHS, which noted that:

> *"There is an extensive buffer zone to protect the property's OUV from development which could affect the ability to appreciate Roman military planning and land use".*

3.5.13. The extents of the buffer zone as adopted by UNESCO in 2012 within the Study Area are shown on Figure 2 in **Appendix E**.

3.5.14. Although not part of the nominated property, and therefore not in itself of OUV, the buffer zone is necessarily included within the scope of the 2024 – 2029 Management Plan. The buffer zone encompasses the majority of the scheduled monuments that comprise the nominated property. The 2024-2029 Management Plan describes the Hadrian's Wall WHS buffer zone as follows.

> *"In the rural parts of the Site, the Buffer Zone is mapped as a visual envelope, agreed by the Local Authorities, and extending between 1 and 6 km from the Site, depending on the topography. Its purpose is to signal the area around the WHS that is particularly sensitive to change which could impact on its Outstanding Universal Value.*
>
> *"In the urban areas, the Buffer Zone is a narrow band. It includes the remains of Hadrian's Wall that are not visible (and which are sometimes not precisely located), and that have not therefore been given the statutory protection of scheduling. These buried remains are, nevertheless, of national and international significance and are protected through the planning system. They include areas of archaeological potential associated with the WHS, such as the fort sites at South Shields, Wallsend, Newcastle, Benwell and Stanwix."*

3.6. The setting of the WHS

3.6.1. The setting of the WHS, as defined by the geology, topography and land use of the area, has a role in supporting the OUV of the WHS. The Operational Guidelines state that, *"…properties may be understood to meet the conditions of authenticity if their cultural values (as recognized in the nomination criteria proposed) are truthfully and credibly expressed through a variety of attributes including … location and setting*" (paragraph 82).

3.6.2. The 2024-2029 Management Plan notes that, "*The remains of the Roman frontier still form a significant element of the landscape from Tyne to Solway. Both the Wall's place in its modern landscape, and its effect on that landscape over previous centuries, are therefore important to an understanding of the Site, and to its management".* Aspects of the property's setting that contribute to the understanding and appreciation of Roman military planning and land use form the basis of the majority of the attributes of the OUV of the WHS as identified in the 2024-2029 Management Plan (above).

3.6.3. In UK planning policy, setting is defined as follows:

> *"The setting of a heritage asset is the surroundings in which it is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset and may affect the ability to appreciate that significance or may be neutral."* (National Planning Policy Framework, Annex 2; NPS EN-1, footnote 231)

3.6.4. The X'ian Declaration, adopted by ICOMOS in 2005, defines setting as follows:

"*The setting of a heritage structure, site or area is defined as the immediate and extended environment that is part of, or contributes to, its significance and distinctive character*." (ICOMOS 2005, p.2)

3.6.5. A case study by Historic England was published as a supplement to the UNESCO Guidance for Wind Energy Projects in a World Heritage Context launched in March 2023. This considered an approach to the assessment of renewable energy applications that could be seen from the Hadrian's Wall WHS, focusing on the potential for proposals to be harmful to the understanding and protection of the OUV of the WHS (https://whc.unesco.org/en/wind-energy/case-study-uk/). Although the case study concerned proposals for wind turbine developments rather than transmission lines, the approach was based on Historic England guidance, as set out in *Historic Environment Good Practice Advice in Planning Note 3: The setting of heritage assets* (GPA3; Historic England 2017) and is relevant to the WHSCA for the way in which it considers the setting of the Wall in relation to its function as a frontier.

3.6.6. The case study notes that the SOUV makes clear that, "*the area around Hadrian's Wall plays a role in the significance of the [WHS], where it enhances the understanding and appreciation of Roman military planning and land use*" (Historic England, 2023).

3.6.7. The case study referenced above illustrates how the design and use of the inscribed property (the WHS) as a defensive frontier is an important factor of its setting which supports and contributes to its OUV.

3.6.8. The overall setting of the WHS is not fixed and will reflect the interaction of the settings of the inscribed property (including its buffer zone) and of the individual scheduled monuments that comprise the property. The buffer zone (above) forms part of the setting of the World Heritage Site but does not define it.

Development affecting the setting of the WHS

3.6.9. The approach in the Historic England case study referenced above followed the guidance in Historic Environment Good Practice Advice in Planning: 3 (2nd Edition) (2017) ('GPA3'), which places the emphasis on understanding the significance of a site and the role that setting plays in this, to then allow an understanding of the way that a particular development impacts on that asset. The case study notes that, "*this approach is supported by the National Planning Policy Framework (NPPF), which integrates the protection of World Heritage properties and their setting (paragraphs 202 and 207) alongside provisions on the importance of understanding the impact of proposals on the significance of heritage assets (paragraph 207)*".

3.6.10. The case study assessment can be summarised as follows:

- The SOUV and the nomination and acceptance documents clearly show that the area around Hadrian's Wall contributes to its significance, allowing an understanding and appreciation of Roman military planning and land use.
- In the central sector, the Wall was positioned on high ground not only because it was more defensible, but also to allow Roman troops to have a general view of their surroundings.
- However, the terrain to both north and south includes a series of valleys with several areas that cannot be seen from the Wall, suggesting that in this sector, Roman troops did not only rely on direct observation for their protection, but were more likely to have controlled the northern approaches to the Wall via military patrols.
- Consequently, views north, across the hills and hidden ground in the valleys, did not play such a crucial role in the planning and operation of the Wall frontier.

3.6.11. Following this approach, the case study assessment concluded that the ability to see wind turbines on distant hills from the central section of the Wall did not harm the OUV of the property as the Romans did not design their frontier and base their control of this landscape in a way that was reliant on views of these distant hills. Although the turbines on the hills would be visible, they would not interrupt or harm any views crucial in understanding and appreciating the Hadrian's Wall frontier.

3.6.12. However, another wind energy project sited on the Cumbrian coastline was considered to affect the setting of the Hadrian's Wall WHS. The Cumbrian coastline itself formed the defended frontier line, with a series of towers and fortlets located every 600 m to look for enemy incursions from across the sea, sited to communicate visually with each other. Due to the curved orientation of the coast here, the proposed turbines would sit visually just behind the line of the frontier and would therefore distract the eye and harm the ability to understand and appreciate the Roman military planning and operation of the frontier. In this case, assessment focused on the ability to appreciate and understand the presence of the frontier around and along the coast, and the impact on the intervisibility of the locations of these Roman military installations, concluding that there would be a potential negative impact on the property's OUV because of the distraction that the proposed turbines would cause.

4. Legislative requirements

4.1. Planning Act 2008

4.1.1. The Planning Act sets the statutory framework for the consenting of 'nationally significant infrastructure projects' ('NSIPs'). The requirements for treatment of World Heritage Sites, as assets of the highest sensitivity, go to Section 104 of the Planning Act 2008. Section 104 (2) requires that the Secretary of State must have regard to a relevant National Policy Statement:

(2) In deciding the application the [Secretary of State] must have regard to−

(a) any national policy statement which has effect in relation to development of the description to which the application relates (a "relevant national policy statement"),

4.1.2. The relevant National Policy Statements (NPS) are the overarching National Policy Statement for Energy (NPS EN-1) and the National Policy Statement for Electricity Networks (NPS EN-5).

4.1.3. Section 104 (3) stipulates:

(3) The [Secretary of State] must decide the application in accordance with any relevant national policy statement, except to the extent that one or more of subsections (4) to (8) applies.

4.1.4. Of the exceptions provided by subsections (4) to (8), Section 104 (4) is relevant in terms of the United Kingdom's responsibilities as a signatory to the World Heritage Convention:

(4) This subsection applies if the [Secretary of State] is satisfied that deciding the application in accordance with any relevant national policy statement would lead to the United Kingdom being in breach of any of its international obligations.

4.2. World Heritage Convention obligations

4.2.1. Regarding the UK's international obligations, these go to Articles 4 and 5 of the World Heritage Convention ('the Convention'). Article 4 sets out the duties of States Parties:

Article 4

Each State Party to this Convention recognizes that the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 and situated on its territory, belongs primarily to that State. It will do all it can to this end, to the utmost of its own resources and, where appropriate, with any international assistance and co-operation, in particular, financial, artistic, scientific and technical, which it may be able to obtain.

4.2.2. Article 5 sets out the actions expected of States Parties in respect of the responsibilities listed in Article 4. These include:

Article 5

To ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage situated on its territory, each State Party to this Convention shall endeavor (sic.), in so far as possible, and as appropriate for each country:

(d) to take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage.

4.2.3. The Convention has not been incorporated into domestic law.

4.2.4. The interpretation of Articles 4 and 5 of the Convention in terms of the application of Section 104 (4) of the Planning Act was considered in the Court of Appeal in relation to the granting in July 2023 on redetermination by the Secretary of State for Transport (SST) of a DCO for the A303 Stonehenge improvements (Save Stonehenge v Secretary of State). In redetermining the application and granting a new DCO, and with reference to the judgment of the High Court in July 2022 quashing a previous DCO, the SST had concluded that he was required by Section 104 (3) of the Planning Act to determine the application in accordance with the policy in the relevant NPS [the NPS for National Networks], unless he was satisfied that this would lead to a breach of the UK's international obligations [under the World Heritage Convention], as per Section 104 (4). The SST had further concluded that, (i) application of the relevant NPS required him, having found that the scheme would result in 'less than substantial harm' to the significance of the WHS, to weigh this less than substantial harm against the public benefits of the proposal; and (ii) that Articles 4 and 5 of the Convention did not proscribe such a 'balancing' exercise. The Court of Appeal considered (inter alia), whether the Secretary of State's view on the [A303] scheme's compliance with the Convention was legally sound.

4.2.5. In relation to the interpretation of Articles 4 and 5, the Court of Appeal held that:

- The provisions of Section 104(3) and (4) of the 2008 [Planning] Act do not give effect to any of the obligations in the Convention. Their effect is to make the Secretary of State's being satisfied that there is a breach of those obligations one of the statutory grounds for not having to apply policy in a relevant national policy statement. (Save Stonehenge v Secretary of State, 152).

- Neither Article 4 nor Article 5 [of the Convention] expresses an absolute prohibition on any heritage harm being allowed to occur to a World Heritage Site. The objectives and commitments they state are cast at a high level and in general terms. The broad language in them does not exclude the possibility that in particular circumstances, not defined, some harm to a World Heritage Site might be permissible. Article 4 expresses the commitment of the State Party to "do all it can … to the utmost of its own resources" to protect any World Heritage Site in its territory. This is not an unqualified requirement, either in its own terms or when read with Article 5. The steps identified in Article 5 as necessary to achieving such protection must be implemented "in so far as possible, and as appropriate to each country" (Save Stonehenge v Secretary of State, 157).

- The concept in Article 4 of a State Party doing "all it can … to the utmost of its own resources", taken in context, does not mean that the protection of a World Heritage Site must in every circumstance be given absolute priority over all other considerations – social, economic and environmental – and have unlimited resources committed to it, to ensure the total avoidance of harm […] (Save Stonehenge v Secretary of State, 158).

- [This] is not inconsistent with the purpose of the Convention to protect cultural heritage of this importance. It does not diminish the commitment expressed in Article 4 – for a State Party to do all it can to protect World Heritage Sites to the utmost of its own resources.[…] any balancing exercise conducted by a State Party in decision-making on a proposal for development affecting a World Heritage Site must recognise and give great weight to the need to safeguard its "outstanding universal value". Anything less would be liable to undermine the State Party's commitments in the Convention, and especially its commitment to "protection". (Save Stonehenge v Secretary of State, 160).

- Applying [the Court's] conclusions on the meaning and effect of articles 4 and 5 of the Convention, […] the Secretary of State was lawfully entitled to conclude that approving the proposed development in this case would not lead to a breach of those provisions (Save Stonehenge v Secretary of State, 166).

4.2.6. The appeal was dismissed in the Appeal Court judgment handed down on 16 October 2024; permission to appeal to the Supreme Court was refused on 27 January 2025.

4.3. National Policy Statements

4.3.1. Although WHS designation brings no new statutory controls (notwithstanding that individual components of the WHS benefit from statutory protection as Scheduled Monuments), WHS are recognised in the National Policy Statements (NPS) as assets of the highest importance. Paragraph 5.9.30 of NPS EN-1 states that, "*substantial harm to or loss of significance of assets of the highest significance, including Scheduled Monuments; Protected Wreck Sites; Registered Battlefields; grade I and II* Listed Buildings; grade I and II* Registered Parks and Gardens; and World Heritage Sites, should be wholly exceptional*". Consent can be refused unless it can be demonstrated that any substantial harm to or loss of significance is necessary to achieve substantial public benefits that outweigh the harm or loss: such circumstances will necessarily be wholly exceptional. For World Heritage Sites, the cultural value described within each site's Statement of Outstanding Universal Value forms part of its significance. However, as noted in NPS EN-1 (paragraph 5.9.34), not all elements of a World Heritage Site will necessarily contribute to its significance.

Overarching National Policy Statement for Energy (EN-1)

4.3.2. Section 5.9 of EN-1 sets out the historic environment aspects to be taken into account by applicants and by the Secretary of State in decision making.

Applicant assessment

5.9.15 Applicants should look for opportunities for new development within Conservation Areas and World Heritage Sites, and within the setting of heritage assets, to enhance or better reveal their significance. Proposals that preserve those elements of the setting that make a positive contribution to the asset (or which better reveal its significance) should be treated favourably.

Secretary of State decision making

5.9.27 - When considering the impact of a proposed development on the significance of a designated heritage asset, the Secretary of State should give great weight to the asset ' s conservation. The more important the asset, the greater the weight should be. This is irrespective of whether any potential harm amounts to substantial harm, total loss, or less than substantial harm to its significance.

5.9.28 The Secretary of State should give considerable importance and weight to the desirability of preserving all heritage assets. Any harm or loss of significance of a designated heritage asset (from its alteration or destruction, or from development within its setting) should require clear and convincing justification.

5.9.30 Substantial harm to or loss of significance of assets of the highest significance, including Scheduled Monuments; Protected Wreck Sites; Registered Battlefields; grade I and II Listed Buildings; grade I and II* Registered Parks and Gardens; and World Heritage Sites, should be wholly exceptional.*

5.9.31 Where the proposed development will lead to substantial harm to (or total loss of significance of) a designated heritage asset the Secretary of State should refuse consent unless it can be demonstrated that the substantial harm to, or loss of, significance is necessary to achieve substantial public benefits that outweigh that harm or loss, or all the following apply:

- *the nature of the heritage asset prevents all reasonable uses of the site*
- *no viable use of the heritage asset itself can be found in the medium term through appropriate marketing that will enable its conservation*
- *conservation by grant-funding or some form of not for profit, charitable or public ownership is demonstrably not possible*
- *the harm or loss is outweighed by the benefit of bringing the site back into use*

5.9.32 Where the proposed development will lead to less than substantial harm to the significance of the designated heritage asset, this harm should be weighed against the public benefits of the proposal, including, where appropriate securing its optimum viable use.

5.9.33 In weighing applications that directly or indirectly affect non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.

5.9.34 Not all elements of a Conservation Area or World Heritage Site will necessarily contribute to its significance. Loss of a building (or other element) which makes a positive contribution to the significance of the Conservation Area or World Heritage Site should be treated either as substantial harm under paragraph 5.9.30 or less than substantial harm under paragraph 5.9.32, as appropriate, considering the relative significance of the element affected and its contribution to the significance of the Conservation Area or World Heritage Site as a whole.

5.9.36 When considering applications for development affecting the setting of a designated heritage asset, the Secretary of State should give appropriate weight to the desirability of preserving the setting such assets and treat favourably applications that preserve those elements of the setting that make a positive contribution to, or better reveal the significance of, the asset. When considering applications that do not do this, the Secretary of State should give great weight to any negative effects, when weighing them against the wider benefits of the application. The greater the negative impact on the significance of the designated heritage asset, the greater the benefits that will be needed to justify approval.

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

4.3.3. Paragraphs 2.9.16 to 2.9.19 of EN-5 summarise the relevant guidelines for the routing of new OHLs (the Holford Rules) and for the siting of substations (the Horlock Rules). The discussion below is based on the Holford Rules (available at: Microsoft Word - The Holford Rules.doc) and the Horlock Rules (available at https://www.nationalgrid.com/sites/default/files/documents/13796-The%20Horlock%20Rules.pdf) (see footnote 19 to EN-5).

Holford Rules

4.3.4. The Holford Rules (Guidelines for the routing of new High Voltage Overhead Transmission Lines) were first formulated in 1959, are still in use by National Grid as a basis of the approach to OHL routeing and are a valuable tool in the selecting and assessing of potential route options as part of the environmental assessment process.

4.3.5. Rule 1 of the Holford Rules concerns avoidance of areas of the highest amenity value:

Rule 1:

Avoid altogether, if possible, the major areas of highest amenity value, by so planning the general route of the first line in the first place, even if the total mileage is somewhat increased in consequence.

Note on Rule 1

Investigate the possibility of alternative routes, avoiding if possible the areas of the highest amenity value. The consideration of alternative routes must be an integral feature of environmental statements.

Areas of highest amenity value are:

- Areas of Outstanding Natural Beauty[8]
- National Parks
- Heritage Coasts
- World Heritage Sites

4.3.6. For the purposes of Rule 1 of the Holford Rules, given the definition of the WHS boundary (individual components protected as scheduled monuments) and the way in which the functional setting of the WHS as it relates to the defensive frontier complex (see paragraph 2.1.33 above) – and the buffer zone, insofar as it is intended to define the immediate setting of the WHS – contributes to its OUV, it is proposed that the WHS together with its buffer zone as a whole should be regarded as the 'area of highest amenity value' relating to the WHS, which the Holford Rules advise should be avoided where possible.

4.3.7. Notwithstanding the principle of avoiding areas of the highest amenity value where possible, an existing OHL (XB 275kV) lies within the WHS buffer zone and the setting of the WHS: the existing line was installed in 1964 and was extant when the WHS was inscribed on the World Heritage List in 1987.

4.3.8. As noted in Paragraph 5.9.30 of National Policy Statement (NPS) EN-1, not all elements of a World Heritage Site will necessarily contribute to its significance. Hence, the capacity of the WHS and its buffer zone to absorb change without adversely impacting the OUV of the WHS will vary from location to location, taking into account the relative state of preservation (extent of survival) of the components of the WHS, the sensitivity to change of the historic landscape, and the presence of existing OHL and transport infrastructure corridors.

Horlock Rules

4.3.9. The Horlock Rules – guidelines for the design and siting of substations – were established by National Grid in 2009 in pursuance of its duties under Schedule 9 to the Electricity Act 1989. These principles should be embodied in applicants' proposals for the infrastructure associated with new overhead lines.

4.3.10. In brief, the Horlock Rules state that applicants should:

- *"consider environmental issues from the earliest stage to balance the technical benefits and capital cost requirements for new developments against the consequential environmental effects in order to keep adverse effects to a reasonably practicable minimum.*
- *"seek to avoid altogether internationally and nationally designated areas of the highest amenity, cultural or scientific value by the overall planning of the system connections.*
- *"Internationally and nationally designated areas of highest amenity, cultural or scientific value are: National Parks; Areas of Outstanding Natural Beauty; Heritage Coasts; World Heritage Sites; Ramsar Sites; Sites of Special Scientific Interest; National Nature Reserves; Special Protection Areas; Special Areas of Conservation. Care should be taken in relation to all historic sites with statutory protection e.g. Scheduled Monuments, Battlefields and Listed Buildings."*

5. Landscape and archaeological background

5.1. Introduction

5.1.1. The following section is not intended to provide a detailed overview of the history and development of the landscape of the Study Area, but rather to provide some brief background information relating to Hadrian's Wall and its associated monuments, as well as the landscape in which it is located. It does not examine the wider history of the Proposed Development WHSCA Study Area, but focuses on the assets that form the Hadrian's Wall WHS, and contribute to its OUV. As has been noted previously, the WHS inscription comprises a number

8 Areas of Outstanding Natural Beauty are now referred to as National Landscapes

of scheduled monuments; those within the Proposed Development WHSCA Study Area are listed in **Appendix D** and shown on Figure 4 (**Appendix E**). Where these are discussed in the text, they are referred to by the relevant National Heritage List for England (NHLE) reference number.

5.2. Site visits

5.2.1. An initial site visit was undertaken on the 10th and 11th of December 2024. The aim of the visit was to characterise the landscape of the WHS and its associated buffer zone within the Proposed Development WHSCA Study Area, as well as examine the visibility of the scheduled monuments that make up the WHS. The survey also examined the impact of modern development on the Proposed Development WHSCA Study Area, as well as the current visibility of modern infrastructure such as the operational overhead lines. A selection of site photographs is provided in **Appendix G** to illustrate the landscape of the WHS buffer zone within the Proposed Development WHSCA Study Area.

5.2.2. Weather conditions for all site work were very good, with very good visibility (i.e., over 60km from the A69 near Low Row in the east to the summit of Criffel in the west). The site visit was undertaken from public rights of way and publicly accessible land.

5.2.3. In general, the landscape of the WHS and its buffer zone, within the limits of the Proposed Development WHSCA Study Area, was found to consist of agricultural land, with a mix of pasture and arable farming visible in the eastern and western sections, with the more upland areas of the central sectors semi-improved pasture with some commercial woodland. Hedgerows form the predominant form of field boundary, and both these and the small pockets of woodland that litter the landscape provide relatively effective screening of lower infrastructure when coupled with the undulating landscape. A large number of settlements of varying size are present within the Proposed Development WHSCA Study Area, as well as isolated farmsteads. Larger settlements, such as Brampton and Warwick Bridge fall outside of the buffer zone, as does most of Carlisle.

5.2.4. The buffer zone is also defined by many infrastructure corridors, including the M6 running broadly north-south, and the A69 and A689 which run roughly east-west. These major roads are accompanied by a network of smaller ‘B’ and ‘C’ class roads, as well as the East-West Railways line, and the West Coast Main Line railway, which forms one of the boundaries of the WHS buffer zone north of Carlisle; the very large Carlisle Kingsmoor Marshalling Yards on the railway line fall within the WHS buffer zone.

5.2.5. Other visible modern infrastructure within the buffer zone includes several existing OHLs, most of which run into the Harker Substation north of Carlisle, as well as Carlisle Lake District Airport north-east of the City. Finally, modern agricultural activity has also left a significant visible footprint on the landscape of the WHS and its buffer zone within some parts of the Proposed Development WHSCA Study Area, with a number of very large agricultural buildings noted. These larger farms are very much focused on the lower lying land at the eastern and western ends of the Proposed Development WHSCA Study Area.

5.2.6. The very western end of the Proposed Development WHSCA Study Area was dominated by the meandering course of the River Eden as it makes its way to the Solway Firth, with evidence of flooding/an elevated water table visible throughout the low-lying flood plain that flanks the river. The Wall in this area is positioned on the edge of a slight escarpment that overlooks the river, although no clear traces of the monument survived as above ground features or earthworks.

5.3. Landscape and topography

5.3.1. The Proposed Development WHSCA Study Area lies entirely within the modern county of Cumbria; with the sections of Hadrian’s Wall (‘the Wall’) that form the basis of this study running from near Lanercost in the east to Kirkandrews-on-Eden in the west (Figure 3 in **Appendix E**). Although the main element of the WHS is the linear monument known as Hadrian’s Wall, with the Vallum to the south, the WHS inscription also incorporates a number of other associated scheduled monuments, including forts and temporary camps. The distribution of these assets means that the WHS consists of a corridor of archaeological remains, which are enclosed within an associated buffer zone agreed by the World Heritage Committee in 1997.

5.3.2. The size of the WHS and its buffer zone means that the landscape varies as the monument runs from east to west. At the eastern end of the Proposed Development WHSCA Study Area, the Wall and the Vallum follow the higher ground rising from the north side of the River Irthing, providing some views north as well as extensive views south to the valley of the River Irthing and the high ground of the North Pennines. As the Wall continues west it passes through an undulating landscape, dropping into relatively small steep valleys that flow south into the Irthing, before it finally makes the short descent into the more open landscape of the Irthing valley near the settlement of Irthington and Carlisle Airport. From here the Wall continues west on the northern edge of the Irthing flood plain until reaching Carlisle, where it crosses the River Irthing and River Eden near the point where they converge.

5.3.3. From Carlisle, the Wall proceeds west along the southern side of the River Eden as it meanders in a north-

westerly direction towards the Solway Firth. In this area, the alignment of the Wall and Vallum largely run along the top of a shallow escarpment that overlooks the Eden/Solway flood plain, with the Proposed Development WHSCA Study Area terminating at Kirkandrews-on-Eden.

5.3.4. The southern extent of the scheduled monuments that form the WHS, as well as the northern and southern extent of the buffer zone, largely cover a similar landscape to that of the Wall and Vallum, although the very extreme southern limits rise onto slightly higher ground. This is more apparent immediately east of Carlisle, where the limits of the buffer zone follow elevated ground overlooking the River Irthing flood plain.

5.3.5. The WHS in this area largely survives as below ground remains, with large sections of the Wall and its associated remains completely ploughed out. However, remains of the Wall Ditch do survive as earthworks in a number of areas, while minor roads and field systems follow the alignment across large sections of this area.

5.4. Historic landscape

Cumbria Historic Landscape Characterisation

5.4.1. The Cumbria County Council historic landscape database was derived as part of the Cumbria and Lake District National Park Historic Landscape Characterisation Proposed Development, which was completed in 2009. Historic Landscape Characterisation (HLC) is considered as, *"an aspect of more general landscape characterisation, providing an additional element of 'time depth'. It allows the historical evolution of the landscape to be perceived and understood*" (Cumbria County Council 2009).

5.4.2. The WHS and its buffer zone, and wider 3km Study Area adopted as part of the Proposed Development WHSCA Study Area fall within three of the character areas identified as part of the Cumbria Historic Landscape Characterisation Projects and which contain parts of the WHS and its setting. These are listed below and described in Table 2 below:

- Area 10: Carlisle
- Area 27: Irthing Valley
- Area 41: Solway Plain
- Area 50: Westlinton

Table 2: Descriptions for the key Historic Landscape Characterisation types within the element of the Hadrian's Wall World Heritage Site and Buffer zone which fall within the Study Area (after Cumbria County Council 2009).

Area	Description
Area 10: Carlisle	The area is dominated by the city of Carlisle with urban development including municipal parks and cemeteries, and industrial estates. Nevertheless, the whole is a cohesive character area because the urban extent of Carlisle overlies an historic landscape that is the same in the urbanised west as in the less urbanised areas to the east. Moreover, the less urbanised parts of the character area are still influenced by Carlisle and have many suburban features. The settlement pattern is highly nucleated, and whilst many of these settlements originated in the medieval period, 75% of the nucleated settlement area is modern. Seventy-four per cent of the discrete settlements and small nucleations originated after 1770. A key influence on 19th century and modern settlement and industrial development and location were the railways. This is especially so to the north of Carlisle, where early 20th century military sites have been converted into modern industrial estates. The influence of the railway has been re-emphasised by the development of the M6 motorway. The urbanised and suburbanised character of the area is reflected in the large number of ornamental parks (both private and municipal). Overall, the character of the area dates mainly to the 19th and 20th centuries, although the surviving field pattern still reflects its medieval origins, particularly former common arable fields, which are large. There is very little woodland, with some plantation blocks in areas of planned enclosure and within landscape parks. Ancient woodland is restricted to small areas of river valleys, such as along the River Eden at Corby. Legacy: A largely 19th and 20th century landscape. Moderate legibility of landscape elements of medieval origin, moderate survival of 19th century industrial features. Landscape designation and status: Includes part of the Hadrian's Wall World Heritage

Area	Description
	Site and its setting, registered park at Dalston Road Cemetery.
Area 27: Irthing Valley	The River Irthing and its tributaries are the main topographical features of this character area. Much of the character area is within the Hadrian's Wall World Heritage Site visual impact zone. The line of the Wall runs to the north of the River Irthing, and for part of its length forms a discernible feature within the local fieldscape. Aside from Brampton, a medieval market town, there are relatively few nucleations and most are small. Around half of all nucleated settlements have origins which pre-date 1770, but there is little evidence of medieval planning other than at Talkin. The settlement pattern is predominantly dispersed, with 39% of the discrete settlements pre-dating 1770, and 47% are of 19th century origin. Many of the discrete settlements are around the edge of former common waste, and some of the discrete and nucleated 19th century settlements relate to small-scale rural industry, including coal mining. Although much of the settlement pattern appears to be of relatively recent origin, the field systems have much older roots. The character area is dominated by ancient enclosures with former common arable areas associated with the principal older nucleations such as Walton, Brampton, Farlam and Talkin. Planned enclosures are largely confined to low moorlands. The area is reasonably well wooded, with Miltonrigg Wood, to the east of Brampton, forming quite an extensive area of ancient woodland. The remainder of the ancient woodland is confined to the valleys of the River Irthing, Cam Beck, King Water and River Gelt. Plantation woodlands within the character area are of two principal types: mixed, usually small woodlands within both ancient and planned enclosure areas, and plantations within landscape parks. The most significant of the latter are the mixed woodlands in Naworth Park, the ornamental grounds surrounding Naworth Castle. Legacy: A mixed pattern of modern and older settlements and field enclosure, moderate legibility of landscape elements of medieval origin. Landscape designation and status: Includes part of the Hadrian's Wall World Heritage Site and its setting.
41: Solway Plain	A low-lying area bounded by the coast to the north and west with extensive areas of sand, shingle, saltmarsh and mudflats. Much of the coastal zone lies within the Solway Coast AONB, apart from a small area around the town of Silloth. In terms of historic landscape character, the Solway Coast AONB is not distinct from the remainder of the Solway Plain character area. The area of the AONB broadly coincides with the visual impact zone for the Hadrian's Wall World Heritage Site. Hadrian's Wall has some impact on the character of the area, as most of the Roman forts were later sites for medieval settlement. The settlement pattern is varied, with large and small nucleated settlements intermixed with many discrete farms scattered across the landscape. Two thirds of the discrete farms, however, post-date 1770, and many are related to the improvement and enclosure of the wastes. In contrast, most of the nucleated settlements are of medieval origin. One exception is Silloth, a 19th century planned settlement, which is the area's only town. The older settlements are distributed within and around the edge of former common arable fields. Three quarters of the developed areas of nucleated settlements were in existence before 1770, and only 19% of the developed areas post-date 1900. Consequently, the settlement pattern is relatively traditional in comparison to some other character areas, it has a good degree of time depth and has been little altered by post-19th century development. In general, the character area retains a considerable discernible legacy from the Middle Ages in both its settlement pattern and field systems. The area is dominated by former common arable fields, with extensive areas of 19th century planned enclosures in between. The planned enclosure is mainly in areas of drained mosslands, which is one of the key features of the area. Small patches of unimproved mossland survive, especially around Wedholme Flow. In recent times, peat cutting was a significant industry around Kirkbride, on Wedholme Flow and Bowness Common, and evidence of moss rooms survive. There are small areas of anciently enclosed land, mostly belonging to individual farms. This mix of older and 19th century planned enclosures is reflected in the road system, with numerous meandering lanes amongst the former common arable fields, and fewer, straighter roads across areas of planned fields. A key characteristic of more recent development is a number of former military airfields, at Cardunnock, Kirkbride, Silloth and Wiggonby. There is very little woodland, although field boundaries usually comprise hedgerows, both for more ancient

Area	Description
	and 19th century enclosures. Legacy: A very traditional settlement pattern that largely pre-dates the 19th century with mixed enclosures of modern and earlier date, strong legibility of landscape elements of medieval origin. Landscape designation and status: Northern coastal portion is mainly within the Solway Coast AONB, much of the same area includes part of the Hadrian's Wall World Heritage Site and its setting.
50: Westlinton	To the north of Carlisle, this area of gently rolling, low-lying topography is quite sparsely populated, and is superficially similar to the Inglewood[9] character area. It includes the course of the Hadrian's Wall World Heritage Site, but this has no discernible impact on the character of the landscape. It has a patchwork mix of field systems and settlement types. The dominant settlement form is discrete, and most nucleations are small. Around 34% of the discrete settlements pre-date 1770. The remainder of the discrete settlements (45% of the total) relate largely to the enclosure and improvement of the unenclosed wastes in the 19th century. Around a third of all the nucleated and small nucleated settlements pre-date 1770 in origin, but only Irthington exhibits any evidence of medieval planning. The remainder of the settlements originated in the 19th century. Despite the relatively recent origin of much of the nucleated settlement pattern, only 29% of the total area of all nucleation post dates 1900. The field pattern is dominated by a combination of planned enclosures and ancient enclosures. Former common arable fields are scattered throughout, but are generally small. The planned enclosures are concentrated in areas of former low moorland and moss, but around the Brampton to Longtown road there are planned enclosures associated with pre-1770 discrete settlements. Woodland is largely modern plantation, and focused in the areas of planned enclosure on former mossland, for example at Scaleby Moss and Todhills. The only ancient woodland within the character area is along the Hether Burn in the north-eastern corner of the character area. Despite the area's proximity to Carlisle, and the inclusion within it of Carlisle Airport, the area is overwhelmingly rural in character. Legacy: A mixed pattern of modern and older settlements and field enclosure, but with a slight predominance of 19th century forms, moderate legibility of landscape elements of medieval origin. Landscape designation and status: Contains part of the Hadrian's Wall World Heritage Site and its setting.

5.4.3. All of these HLC area descriptions note under landscape designation and status that the areas contain parts of the WHS and its setting (undefined).

5.4.4. The eastern section of the WHS buffer zone in the Proposed Development WHSCA Study Area largely falls within HLC Area 27, which consists of the agricultural land of the Irthing Valley as well as an undulating landscape that flanks it to the north and south. The majority of this HLC area lies within the WHS and its associated buffer, with no other landscape designations located within this HLC area. The character area description notes that it is within the 'visual impact zone' (undefined) for the WHS, with the line of the Wall for part of its length "forming a discernible feature within the local fieldscape".

5.4.5. The majority of the central section of the WHS buffer zone in the Proposed Development WHSCA Study Area falls within HLC Area 10, which consists of a wide-open valley formed by the River Eden at the point where it widens after converging with the Irthing near Newby East. While land use in this area is dominated by agriculture, most of which is arable, the area is very much characterised by modern infrastructure including OHLs and the M6, as well as Carlisle and its suburbs which form the focus of the HLC area. The West Coast Mainline railway also passes through this area, and the large Carlisle Kingsmoor Marshalling yards on the line north of Carlisle add to the 19th and 20th century development that characterises the area. As the Proposed Development WHSCA Study Area excludes the urban extents of Carlisle, only the eastern, more rural landscape of HLC Area 10 falls within the WHS buffer zone, with no other landscape designations within the part of HLC Area 10 that falls within the Proposed Development WHSCA Study Area.

5.4.6. The western element of the WHS buffer zone in the Proposed Development WHSCA Study Area falls within HLC Area 41, which consists of the Solway Plain. This large HLC area covers the northwestern coastal

9 The Inglewood character area lies outside the Study Area and is not discussed in this report.

elements of Cumbria, with only the extreme northern section falling within the Proposed Development WHSCA Study Area. This landscape is again largely agricultural and includes undulating fields and flood plain that flank the River Eden as it meets the Solway Firth. Modern infrastructure is again evident, including OHLs and roads. The character area description notes that the 'visual impact zone' broadly coincides with the AONB, while "Hadrian's Wall has some impact on the character of the area, as most of the Roman forts were later sites for medieval settlement". Other landscape designations within HLC Area 41 include the Solway Coast AONB; however, this area is excluded from the Proposed Development WHSCA Study Area.

5.4.7. The extreme northern elements of the WHS buffer zone within the Proposed Development WHSCA Study Area fall within HLC Area 50, Westlinton, a landscape dominated by rolling agricultural land. While the WHS buffer zone partially falls within this area, the description specifically notes that it, "has no discernible impact on the character of the landscape" (Cumbria County Council 2009, 111).

5.5. Archaeological overview

5.5.1. The key focus of the Hadrian's Wall WHS is the linear defensive monument. A full discussion of the history, development and function of the monument does not form part of the present scope, with detailed published accounts available (i.e. Breeze and Dobson, 2000; Breeze 2006, Symonds & Mason 2009). However, a brief overview of the archaeological remains that form the inscribed property within the Proposed Development WHSCA Study Area is provided here to place the Wall in its context.

5.5.2. The most distinctive element of the property is the Wall itself, a linear feature running from Wallsend in the east to Bowness in the west. This linear monument, widely accepted to have been primarily defensive in nature, generally consisted of a wall of varying construction, with a defensive ditch to the north, and a second ditch (generally flanked by two banks) to the south known as the Vallum. A road, known as the Military Way, also ran behind the Wall for much of its length providing a communication link.

5.5.3. Prior to the construction of the Wall, a series of forts and fortlets were constructed to provide a defensive line between the Tyne and the Solway and support the Roman army and their campaigns further north, including Brampton Old Church within the Proposed Development WHSCA Study Area. Many of these structures, dating to the later first century, were abandoned when Hadrian's Wall was constructed, with works on the Wall accepted as beginning c. AD 120 after Hadrian ordered the construction of the barrier.

5.5.4. The Wall was initially constructed in stone between the lower Tyne in the east and the River Irthing in the west, from where the construction changed to a turf rampart from the River Irthing until it reached the Solway at Bowness in the west. The original design also included a defended gateway every mile, known as a milecastle, with two turrets between each milecastle. Milecastles are numbered from east to west, with Milecastle 1 located near Wallsend in the east, and Milecastle 80 located on the coast near Bowness. The intervening turrets are identified by the number of the previous milecastle with the suffix 'a' or 'b', so that Milecastle 53 would be followed by Turret 53A and Turret 53B. The section of the Wall within the Proposed Development WHSCA Study Area extends from the postulated location of Milecastle 9 in the east (NGR NZ 17842 66264) to the postulated location of Turret 69B at approximately NGR NY 35392 58488 in the west.

5.5.5. At some stage after construction had commenced on the Wall, the decision was made to construct a number of forts on the south side of the monument. Positioned approximately 11.6km apart, these 'Wall forts' represent some of the most significant remains within the WHS and were generally associated with a vicus or civilian settlement that developed around them. Several such Wall forts are located within the Proposed Development WHSCA Study Area and include Haltonchesters (NHLE 1010624), Chesters (NHLE 1010959), Housesteads (NHLE 1018585), Birdoswald (NHLE101994), Castlesteads (NHLE1010985) and Stanwix (NHLE1017948).

5.5.6. Evidence suggests that works to replace the western end of Hadrian's Wall with a stone wall started towards the end of Hadrian's rule, although these works were limited to near Milecastle 54 (Breeze 2006, 60). The death of Hadrian in 138 saw the Wall become redundant as the Emperor Antoninus Pius campaigned further north in southern and central Scotland. These campaigns culminated in the construction of the Antonine Wall, between the Firth of Forth and the Clyde, the remains of this new boundary also forming part of the wider UNESCO Frontiers of the Roman Empire World Heritage Site.

5.5.7. The advance north into Scotland was relatively short lived and by 164 Hadrian's Wall had been reinstated as the northern frontier of the Roman Empire, and a programme of rebuilding commenced which saw the turf wall rebuilt in stone. This appears to have started c. 164 but may not have been completed until the early third century.

5.5.8. While the Wall and Vallum form the principal focus of the World Heritage Site, a number of other associated scheduled monuments are also included in the WHS inscription. These are largely located to the south of the Wall and include other Roman works such as temporary forts and camps, quarries, and sections of Roman roads, as well as the Roman fort and town at Corbridge. Components north of the Wall are less frequent, and are largely limited to a section of Roman road (known as the Maiden Way) which linked the Wall to the outpost

fort of Bewcastle (also a component of the WHS), as well as the aqueduct that supplied Great Chesters Fort, and a Romano-British settlement near Grottington Farm, all of which are located outside of the Proposed Development WHSCA Study Area. While most of these components fall within the WHS buffer zone, a limited number are located outside of the buffer zone. These consist of the Maiden Way (NHLE1018242) and Bewcastle Fort (NHLE1015728) north of the Wall, and Corbridge Roman Station (NHLE1006611), Red House Roman Camp (NHLE1006492), and a quarry with inscription at Gelt (NHLE1014582) to the south, although only the latter of these assets falls within the Proposed Development WHSCA Study Area.

5.5.9. It is generally assumed that the Wall was abandoned in the 5th century, although excavations at a number of forts (e.g. Birdoswald and Bewcastle) have demonstrated that sections of the monument continued in use into the early medieval period. The political situation during the medieval period resulted in large areas of the Anglo-Scottish border (including the Wall) being unsafe for significant periods of time, although the removal of stone from the Wall commenced during this period with the monument used as a 'quarry'. This continued at pace as the region became more stable, with many of the farms constructed in this area during the 18th and 19th century built from stone won from the Wall. In the eastern end, the Wall had been so greatly reduced by the mid-18th century that its foundations were largely used as the foundations for the Military Road (now the B6318) constructed by General Wade in 1746 to help suppress Jacobite forces (for a more detailed discussion see authors including Lawson 1966). As a result, the line of the Wall largely lies under the B6318 for large sections of the road from the western fringes of Newcastle in the east to Brunton in the west, with the Wall Ditch and Vallum often visible as ditches to the north and south of the B6318 respectively.

5.5.10. While there had been some study of the Wall in the 16th, 17th, and 18th centuries, significant antiquarian interest in the monument commenced in the 19th century. By the mid-19th century John Clayton had recognised that the Wall was at risk of being lost through elements such as the robbing of stone, and he purchased large sections and commenced a programme of restoration, consolidation, and excavation. This work was primarily focused in the central sector from Brunton, near where the Wall crosses the North Tyne in the east, to Cawfields in the west (see Woodside & Crow 1999 and McIntosh 2015). This landscape falls to the west of the Proposed Development WHSCA Study Area and contains the most visible/best preserved sections of the WHS., while remains of the monument within the Proposed Development WHSCA Study Area have been largely removed/destroyed.

5.5.11. A full list of all scheduled monuments that constitute the inscribed WHS within the Proposed Development WHSCA Study Area, with detailed descriptions, is included in **Appendix D.** The scheduled monuments are shown on Figure 4 (**Appendix E**).

Preservation, survival and visibility of the World Heritage Site within the Study Area

5.5.12. The state of preservation (extent of survival) of the scheduled remains that form the WHS varies throughout the WHS, with clearly identifiable elements surviving as visible above ground remains or earthworks only recorded in specific areas. A rapid review of satellite images and available LiDAR data, as well as published sources and the site visit, noted that in most of the Proposed Development WHSCA Study Area the Wall and the Vallum, as well as associated monuments such as temporary camps, have been largely ploughed out or levelled. The clearance of the Wall commenced in the medieval period, with stone from the Wall and associated structures 'robbed' for the construction of new buildings in the surrounding area, with later changes such as the industrialisation of agriculture (especially arable cultivation) and quarrying, also having a major impact on remains. The absence of remains is most evident in the lower lying areas within the Proposed Development WHSCA Study Area, with extensive arable agricultural activities since the Second World War ploughing out earthworks.

5.5.13. This lack of visibility also extends to information and interpretation panels, with the most obvious evidence of the Wall in the Proposed Development WHSCA Study Area being the footpath and associated way markers that identify the alignment of the long-distance Hadrian's Wall Path National Trail that follows the monument. The majority of visitor centres, museums, and facilities such as carparking and interpretation panels are outside the Proposed Development WHSCA Study Area, in the central section of the Wall between Chesters Roman Fort / River North Tyne crossing to Banks, where the monument is best preserved and most visible (see section 5.8 below).

5.5.14. While there is extremely limited evidence of remains visible on the surface in most sections, excavation since at least the mid-19th century has demonstrated that buried archaeological remains survive relatively well in most areas. Reviews of archaeological investigations, as well as research, over the last 20 years can be found in Collins and Symonds (2019) and Hodgson (2009), as well as site specific reports such as those dealing with Halton Chesters, Birdoswald, and Carlisle Roman Fort and settlement.

5.5.15. Early antiquarian interest in the Wall can be traced back to the 17th and 18th centuries when an improved political situation along the Anglo-Scottish border enabled access to the monument. Horsley described the Wall in some detail in his publication *Britannia Romana*, a volume which also included the first attempt at a detailed

survey of the monument (Horsley 1732). However, the 19th century marked the first real age of detailed study in the Wall and the start of its preservation and conservation. Instrumental in this work was John Clayton, who purchased large sections of the Wall, and funded excavations as well as consolidation projects. This research was accompanied by the first accurate mapping of the monument by Henry MacLauchlan (MacLauchlan 1857), while John Collingwood Bruce published the first detailed description of the monument (Collingwood-Bruce 1863) as well as a shorter version which he published as a more manageable guide to be used by those visiting the monument (Collingwood-Bruce). Most of this work was, however, focused on the Central Sector of the Wall, and therefore outside of the Proposed Development WHSCA Study Area.

5.5.16. Excavation, as well as conservation and preservation, continued throughout the 20th and 21st centuries, although this was again focused on sections of the monument outside of the Proposed Development WHSCA Study Area. While relatively large scale excavations have taken place in locations including Carlisle to the west, work within the Study Area has been more limited. Some of the most extensive works in the Proposed Development WHSCA Study Area include excavations associated with the construction/installation of a new gas pipeline near Walby which saw a transect across the Wall excavated (Bennett 2009). However, the monument within the Proposed Development WHSCA Study Area remain difficult to discern due to its poor survival as surface/above ground features, with the most visible structural remains largely limited to WHS to the east of the Proposed Development WHSCA Study Area.

5.5.17. As a result of the poor preservation within the Proposed Development WHSCA Study Area, there has been limited opportunity for conservation of above ground remains, with the main focus of conservation, consolidation, and rebuilding (including those under Clayton in the 19th century) to the east of the Proposed Development WHSCA Study Area. Large scale reconstructions are limited to a section of Wall and a temple at Vindolanda in the central sector, while other significant reconstruction are located outside of the Proposed Development WHSCA Study Area at the eastern end of the Wall at the forts of *Segedunum* (modern day Wallsend) and *Arbia* (modern day South Shields).

5.6. Existing transport and transmission corridors

5.6.1. While Proposed Development WHSCA Study Area excludes the city of Carlisle, the east-west corridor in which the Proposed Development WHSCA Study Area is located means that it has become something of an infrastructure centre. A number of high voltage OHLs (carried on towers rather than poles) exist in the Study Area, with most feeding into the Harker Substation; those assets owned by NGET are shown (with a 100m buffer) on Figure 2 (**Appendix E**). While these towers are visible in the landscape in some areas, such as from parts of the A69 and the A689, as well as the M6, their general positioning, when coupled with the undulating landscape and screening provided by trees/vegetation, means that their visible appearance is often limited when viewed from the WHS: to that extent, the impact of these existing lines on the setting of the WHS, and therefore its OUV, is minimal in most areas.

5.6.2. The existing XB 275kV line encroaches on scheduled monuments that form the WHS in one location within the Proposed Development WHSCA Study Area where the existing line crosses the WHS in the scheduled area defined as 'Birky Lane at Walby' on the east side of the M6 (NHLE 1010980), and one tower is located within the scheduled area / WHS. Otherwise, the OHL lies within the WHS buffer zone.

5.6.3. Other major infrastructure that is prominent on the skyline in views from the WHS, its buffer zone and surrounding landscape includes a number of tall lighting towers/floodlights at the Carlisle Kingsmoor Marshalling Yards, north of Carlisle, with the lighting towers especially visible in the western end of the Proposed Development WHSCA Study Area. A number of telecommunications masts are also visible to the north and south of the Wall in the central and western ends of the route, while wind turbines can also be seen in the distance from a number of areas. These include the Green Rigg Wind Farm, situated approximately 12km north of the Wall near the A68, which is visible from the higher ground around Black Carts/Milecastle 30 to the west of the River North Tyne.

5.6.4. While there is an extensive network of roads in the Proposed Development WHSCA Study Area, including the M6, A69 and A689, their impact is less visible due to the low-lying nature of the roads. This is partially a result of limited lighting columns on most roads, although some of the larger roads are audible with the sound of traffic obvious for some distance. Other existing infrastructure includes railways lines, running both north-south and east-west, and Carlisle Lake District Airport, which is located to the east of the city near the western end of the Study Area. The visible appearance of this infrastructure is most apparent from Brampton to Kirkandrews-on-Eden and around Carlisle.

5.7. Contemporary landscape character and visual baseline

Banks to Solway Firth

5.7.1. Whilst the presence of the WHS contributes to the character of all landscapes through which it passes to some

extent, the contribution to present day character varies across areas with some areas presenting a strong connection through:

- clearly visible and recognisable remnant features (above or below ground);
- integration with pattern and sense of linearity (i.e. roads closely following the Wall alignment or remnant features of the WHS following ridgelines); and
- presence of people and activity within the landscape associated with the WHS.

5.7.2. A detailed analysis of the contemporary landscape character and visual baseline is presented in **Appendix F** and illustrated on Figure 5 (**Appendix E**). The following is a summary of the key characteristics of the contemporary landscape character between Banks and the Solway Firth, with a focus on understanding the relationship between the WHS, WHS buffer zone and landscape and visual characteristics.

5.7.3. The eastern parts of the area include the transition parts of the River Irthing valley (**LCT Main Valleys** (**LCT Sub type 8b Broad Valleys**[10])) where the river flows into the River Eden, which has a much broader landform (**LCT 5 Lowland** (**Sub type 5b: Low Farmland** and **Sub type 5c: Rolling Lowland**)). LCT 7 Drumlins (**Sub type 7c: Sandy Knolls and Ridges**) is within the south of the WHS buffer, on the western edge of the North Pennines National Landscape. The western periphery of the study area comprises the LCT 2 Coastal Margins **(Sub type 2b Coastal Mosses and Sub type 2c Coastal Plain)** on the edge of the Solway. The majority of the area comprises lowlands, at the eastern fringe of the city of Carlisle, with the network of road infrastructure and meandering watercourses resulting in a mosaic landscape comprising a combination of land uses (arable, pasture, recreational, aviation), scales and irregular pattern.

5.7.4. A very small part of the south-eastern edge of the Proposed Development WHSCA Study Area is located in the North Pennine National Landscape.

Settlement

5.7.5. The town of Brampton is located within the eastern part of the area and is connected to Carlisle to the west of the area via major roads along which a number of villages are distributed, including Corby Hill, Warwick Bridge, Warick-on-Eden, Aglionby, Ruleholme and Crosby-on-Eden. Villages across the northern part of the 3km study area are distributed along the A6071 which heads north-east from Brampton and a network of local roads and includes Newtown, Smithfield, Scaleby and Laversdale. The A7 heads north from Carlisle with a series of small villages including Harker, Blackford and Westlinton located along its route.

Landform

5.7.6. The River Irthing valley contributes to the landform character across the eastern part of the area. It is a tributary of the River Eden which flows through the western part of the area with a less pronounced valley running through lowland areas towards the Solway Firth to the west. The River Eden valley landform is more prominent in the southern parts of the area where it flows through Wetheral and Warwick Bridge.

Land cover, pattern and land use

5.7.7. The area has mixed landcover and irregular pattern influenced by the River Irthing and River Eden and a network of main roads which extend eastwards from Carlisle. The northern parts of the area are predominantly agricultural with isolated farmsteads and small villages connected by a network of local roads. The central and southern parts of the area include pasture land use and a higher concentration of woodland adjacent to the watercourses with a mosaic of arable land, settlement and occasional recreational land uses dispersed between watercourses and road infrastructure. Carlisle Lake District Airport is located centrally within the area to the north of the A689.

Access and connectivity

5.7.8. The A689 and A69 run centrally across the area from east to west converging near Brampton in the eastern part of the area and connecting into the M6 at the outskirts of Carlisle in the western part of the area. The M6 is located to the east of Carlisle and runs north to south across the western part of the area. The A7 heads north from Carlisle connecting to Longtown which is located outside the area to the north. The A6071 connects Brampton and Longtown. There is a network of local roads connecting smaller villages and isolated properties across the rest of the area.

5.7.9. The Tyne Valley railway crosses the western part of the area between Scotby and Wetheral.

5.7.10. The area is relatively well connected by a network of PRoW. The Hadrian's Wall Path NT closely follows the

10 Cumbria County Council (2011) Cumbria Landscape Character Guidance and Toolkit

WHS across the majority of the area. Across the western part of the area the NT diverts south, near to Crosby on Eden before following the River Eden to the boundary of the area.

Electricity transmission infrastructure

5.7.11. OHL run to the south of the WHS and WHS buffer zone across the eastern part of the area before entering the WHS buffer zone near Newby East and heading north to cross the WHS close to Crosby on Eden. Another OHL runs north to south across the western part of the area from Harker substation in the north towards Cumwhinton located outside the area to the south.

WHS focal points and visual characteristics

5.7.12. Lanercost Priory is identified within the WHS Interpretation Framework and is located within the WHS buffer zone. It is located within the western extent of **LCT Sub type 8b Broad Valleys**. Views are enclosed by mature vegetation and the surrounding valley landform.

Analysis

5.7.13. Across the eastern part of the area, the WHS and WHS buffer zone is located within **LCT Sub type 8b Broad Valleys**. The landscape transitions into **LCT Sub type 5b: Low Farmland** across the central and western part of the area and there are limited above ground remnants or visible features of the WHS and WHS buffer zone. The network of road infrastructure and mosaic of land uses is intersected by the meandering River Eden, which results in irregular landscape pattern across much of the area, without the same strength of linearity that is present in other areas, which reinforces the presence of the WHS and WHS buffer zone within the landscape.

5.7.14. Across the western part of the area the Hadrian's Wall Path NT diverts from the alignment of the WHS further reducing its strength of character across the area and contribution to contemporary landscape character.

5.8. Socio-economic aspects: levels of tourism activity

Overview

5.8.1. Hadrian's Wall and associated tourism infrastructure pass through a mix of urban, rural, and upland landscapes, with tourism-related activity heavily concentrated in the area between Chesters and Banks. This section is the most visited due to the visibility of upstanding Wall remains, and its inclusion within Northumberland National Park.

5.8.2. Within the Proposed Development WHSCA Study Area, key settlements include Brampton, Lanercost and Carlisle, and Bowness-on-Solway further west. Smaller villages such as Irthington are also key providers of tourism infrastructure.

5.8.3. Key viewpoints and tourist attractions are shown in relation to the Study Area on Figure 6 in **Appendix E**. The Hadrian's Wall Path National Trail is shown on Figure 5.

Wall-related Museums, Visitor Centres and other attractions

5.8.4. Museums, visitor centres, and attractions within the Proposed Development WHSCA Study Area directly related to Hadrian's Wall are limited with most of these features located outside the Proposed Development WHSCA Study Area within or near the Central Sector of the Wall immediately to the east. This section of the Wall, running from Chesters in the east to Banks in the west, also represents the area where physical remains of the Wall are most visible. The main attractions in the Chesters to Banks section include: Chesters Roman Fort and Museum (adjacent to Humshaugh), Housesteads Roman Fort, Vindolanda, the Roman Army Museum at Carvoran, Brocolitia Roman Fort in Hexham, and Banks East Turret. They provide exhibitions, reconstructed buildings, excavated artefacts, and historical interpretation that explain the function and significance of the Wall. These assets help with public understanding of the OUV of the WHS.

5.8.5. Several visitor information centres in the Central Sector also support Wall-related tourism. These include the Hadrian's Wall Visitor Information Centre, Sill: National Landscape Discovery Centre, and the Haltwhistle Tourist Information Centre at Lanercost Tea Rooms, all of which are located in the Chesters to Banks section, outside the Proposed Development WHSCA Study Area. Within the Proposed Development WHSCA Study Area, the Brampton Tourist Information Centre provides some focused information on Hadrian's Wall and its surrounding landscape.

Non-Wall-related Museums, Visitor Centres, and other Attractions

5.8.6. The Proposed Development WHSCA Study Area contains a number of heritage attractions that are not directly related to Hadrian's Wall but contribute to the broader visitor offer. Notable sites include Carlisle Castle, Tullie House Museum, and Carlisle Cathedral, which provide a broader historical narrative encompassing medieval and post-Roman periods. Other heritage sites include Lanercost Priory and St Michael's Church in Burgh-by-

Sands. Visitor information centres in these locations typically support general tourism activity. The Carlisle Tourist Information Centre primarily serves the city and has limited direct emphasis on Hadrian's Wall. These centres offer information regarding broader cultural and recreational assets within the Proposed Development WHSCA Study Area.

Hadrian's Wall Path National Trail

5.8.7. The Hadrian's Wall Path National Trail runs coast-to-coast for 84 miles (135 km) and its central stretch between Chesters and Banks encompasses the longest continuous stretch of visible Wall remains and associated Roman features, offering sustained visual access to Roman installations, including turrets, milecastles, forts, and the Vallum. The Trail is well-used by both long-distance walkers and day visitors for recreational and heritage purposes. Within the Proposed Development WHSCA Study Area, the Trail west of Banks descends into gentler, lowland terrain through Walton, Carlisle, and onto the Solway Firth, offering subtler engagement with the Wall line via earthworks and hedgerows. However, it should be noted that the section of the trail from Walby to Stanwix does not follow the Wall, and instead runs to the south of the WHS.

Visitor Car Parks

5.8.8. Car parks within the Proposed Development WHSCA Study Area are limited with most car parks located in the Central Sector to the east where they are integral to enabling access to the Trail and associated heritage attractions. Parking provision within the Proposed Development WHSCA Study Area is more fragmented and typically embedded in village centres or urban fringe locations. Within the Proposed Development WHSCA Study Area, public parking is available in Carlisle, with limited access points from settlements such as Low Crosby, Newtown, and Walton. These car parks support access to National Trail segments, museums, and churches, but lack the concentration and proximity to key sites of those in the Central Sector. Some private or council-operated facilities – particularly at Tullie House and Lanercost Priory – do serve WHS-related tourism: their importance lies in accommodating dispersed visitor flows, enabling access to less visited Trail segments, and supporting localised heritage.

Hospitality Businesses

5.8.9. Hospitality provision varies in regard to the type of offering and geographical location. Within the Proposed Development WHSCA Study Area, accommodation is more dispersed than in the Central Sector from Chesters to Banks corridor and includes rural B&Bs and inns near Walton, Lanercost, and Irthington, including the String of Horses Inn, a former coaching inn near Brampton. Further west, Carlisle provides a range of hotel and guesthouse options.

6. World Heritage Site Capacity Assessment – analysis

6.1. Overview

6.1.1. Analysis of the OUV, as well as elements such as archaeological preservation (extent of survival), historic landscape character, topography and existing transport and transmission corridors within the Proposed Development WHSCA Study Area, has enabled definition of six WHSCA Zones of varying sensitivity in terms of the potential for the Proposed Development to be constrained by aspects related to the WHS and its buffer zone. The six WHSCA Zones are shown on Figure 7 (**Appendix E**). The boundaries of the Zones have been drawn based on changes in landscape character and other factors set out in the methodology.

6.1.2. Appendix C considers the potential for each attribute of OUV of the WHS, as identified in the 2024-2029 Management Plan, together with its integrity and authenticity, to be impacted by construction, operation or decommissioning activities associated with a new OHL, in line with Tool 2 of the 2022 UNESCO HIA Guidelines. The following activities have been identified which could result in impacts on the attributes of OUV of the WHS, integrity and authenticity:

Construction phase

- Establishment of temporary site access and works compounds
- Excavation for and installation of new pylon tower bases
- Laydown & assembly of new pylon towers
- Erection and presence of new pylon towers
- Layout and stringing of new overhead cable

- Removal of temporary site access and works compounds

Operation phase

- Inspection and maintenance activities (planned works to apparatus in situ)
- Overhaul and repair activities (planned or responsive works such as renewal and replacement of apparatus)

Decommissioning phase

- Establishment of temporary site access and temporary works compounds
- Removal of overhead cable
- Dismantling and removal of pylon towers
- Removal of pylon tower bases and ground restoration
- Removal of temporary site accesses and works compounds

6.1.3. This analysis indicates that the following attributes of OUV would potentially be impacted by construction and/or operation and decommissioning activities:

- *1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].*
- *2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.*
- *3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.*
- *4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.*
- *5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.*
- *6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.*
- *7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.*
- *8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.*
- *9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection*.

6.1.4. The integrity and authenticity of the WHS would also be potentially impacted by construction, operation and decommissioning activities.

6.1.5. This section discusses the six WHSCA Zones, working from east to west. The character of each WHSCA Zone is described, and its sensitivity is discussed with regard to the potential capacity of the Zone to absorb change without impacting relevant attributes of the OUV of the WHS, its authenticity and integrity. The potential for each attribute of OUV, as identified in the 2024-2029 Management Plan, to be impacted by construction, operation or decommissioning activities is indicated in each of the following sections. In all cases, assessment is based on professional judgement. The capacity to accommodate a new OHL in any WHSCA Zone will be subject to the next stage of assessment – routing and siting – guided by HIA, in line with the UNESCO guidance and toolkit (2022).

This WHSCA considers the relative sensitivity to change of parts of the Hadrian's Wall WHS, its buffer zone and setting, within the Study Area. It accepts that the WHS is of the highest importance nationally and internationally, as well as being of heightened sensitivity. Therefore, the rating and colour coding ascribed to parts of the WHS, its buffer zone and its setting are expressions of relative sensitivity. Thus, an area described as having a greater capacity to accommodate change in this assessment may still be of high importance and high sensitivity to change in overall terms. Such sensitivity to change and ability to accommodate change as assessed in this report are matters of expert judgement [different experts may arrive at differing views, although it is considered that the conclusions expressed here are sound and objectively justified].

6.2. WHSCA Zone 1

Classification Value	Classification Value Description
Red	Highly sensitive to change – least potential to absorb change

6.2.1. Zone 1 represents a landscape transitioning from the more upland landscape beyond the Proposed Development WHSCA Study Area to the east, containing well preserved archaeological remains, to a lower lying landscape dominated by arable cultivation and enclosed pasture that has been subject to improvement. Modern infrastructure within Zone 1 includes smaller roads, however, Carlisle Airport does lie within Zone 1, as does the WHS buffer zone, as well as a number of larger industrial scale farms with large sheds and supporting infrastructure.

6.2.2. Visible remains of the Wall are limited in this area, largely due to the medieval and post-medieval removal of stone from the Wall, as well as 20th century arable agriculture destroying earthworks, which has partially resulted in the buffer zone being wider in this area. However, the WHS in this area includes a number of components to the south of the Wall such as forts and temporary camps. As a result, any new OHL in this area would not only be visible from the Wall, but would have the potential to impact on the intervisibility between the components that form the WHS.

6.2.3. Zone 1 largely covers the WHS buffer zone, and as such, the inclusion of the wide WHS buffer zone north of the Wall here includes the functional setting of the Wall/frontier, including land that would be most visible from the monument when looking north.

6.2.4. Based on current knowledge, it is assumed that a new OHL in Zone 1 would have the potential to impact on the attributes of OUV associated with the WHS. This is because aspects such as the inter-relationships between the remains of the Wall and other components of the frontier system to the south are particularly vulnerable to impact from interposed infrastructure.

6.2.5. Potential impacts on Attributes of OUV are detailed in Table 3 below.

Table 3: WHSCA Zone 1: potential for attributes of OUV to be impacted by the Proposed Development

Attributes of OUV	Element of a proposed action that has the potential to cause an impact		
	Construction	Operation	Decommissioning
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	X	X	X
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	X	X	X

3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.	X	X	X
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.	X	X	X
5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.	X		X
6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	X	X	X
7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.	X	X	X
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.	X	X	X
9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.	X	X	X
Integrity	X	X	X
Authenticity	X	X	X

6.2.6. While micro-siting or careful design could remove the potential for physical impacts on the WHS, in terms of both the archaeological remains of the frontier and the integrity of the WHS, the visual impacts of a new OHL would have the potential to result in a significant impact on the WHS in terms of its setting and its authenticity. As such, the area from Walby Farm east to the limit of the Study Area is assigned a sensitivity classification of **RED – Highly sensitive to change (least potential to accommodate change)**.

6.3. WHSCA Zone 2

Classification Value	Classification Value Description
Amber	**Sensitive to change – some potential to absorb change**

6.3.1. WHSCA Zone 2 represents a corridor of land running roughly southeast to northwest from the River Irthing in the south to Long Park in the north, which crosses the Wall to the east of Walby Farm Park. This section represents a more open landscape, with the land use dominated by arable agriculture. While there is limited existing infrastructure in this narrow Zone, the more open nature of the landscape means that existing infrastructure in the surrounding landscape becomes more apparent. This includes the existing XB 275kV OHL which lies to the south and west of the Zone and runs into Harker Substation, as well as the Harker Hutton OHL to the west near the M6 which also runs into Harker. WHSCA Zone 2 can be considered as a transitional zone between the more sensitive Zone 1 to the east (discussed above) and the less sensitive Zone 3 to the west (discussed below).

6.3.2. The remains of the Wall in this area are limited, stretching to approximately 0.4km, with both the Wall and its associated remains, such as the Vallum, ploughed out and no longer visible as above ground features, although it is assumed that remains survive as buried archaeological deposits. A short section of the Stanegate Military Road is also located to the south of the Wall within Zone 2, although this is also poorly preserved with only a slight earthwork recorded.

6.3.3. Based on current knowledge, it is assumed that a new OHL in this Zone would have limited potential to impact on the attributes of OUV associated with the WHS. This is partially a result of difficulties in understanding the monument as a result of later development and the lack of extant remains. The inter-relationships between the remains of the Wall and other components of the frontier system to the south are vulnerable to impact from interposed infrastructure.

6.3.4. Potential impacts on Attributes of OUV are detailed in Table 4 below.

Table 4: WHSCA Zone 2: potential for attributes of OUV to be impacted by the Proposed Development

Attributes of OUV	Element of a proposed action that has the potential to cause an impact		
	Construction	Operation	Decommissioning
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	X	X	X
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	X	X	X
3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.	X	X	X
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.	X	X	X
5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.	X		X
6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	X	X	X
7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.			
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.	X	X	X
9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.			
Integrity	X	X	X
Authenticity	X	X	X

6.3.5. Analysis of WHSCA Zone 2 suggests that this landscape could potentially absorb change, while avoiding or, if this is not possible, minimising adverse impacts on relationships between elements of the frontier system and the setting of the WHS, as the landscape of the WHS and its buffer zone has been degraded as a result of existing infrastructure. The limited/poor survival of the components of the WHS in this zone would also suggest that change could be accommodated without substantially diminishing the authenticity and integrity of the WHS, although there may be some potential for impacts on archaeological and palaeoenvironmental remains where these survive. As such, Zone 2 is assigned a sensitivity classification of **AMBER - Sensitive to change (some potential to accommodate change)**.

6.3.6.

6.4. WHSCA Zone 3

Classification Value	Classification Value Description
Green	Least sensitive to change – greatest potential to absorb change

6.4.1. WHSCA Zone 3 extends from the point at which the River Irthing and River Eden converge in the east, to the eastern limits of Carlisle in the west, and includes approximately 4km of Wall and Vallum. This section of the WHS buffer zone has suffered most from 20th century developments, notably modern infrastructure, including the M6 Motorway as well as two large OHLs. However, while the open nature of this landscape means the existing OHLs are visible, the extensive network of hedgerows and small pockets of woodland, that are a key component of the arable agricultural landscape in this Zone, do provide effective screening. Furthermore, the slightly undulating nature of the landscape as it rises to the north also helps limit the visual dominance of the existing OHLs.

6.4.2. As with other parts of the Proposed Development WHSCA Study Area in lower lying landscapes, the Wall in Zone 3 survives only partially as an above ground feature or earthworks. There is survival of the Wall ditch east of the M6 and the Vallum east and west of the M6. Extensive ploughing has eroded and levelled the monument, although it is assumed that elements of the monument survive as below ground archaeological remains. There are no component parts of the WHS, such as forts or temporary camps, south of the Wall and Vallum in this Zone. Furthermore, the Hadrian's Wall long distance path in this area does not follow the alignment of the Wall, and instead follows an alignment approximately 1km to the southeast, with the footpath only joining the Wall at Walby Farm Park.

6.4.3. While the relative openness of the landscape in Zone 3 means that any new OHL is likely to be relatively visible, the extensive hedgerows and woodland may help to screen new transmission infrastructure in the landscape. Furthermore, the presence of two existing OHLs (XB 275kV and Harker Hutton) as well as other infrastructure do not currently impact on the OUV of the monument, or the ability to understand it, as the landscape is predominantly a post-medieval agricultural one (changed both by intensive ploughing and the development of new boundaries and field systems), which has already changed the landscape and the understanding of the frontier and its functional setting.

6.4.4. Potential impacts on Attributes of OUV are detailed in Table 5 below.

Table 5: WHSCA Zone 3: potential for attributes of OUV to be impacted by the Proposed Development

Attributes of OUV	Element of a proposed action that has the potential to cause an impact		
	Construction	Operation	Decommissioning
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	X	X	X
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	X	X	X
3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.	X	X	X
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.	X	X	X

5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.	X		X
6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	X	X	X
7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.			
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.	X	X	X
9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.	X	X	X
Integrity	X	X	X
Authenticity	X	X	X

6.4.5. Due to a combination of the existing infrastructure, as well as the poor preservation of the Wall, it is considered that WHSCA Zone 3 could potentially accommodate change while avoiding or, if this is not possible, minimising adverse impacts on relationships between elements of the frontier system and the setting of the WHS, if carefully sited. Furthermore, although the landscape in this area already contains two OHL and the M6 running on a roughly north-south alignment, the open nature of the landscape in Zone 3 has the capacity to accommodate change, while potentially avoiding or, if this is not possible, minimising adverse impacts on the attributes of OUV of the WHS, its authenticity and integrity. There are no archaeological components to the north and south of the Wall in this Zone, and therefore less potential for a new OHL to sever views between the monuments that make up the WHS, although there may be some potential for impacts on archaeological and palaeoenvironmental remains where these survive. As a result, Zone 3 is assigned a sensitivity classification of **GREEN - Least sensitive to change (greatest potential to absorb change)**.

6.5. WHSCA Zone 4

Classification Value	Classification Value Description
Green	Least sensitive to change – greatest potential to absorb change

6.5.1. Zone 4 covers the whole of the Proposed Development WHSCA Study Area south of the WHS, extending from the Miltonrigg Wood area in the east to the eastern fringe of Carlisle in the west. The Zone falls outside of the WHS buffer zone and includes various elements of transport infrastructure including the A69 road, parts of the A689, as well as a small section of the Newcastle to Carlisle railway line, and sections of the existing XB 275kV OHL.

6.5.2. Land use within the Zone is largely comprised of mixed agriculture, while a number of settlements are also located throughout the area including Brampton and Warwick on Eden. The topography also varies from undulating along the A69, to a relatively steeply rising upland landscape in the central part of the area where the northern slopes of the North Pennines fall within the southern limits of the Zone.

6.5.3. As noted, in most areas the WHS and its buffer zone fall outside of the Zone, or form the northern boundary of the Zone, with the only sections of WHS buffer within Zone 4 consisting of woodland near the A69. While a single component of the WHS falls within the Zone, this scheduled monument is a former quarry and a carved stone on the River Gelt, located at least 4.7 km to the south of the Wall (and at least 2km south of the WHS buffer zone), and its setting is very much focused on the river and rock outcrops that were exploited to win stone for the construction of the Wall.

6.5.4. Based on current knowledge, it is assumed that change in this Zone would have limited potential to impact on the attributes of OUV associated with the WHS due to aspects such as the distance between the WHS and the Zone, as well as topography and screening. This is further demonstrated by the presence of the existing XB 275kV OHL in this area, which does not impact on the ability to understand the functional setting of the frontier,

and the attributes of OUV associated with it.

6.5.5. Potential impacts on Attributes of OUV are detailed in Table 6 below.

Table 6: WHSCA Zone 4: potential for attributes of OUV to be impacted by the Proposed Development

Attributes of OUV	Element of a proposed action that has the potential to cause an impact		
	Construction	Operation	Decommissioning
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	X	X	X
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	X	X	X
3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.			
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.			
5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.			
6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	X	X	X
7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.			
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.			
9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.			
Integrity	X	X	X
Authenticity	X	X	X

6.5.6. There would be limited potential for physical impacts on the WHS in this zone, in terms of both the archaeological remains of the frontier and the integrity of the WHS, as only a single component falls within Zone 4. The visual impact of a new OHL would also be limited in this zone. The rising land of the North Pennines should also help backcloth any OHL. As such, WHSCA Zone 4 is assigned a sensitivity classification of **GREEN – Least sensitive to change (greatest potential to absorb change)**.

6.5.7. Alternative construction methods in Zone 4, such as undergrounding, could potentially remove impacts on setting and it is assumed that above ground infrastructure such as sealing end compounds etc., could also be designed to avoid setting impacts. Furthermore, there should not be physical impacts on any components of the

WHS and therefore the potential for an underground option to result in significant impacts on Attributes of OUV are considered unlikely. However, as Zone 4 is already considered to be Green, in terms of capacity, an underground option is unlikely to change this rating.

6.6. WHSCA Zone 5

Classification Value	Classification Value Description
Amber	Sensitive to change – some potential to absorb change

6.6.1. Zone 5 is located north of the Wall and covers an area stretching from Walton Wood/King Water in the east to Longpark in the west. The landscape is generally undulating, with land use dominated by a mixture of land used for arable agriculture and pasture. Settlement activity in the Zone is characterised by small settlements and dispersed farmsteads, with a number of larger roads bisecting the Zone, including the A6071.

6.6.2. There are no component parts of the WHS within the Zone, with the nearest sections of the monument being at least 500m to the south, and most sections of the Wall being at least 1km to the south.

6.6.3. While the Zone falls to the north of the Wall, the undulating nature of the landscape means that in most cases views into the Zone would have been limited. This is partially demonstrated by the varying width of the WHS buffer zone south of Zone 5 (and within Zone 1), which is designed to protect the setting of the monument.

6.6.4. Based on current knowledge, it is assumed that change in this Zone would have limited potential to impact on the attributes of OUV associated with the WHS. While new transmission infrastructure in this Zone might be visible in certain locations, the distance between the Zone and the WHS will limit the impact new towers, for example, will have on views out from the Wall. This should therefore not diminish the ability to understand the functional setting of the frontier, and the attributes of OUV associated with it. Potential impacts on Attributes of OUV are detailed in Table 7 below.

Table 7: WHSCA Zone 5: potential for attributes of OUV to be impacted by the Proposed Development

Attributes of OUV	Element of a proposed action that has the potential to cause an impact		
	Construction	Operation	Decommissioning
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	X	X	X
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	X	X	X
3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.			
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.			
5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.			

6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	X	X	X
7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.			
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.			
9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.			
Integrity	X	X	X
Authenticity	X	X	X

6.6.5. There should be limited need for micro-siting to remove the potential for physical impacts on the WHS, in terms of both the archaeological remains of the Frontier and the integrity of the WHS, as there are no components of the WHS within Zone 5. The visual impact should also be limited through careful design to avoid positioning new transmission infrastructure in areas where there are key views north from the Wall, although topography and the distance between the Wall and Zone 5 will further limit the visual impact. As such, WHSCA Zone 5 is assigned a sensitivity classification of **AMBER - Sensitive to change (some potential to absorb change)**.

6.7. WHSCA Zone 6

Classification Value	Classification Value Description
Green	Least sensitive to change – greatest potential to absorb change

6.7.1. Zone 6 covers the outer limits of the Proposed Development WHSCA Study Area, and falls within an undulating landscape, dominated by agriculture, to the north of the WHS. A number of larger roads pass through the Zone, while the western limits straddle the A7 and fall within a landscape that contains a significant amount of transmission infrastructure near the existing Harker Substation.

6.7.2. All components of the WHS are to the south of the Zone, with most being situated between 2km and 3km away, and views north from the Wall in this area also limited due to the topography providing effective screening. The visual impact of new transmission infrastructure would be further limited as a result of the distance between the WHS and the Zone, while the increase in settlement activity, both small villages, isolated farms, and larger industrial scale farming operations, and larger roads such as the A6071 and the A7 give the landscape a more post-medieval appearance.

6.7.3. Furthermore, the wide WHS buffer zone north of the Wall in parts of this area very much covers the functional setting of the Wall/frontier, covering the land that would be most visible from the monument when looking north.

6.7.4. Based on current knowledge, it is assumed that change in this Zone would have limited potential to impact on the attributes of OUV associated with the WHS due to aspects such as the distance between the WHS and the Zone, as well as topography and screening (the extent of the northwestern edge of this Zone as shown on Figure 7 (Appendix E) being limited by the local topography as it approaches the Lynne Water and the River Tweed). As such, there is limited potential for impacts on the ability to understand the functional setting of the frontier, and the attributes of OUV associated with it.

6.7.5. Potential impacts on Attributes of OUV are detailed in Table 8 below.

Table 8: WHSCA Zone 6: potential for attributes of OUV to be impacted by the Proposed Development

Attributes of OUV	Element of a proposed action that has the potential to cause an impact

	Construction	Operation	Decommissioning
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	X	X	X
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	X	X	X
3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.			
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.			
5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.			
6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	X	X	X
7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.			
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.			
9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.			
Integrity	X	X	X
Authenticity	X	X	X

6.7.6. There should be no need for micro-siting to remove the potential for physical impacts on the WHS in terms of both the archaeological remains of the frontier and the integrity of the WHS, as no components fall within Zone 6. The visual impact of new transmission infrastructure would also be limited, although these may be further reduced by micro-siting/careful design to exploit aspects such as topography as screening. As such, WHSCA Zone 6 is assigned a sensitivity classification of **GREEN - Least sensitive to change (greatest potential to absorb change)**.

7. Summary, Conclusions and Recommendations

7.1. Summary

7.1.1. A World Heritage Site Capacity Assessment (WHSCA) has been undertaken to support development of the Cross Border Connection ('the Proposed Development'), which proposes the construction of a new 400kV double circuit from Teviot, in Scotland, to the Carlisle area, and the construction of a new 400kV substation to facilitate connection to the existing network and future network developments.

7.1.2. The study area for the Corridor Preliminary Routing and Siting Study (CPRSS) for the Proposed Development includes elements of the Hadrian's Wall component of the UNESCO Frontiers of the Roman Empire World Heritage Site, its buffer zone and setting. This WHSCA reviews the implications for the CPRSS, with reference to the extent to which the World Heritage Site (WHS) and its buffer zone include areas of lower sensitivity – due to aspects of character, designation, conservation, levels of tourism activity or the presence of existing infrastructure such as OHLs, railways and motorways and other roads – which may have a relatively greater capacity to absorb change while avoiding or, if this is not possible, minimising impacts on the OUV, of the WHS, its integrity and authenticity.

7.1.3. The Proposed Development WHSCA Study Area comprises the WHS, the WHS buffer zone, and a 3km area surrounding the WHS buffer zone, to the east and northwest of Carlisle, between Banks and the Solway Firth. The focus of the WHSCA is on the capacity of the Study Area to absorb change, taking as a starting assumption construction of a new 400kv OHL supported on lattice towers. The WHSCA has been compiled using desk-based techniques supported by a site visit to assess the impact of existing infrastructure within the WHS buffer zone and view the state of preservation (extent of survival) of the components of the WHS in the landscape.

7.2. Conclusions

7.2.1. This WHSCA has identified six Zones of varying sensitivity in terms of their potential capacity to absorb change while avoiding or, if this is not possible, minimising impacts on relevant attributes of the OUV of the WHS, its integrity and authenticity. The Zones are shown on Figure 7; the sensitivity classification of each Zone are summarised in Table 9 below.

7.2.2. The assessment is based on professional judgement and the capacity for any individual Zone to absorb change (in the form of new transmission infrastructure) (see Table 9 below) will be further assessed at the routing and siting stage of the Proposed Development, which will be guided by HIA in line with the UNESCO guidance and toolkit (2022).

7.2.3. The assessment has found that, in general, the WHS components in the Proposed Development WHSCA Study Area generally do not survive as readily discernible above ground features or earthworks (although it is assumed that elements of the monument do survive as below ground archaeological remains). This lack of visibility also extends to information and interpretation panels, with the most obvious evidence of the Wall in the Proposed Development WHSCA Study Area being the footpath and associated way markers that identify the alignment of the long-distance Hadrian's Wall Path National Trail that follows the monument. Consequently, it is very difficult for the visitor to appreciate the WHS and its setting, with limited interpretation or information available to visitors in most Zones in the Study Area. The ability to understand and appreciate the Wall and the Roman frontier zone diminishes as the visitor moves away from the upstanding remains/earthworks, with elements such as modern field systems and settlement activity further limiting the ability of the visitor to understand the WHS.

7.2.4. The Zones identified within the Proposed Development WHSCA Study Area have also been variously subject to encroachment through 20th century development and contain infrastructure that was in place when the WHS buffer zone was established, including the railway, the A69 road, and the existing XB 275kV OHL. While these existing elements of infrastructure limit the potential to place a new OHL in certain areas, due to the risk of the landscape reaching capacity / saturation point in terms of OHL infrastructure, such that further development would be likely to compromise the setting of the WHS as an attribute of its OUV, in other areas, notably Zones 3, 4 and 6, they may present an opportunity to utilise areas where the WHS and its buffer zone have already been impacted. In these Zones, the WHS and the WHS buffer zone have already absorbed change and, have the capacity to absorb further change without detracting from the experience, understanding and appreciation of the WHS and the attributes that convey its OUV, its integrity and authenticity, and their settings.

Table 9: WHSCA Zones and Classifications

WHSCA Zone	Classification Value	Classification Value Description
Zone 1	RED	Highly sensitive to change – least potential to absorb change
Zone 2	AMBER	Sensitive to change – some potential to absorb change
Zone 3	GREEN	Least sensitive to change – greatest potential to absorb change
Zone 4	GREEN	Least sensitive to change – greatest potential to absorb change
Zone 5	AMBER	Sensitive to change – some potential to absorb change
Zone 6	GREEN	Least sensitive to change – greatest potential to absorb change

7.2.5. One Red Zone has been identified, which is considered to be highly sensitive to change and to have very high potential to constrain the Proposed Development due to the potential for adverse impacts on attributes of the OUV of the WHS, its integrity and authenticity. This Zone contains the greatest number of component features of the WHS north and south of the Wall, and as a result a new OHL in these areas would have the potential to interrupt views and potentially disrupt intervisibility and understanding of the component parts and their interrelationships.

7.2.6. Amber and Green Zones are considered to be less sensitive to change, and to have more potential in terms of their ability to absorb new transmission infrastructure without impacting relevant attributes of the OUV of the WHS, its authenticity and integrity. However, these Zones still have a high potential to constrain the Proposed Development. Three Green Zones have been identified, these are considered to be the least constrained due to aspects such as topography, the absence of components of the WHS, and/or distance from the WHS. The presence of substantial existing infrastructure in some of the Amber and Green Zones (including existing OHLs, roads, railway lines, and settlements) has partially degraded the setting of the WHS in these Zones. When combined with the presence of contemporary landscape features, including extensive hedgerows and woodland, these Zones have more potential to absorb new transmission infrastructure within them.

7.2.7. There is a generally good concordance between the extent of the WHS buffer zone and Red and Amber Zones, with only Zone 4 within the WHS buffer zone assessed as Green. However, one Amber Zone (Zone 5) has been identified beyond the WHS buffer zone. This reflects the definition of the WHS buffer zone based on visual envelopes rather than a more nuanced consideration of setting and interrelationships between WHS components.

7.2.8. It should be noted that there is high potential for buried archaeological remains to survive even in areas where the WHS components have little or no surface expression. It should also be noted that the WHSCA focuses on the components of the inscribed WHS alone and other heritage constraints may exist which may influence routing and siting studies, and which are not considered in this WHSCA.

7.3. Recommendations

7.3.1. The Overarching National Policy Statement for Energy EN-1 notes that the WHS is an asset of the highest significance. The Holford Rules advise that areas of highest amenity value should be avoided where possible. Notwithstanding that the WHS boundary comprises of individual components protected as scheduled monuments, while the buffer zone was defined on the basis of visual envelopes, the conclusion of the WHSCA indicates that the 'area of highest amenity value' relating to the WHS may be better defined as an area encompassing the Red Zones assessed as highly sensitive to change, noting that these areas in places extend beyond the buffer zone boundaries.

7.3.2. In considering routing options for Proposed Development that cross the WHS and its buffer zone, the CPRSS should have regard to the potential for areas of lower sensitivity within the WHS and its buffer zone to better accommodate new transmission infrastructure, as identified in this WHSCA (i.e. Green or Amber zones). While this WHSCA assumes that a new OHL on lattice towers will be required, it is recommended that development of the Cross Border Connection should also consider whether the Proposed Development can contribute to the rationalisation of OHLs in the Proposed Development WHSCA Study Area and surrounding landscape. This aspect may contribute to reducing the current negative impacts of OHLs on the OUV of the WHS and provide positive changes to the attributes that contribute to its OUV.

7.3.3. The OUV of the WHS and the potential impacts on attributes of OUV, its integrity and authenticity should be specifically considered in an EIA or stand-alone HIA, in line with the UNESCO Guidance and Toolkit for Impact Assessment in a World Heritage context (2022).

7.3.4. Initial consultation undertaken with Historic England regarding the Proposed Development identified that early engagement should be undertaken with stakeholders. This should include further engagement with Historic England. Engagement with Historic England should include provision of relevant Proposed Development information to support notification to the UNESCO World Heritage Committee under paragraph 172 of the UNESCO Operational Guidelines (2023): notification should take place before any irreversible decisions are taken[11].

7.3.5. The results of this WHSCA should be viewed as a strategic overview and starting point for ongoing HIAs that are undertaken in tandem with a further examination of the suitability of the Zones for new transmission infrastructure as development of the Cross Border Connection progresses.

8. Bibilography

11 Relevant project information was provided to the World Heritage Committee by the State Party on 18 August 2025

Bennett, J. (2009) 'Transection in Wall Mile 61, Crosby-on-Eden, Cumbria, 1980-84' *in* Wilmott, T. (ed.) *Hadrian's Wall: Archaeological Research by English Heritage 1976-2000,* Swindon: English Heritage.

Breeze, D. J. (2006) J. Collingwood Bruce's Handbook to the Roman Wall: Fourteenth Edition, Newcastle upon Tyne: Society of Antiquaries of Newcastle upon Tyne.

Breeze, D. J. & Dobson, J. (2000) Hadrian's Wall, London: Penguin Books

Collingwood-Bruce, J. (1867) *The Roman Wall, Third Editon* Newcastle Upon Tyne: Andrew Reid.

Collingwood-Bruce, J. (1863) *The Wallet Book to the Roman Wall,* Newcastle Upon Tyne: Andrew Reid.

Collins, R. & Symonds, M. (2019) Hadrian's Wall 2009-2019: A Summary of Excavation and Research Prepared for the Fourteenth Pilgrimage of Hadrian's Wall, 20-28th July 2019, Kendal: Cumberland and Westmorland Antiquarian and Archaeological Society and Society of Antiquaries of Newcastle upon Tyne

Cumbria County Council (2009) A Guide to Using the Cumbria Historic Landscape Characterisation Database for Cumbria's Planning Authorities, Carlisle: Cumbria County Council. Available at: Cumbria Historic Landscape Characterisation - final report

Department for Energy Security and Net Zero (2023) Overarching National Policy Statement for Energy (EN-1)

Department for Energy Security and Net Zero (2023) National Policy Statement for Electricity Networks Infrastructure (EN-5)

English Heritage (1996) Hadrian's Wall World Heritage Site Management Plan July 1996. London: English Heritage

English Heritage (2002) Hadrian's Wall World Heritage Site Management Plan 2002-2007. London: English Heritage

Hadrian's Wall Partnership (2008) Frontiers of the Roman Empire World Heritage Site - Hadrian's Wall Management Plan 2008-2014

Hadrian's Wall Partnership (2014) The Hadrian's Wall World Heritage Site Management Plan

Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029. Available at: DRAFT-HW-Management-Plan-Objectives-Policies-and-Actions.pdf

Hodgson, N (2009) Hadrian's Wall 1999-2009: A Summary of Excavation and Research Prepared for the Thirteenth Pilgrimage of Hadrian's Wall, 8-14th August 2009, Kendal: Cumberland and Westmorland Antiquarian and Archaeological Society and Society of Antiquaries of Newcastle upon Tyne

Lawson, W. (1966) 'The Origin of the Military Road from Newcastle to Carlisle' *in Archaeologia Aeliana,* Series 4: Volume 44 (pages 185-207).

MacLauchlan, H. (1857) *The Roman Wall, and illustrations of the principal vestiges of Roman occupation in the north of England: consisting of plans of the military works, the stations, camps, ancient ways, and other remains of the earlier periods, in the northern counties / from original surveys made by direction of His Grace the Duke of Northumberland,* Privately Published

McIntosh, F. (2015) 'The Wall's First Great Collection: The Clayton Collection' *in* Collins, R. & McIntosh, F. (eds.) *Life in The Limes: Studies of the People and Objects of the Roman Frontiers Presented to Lindsay Allason-Jones on the Occasion of her Birthday and Retirement,* Oxford: Oxbow.

Ministry of Housing, Communities and Local Government (2024) National Planning Policy Framework (NPPF) December 2024.

Symonds, M. & Mason, D. J. P. (ed) (2009) Frontiers of Knowledge: A Research Framework for Hadrian's Wall, Part of the Frontiers of the Roman Empire World Heritage Site, Durham: Durham County Council.

UK Government (1979) Ancient Monuments and Archaeological Areas Act, London: HMSO.

UK Government (1990) Planning (Listed Buildings and Conservation Areas) Act, London: HMSO

UK Government (1990) Town and Country Planning Act, London: HMSO.

UNESCO World Heritage Centre (2009) World Heritage papers 25: World Heritage and Buffer Zones, International Expert Meeting on World Heritage and Buffer Zones, Davos, Switzerland 11 – 14 March 2008)

UNESCO, ICOMOS, ICCROM and IUCN (2022), Guidance and Toolkit for Impact Assessment in a World Heritage Context. Paris: UNESCO, ICOMOS, ICCROM and IUCN

UNESCO (2023) Case Study: Assessing the potential visual impact of onshore wind energy projects in relation to a World Heritage property in the United Kingdom. United Kingdom of Great Britain and Northern Ireland. Available at: https://whc.unesco.org/en/wind-energy/case-study-uk/

UNESCO (2025) Operational Guidelines for the Implementation of the World Heritage Convention, Paris: United Nations Educational, Scientific and Cultural Organization.

Woodside, R. & Crow, J. (1999) *Hadrian's Wall: An Historic Landscape,* National Trust.

1. World Heritage

1.1. The World Heritage Convention

1.1.1. The Convention Concerning the Protection of the World Cultural and Natural Heritage adopted by the UN in 1972 seeks (Article 4) to "*identify, protect, conserve, present and transmit to future generations cultural and natural heritage of Outstanding Universal Value*". The Convention recognises that cultural and natural heritage is among the priceless and irreplaceable assets, not only of each nation, but of humanity as a whole; parts of that heritage, because of their exceptional qualities, can be considered to be of Outstanding Universal Value (OUV) and thus worthy of special protection.

1.2. Outstanding Universal Value (OUV)

1.2.1. The World Heritage Committee ('the Committee') was established under Article 8 of the World Heritage Convention. The Committee manages the World Heritage List of properties that have met the requirements of the Convention. The Operational Guidelines for the Implementation of the World Heritage Convention ('the Operational Guidelines', UNESCO 2025) are published by the Committee to facilitate the implementation of the Convention and set out, inter alia, the procedures and criteria for inscription of properties on the World Heritage List and for nomination of properties for inscription, including definition of boundaries and identification of buffer zones. The Operational Guidelines are periodically revised to reflect the decisions of the Committee, most recently in July 2025.

1.2.2. For a property[12] to be inscribed on the World Heritage List it must be accepted by the Committee as being of Outstanding Universal Value. The Operational Guidelines define OUV as follows (paragraph 49):

> *"Outstanding Universal Value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole. The Committee defines the criteria for the inscription of properties on the World Heritage List."*

1.3. World Heritage Criteria

1.3.1. The Operational Guidelines specify the key tests that the World Heritage Committee applies to decide whether a property is of Outstanding Universal Value:

- *The Committee considers a property as having OUV if the property meets one or more of the World Heritage criteria (Operational Guidelines, Paragraph 77); and*
- *to be deemed of OUV, a property must also meet the conditions of integrity and [for cultural World Heritage properties] authenticity, and must have an adequate protection and management system to ensure its safeguarding (Paragraph 78).*

Criteria

1.3.2. The criteria relevant for cultural world heritage sites are (Operational Guidelines, Paragraph 77):

"(i) represent a masterpiece of human creative genius;

(ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;

(iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;

(iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;

(v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;

(vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should

12 The terms 'World Heritage property', 'Property/property', and 'World Heritage Site' are analogous and used interchangeably in UNESCO documentation.

preferably be used in conjunction with other criteria)."

Integrity

1.3.3. Regarding integrity, Paragraph 88 of the Operational Guidelines states:

"Integrity is a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes. Examining the conditions of integrity, therefore requires assessing the extent to which the property:

a. includes all elements necessary to express its OUV;

b. is of adequate size to ensure the complete representation of the features and processes which convey the property's significance;

c. suffers from adverse effects of development and/or neglect.

This should be presented in a statement of integrity."

Authenticity

1.3.4. Regarding authenticity of cultural properties, the Operational Guidelines state (Paragraph 82):

"Depending on the type of cultural heritage, and its cultural context, properties may be understood to meet the conditions of authenticity if their cultural values (as recognized in the nomination criteria proposed) are truthfully and credibly expressed through a variety of attributes including:

- form and design;
- materials and substance;
- use and function;
- traditions, techniques and management systems;
- location and setting;
- language, and other forms of intangible heritage;
- spirit and feeling; and
- other internal and external factors."

Protection and management

1.3.5. Regarding protection and management, the Operational Guidelines state:

"Protection and management of World Heritage properties should ensure that their OUV, including the conditions of integrity and/or authenticity at the time of inscription, are sustained or enhanced over time. […]" (Paragraph 96)

"All properties inscribed on the World Heritage List must have adequate long-term legislative, regulatory, institutional and/or traditional protection and management to ensure their safeguarding. This protection should include adequately delineated boundaries. […]" (Paragraph 97)

2. Outstanding Universal Value

2.1. Statements of Outstanding Universal Value

2.1.1. When deciding to inscribe a property on the World Heritage List, the Committee adopts a Statement of Outstanding Universal Value for the property (Operational Guidelines, Paragraph 154), which forms the basis for future protection and management of the property (Paragraph 155).

2.1.2. The Statement of Outstanding Universal Value (SOUV) identifies the criteria under which the property was inscribed and justification for these, including the assessments of the conditions of integrity, and, for cultural and mixed properties, authenticity, and a statement on the protection and management in force and the requirements for protection and management for the future (Paragraph 155).

2.1.3. SOUV were not required for properties inscribed before 2007. A Retrospective Statement of Outstanding Universal Value (RSOUV) for the Frontiers of the Roman Empire WHS was adopted by the Committee in 2016.

2.2. Attributes of OUV

2.2.1. 'Attributes' are aspects of a World Heritage Site which are associated with, or express, its OUV (2024-2029

Management Plan). Attributes are derived from the SOUV and help to articulate the OUV. Attributes are not officially adopted by UNESCO and have no official standing, but they provide a checklist for those considering policies or planning activity that might affect the World Heritage Site (2024-2029 Management Plan).

2.3. Boundaries

2.3.1. The Operational Guidelines note (Paragraphs 99, 100) that delineation of boundaries is essential for effective protection of Properties, and these should be drawn to incorporate all the attributes that convey the OUV and to ensure the integrity and/or authenticity of the property. For cultural properties, boundaries should include all those areas and attributes which are a direct tangible expression of the OUV of the property, as well as those areas which, in the light of future research possibilities, offer potential to contribute to and enhance such understanding.

2.4. Buffer zones

2.4.1. The Operational Guidelines (Paragraphs 103 – 107) require that, wherever necessary for the proper protection of the property, an adequate buffer zone should be provided. A buffer zone is defined as an area surrounding the nominated property which has complementary legal and/or customary restrictions placed on its use and development in order to give an added layer of protection to the property. This should include the immediate setting of the nominated property, important views and other areas or attributes that are functionally important as a support to the property and its protection. Buffer zones are not part of the nominated property.

2.5. Management systems

2.5.1. The Operational Guidelines (Paragraph 108) require every nominated property to have an appropriate Management Plan or documented management system which specifies how the OUV of a property will be preserved.

3. Development affecting World Heritage Sites

3.1. Notification of major developments

3.1.1. Under paragraph 172 of the UNESCO Operational Guidelines (2023) major developments that could affect the OUV of a WHS should be notified to the World Heritage Committee (via the World Heritage Centre, the UNESCO secretariat, based in Paris). Notification should take place before any irreversible decisions are taken.

3.2. Development within buffer zones

3.2.1. Although they are not part of the inscribed World Heritage property, and are not themselves of OUV, development within and beyond buffer zones has the potential to affect attributes of the OUV of the WHS, for example through changes to its setting. Regarding notification of development that may affect the OUV of a property, the report of the International Expert Meeting on World Heritage and Buffer Zones, Davos, Switzerland 11 – 14 March 2008 noted in its 'Lexicon of buffer zone terms' (UNESCO World Heritage Centre, 2009):

> *"Paragraph 172 of the Operational Guidelines clearly includes the property, and can be interpreted as also referring to a buffer zone. Buffer zones are areas protected under the Convention that provide additional protection for the outstanding universal value and integrity of a property. They are monitored by the Committee in relation to their contribution to the effective protection and management of the outstanding universal value of the property" […]*
>
> *"The [Davos] meeting recognised that actions may take place well beyond the boundaries of a property and any buffer zone that might nonetheless have a significant influence upon the outstanding universal value and integrity of a property".*

3.2.2. The ICOMOS position statement on buffer zones that was presented to the Davos Meeting suggests that, "*It may therefore be useful to think of "setting" as including the buffer zone, and defined zone(s) beyond the buffer zone*". The World Heritage Centre in its position statement notes however that, *"[…] there is no guidance within the Operational Guidelines for managing the larger setting of properties which may extend beyond buffer zones*".

3.2.3. The Operational Guidelines note in relation to effective management of WHS (paragraph 112), *"[…] An integrated approach to planning and management is essential to guide the evolution of properties over time and to ensure maintenance of all aspects of their Outstanding Universal Value. This approach goes beyond the property to include any buffer zone(s), as well as the wider setting. The wider setting may relate to the property's topography, natural and built environment, and other elements such as infrastructure, land use patterns, spatial organization, and visual relationships. […] Management of the wider setting is related to its role in supporting the Outstanding Universal Value. […*]".

3.2.4. Regarding impact assessment in relation to proposed developments, the Operational Guidelines advise (paragraph 118bis) that, "*Notwithstanding Paragraphs 179 and 180 of the Operational Guidelines, States Parties shall ensure that Environmental Impact Assessments, Heritage Impact Assessments, and/or Strategic Environmental Assessments be carried out as a pre-requisite for development projects and activities that are planned for implementation within or around a World Heritage property. These assessments should serve to identify development alternatives, as well as both potential positive and negative impacts on the Outstanding Universal Value of the property and to recommend mitigation measures against degradation or other negative impacts on the cultural or natural heritage within the property or its wider setting. This will ensure the long-term safeguarding of the Outstanding Universal Value, and the strengthening of heritage resilience to disasters and climate change*".

3.3. Impact assessment and World Heritage properties

3.3.1. The Operational Guidelines (Paragraph 110) note that, "*Impact assessments for proposed interventions are essential for all World Heritage properties*". *Further, "[…] States Parties shall ensure that Environmental Impact Assessments, Heritage Impact Assessments, and/or Strategic Environmental Assessments [are] carried out as a pre-requisite for development projects and activities that are planned for implementation within or around a World Heritage property. These assessments should serve to identify development alternatives, as well as both potential positive and negative impacts on the Outstanding Universal Value of the property and to recommend mitigation measures against degradation or other negative impacts on the cultural or natural heritage within the property or its wider setting. This will ensure the long-term safeguarding of the Outstanding Universal Value, and the strengthening of heritage resilience to disasters and climate change*" (Paragraph 118bis).

Guidance and Toolkit for Impact Assessment in a World Heritage context

3.3.2. UNESCO and the Advisory Bodies to the World Heritage Committee (ICCROM, ICOMOS and IUCN) have issued guidance for assessing impacts from projects that could potentially affect World Heritage Sites: Guidance and Toolkit for Impact Assessment in a World Heritage context (https://whc.unesco.org/en/guidance-toolkit-impact-assessments/) (UNESCO, 2022). The Guidance explains how impact assessments can be used to protect the OUV of World Heritage properties and provides a framework for impact assessment where development is proposed which may affect the OUV or other heritage/conservation values[13] of a property. The accompanying Toolkit includes step-by-step approaches to identifying and evaluating impacts on one or more Attributes of OUV and provides a template to enable data and analysis to be summarised in a table so that conclusions can be presented clearly (this may be adapted as appropriate on a case-by-case basis). The Guidance and Toolkit can be used to inform assessment under processes such as Environmental Impact Assessment (EIA) and can also be applied where such formal assessments are not required, to assist in producing a standalone Heritage Impact Assessment (HIA).

3.3.3. The Guidance emphasises that assessments of development impacts affecting World Heritage properties should give greater consideration to OUV. Among 11 key principles of impact assessment in a World Heritage context pout forward in the Guidance are (UNESCO, ICOMOS, ICCROM and IUCN (2022), pp. 7-9):

> "*4. Any impact assessment on a World Heritage property should address Outstanding Universal Value specifically, as well as other heritage/conservation values.*
>
> *In many countries, proposed actions that may have an impact on World Heritage will be evaluated through national or other frameworks as part of an Environmental and Social Impact Assessment or Strategic Environmental Assessment. In these cases, World Heritage should be addressed specifically within the broader assessment. When a proposed action is not subject to this type of planning process, a stand-alone Heritage Impact Assessment should be carried out. In both cases, the assessment needs to clearly address potential impacts on the attributes of the property which convey Outstanding Universal Value, as well as other heritage/conservation values.*
>
> *5. Impact assessment should begin at the earliest consideration of a proposed action that may impact on World Heritage, and should continue during and after the action's development and execution.*
>
> *Any decision about whether impact assessment is needed ('screening') should treat World Heritage properties as sensitive and valued. A precautionary approach should be taken: an impact assessment should always be carried out, unless it can be clearly shown that the proposed action will not affect the World Heritage property and its Outstanding Universal Value. This is the case even if the proposed action would have no other impacts. This allows heritage to be adequately considered in advance, and for the proposed action to be adjusted, relocated or prevented, if necessary, before commitments are made or irreversible activities occur. If the*

13 'Other heritage/conservation values' as referred to in UNESCO's Guidance and Toolkit (2022) are usually equated with the significance of the WHS that extends beyond its OUV.

proposed action proceeds, follow-up will be needed during and after its implementation and, when appropriate, during decommissioning and recovery. Monitoring will indicate if and when further responses are needed to ensure that World Heritage is continuously protected.

8. Impact assessment should identify a range of reasonable alternatives, and assess their potential impacts.

Impact assessment should consider both the negative and positive impacts of a proposed action, along with any alternatives, in order to establish the most sustainable option that both protects the Outstanding Universal Value of World Heritage properties and achieves the objectives of the proposed action. These may include alternative locations, scales, processes, site layouts, operating conditions, etc. It is important that the option not to proceed is included."

3.3.4. Section 3.2.3 of the Guidance considers boundaries, buffer zones and the wider setting of properties and their roles in protecting the authenticity and integrity of the property and supporting its OUV, noting that, "*it is important that impact assessment looks at the wider setting of the World Heritage property*" (UNESCO, ICOMOS, ICCROM and IUCN (2022), p. 14).

3.3.5. With regard to mitigation and enhancement considerations as part of formal EIA processes, the Guidance notes, *"It is always preferable to avoid, rather than minimise, impacts on a World Heritage property's attributes. Any loss of, or damage to OUV is unacceptable, which means that rectification, reduction (to less severe but still significant) or offsetting of impacts is inappropriate in a World Heritage context. However, it may be possible to enhance management of the OUV, for instance by providing patrols to prevent illegal activities or removing an obstruction to a view of the World Heritage property"* (UNESCO, ICOMOS, ICCROM and IUCN (2022), p. 27).

3.3.6. This principle is reiterated in consideration of stand-alone HIAs: *"Negative impacts on Outstanding Universal Value should always be avoided altogether, since the OUV of a World Heritage property is irreplaceable and damage to OUV is unacceptable. This should not be limited to a particular step of the impact assessment process: a problem-solving approach can be taken throughout the assessment to achieve the best outcome for World Heritage and wider sustainability"* (UNESCO, ICOMOS, ICCROM and IUCN (2022), p. 32).

Appendix B: Analysis of values and attributes of the WHS with reference to the 2022 UNESCO Guidance and Toolkit, Tool 1, Values and Attributes

Table 10: Analysis of values and attributes of the WHS with reference to the 2022 UNESCO Guidance and Toolkit, Tool 1, Values and Attributes

Tool 1 Heritage
Values and Attributes

Frontiers of the Roman Empire WHS
Hadrian's Wall was inscribed on the UNESCO World Heritage List in 1987. The inscription was revised in 2005 to become the transnational Frontiers of the Roman Empire WHS, initially in 2005 to include the Upper German-Raetian Limes in Germany, and then again in 2008 to include the Antonine Wall in Scotland. The WHS is inscribed for its Outstanding Universal Value (OUV) as a cultural Property under criteria (ii), (iii) and (iv) as defined in paragraph 77 of the Operational Guidelines: *(i) represent a masterpiece of human creative genius;* *(ii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared; and* *(iii) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history.* **References:** 1) World Heritage Committee (UNESCO), 2005. World Heritage Committee Twenty-ninth session. Durban, South Africa. Report. WHC-05/29.COM/INF.8B.1 2) World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19) 3) Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.

Level of recognition	**Heritage Values**	**Attributes**	**Sources of information**
Outstanding Universal Value	<u>Form and significance</u> The extant remains of the fortified German Limes, Hadrian's Wall and Antonine Wall constitute significant elements of the Roman Frontiers present in Europe. *Evidential values:* *- complexity: Hadrian's Wall demonstrates the evolving thoughts of the Roman army on frontier design over 300 years.* *- group value: the Hadrian's Wall frontier is significant in the wider group of the Frontiers of the Roman Empire WHS.* *- scale: the planning and construction of the Wall gives an insight into the organisational abilities of the Roman army, in particular the very high level of its skills in surveying, engineering and logistics.* *- rarity: Hadrian's Wall is one of the three significant artificial frontiers constructed by the Romans in the reign of the Emperor Hadrian and is one of the most concentrated and complex of Roman frontiers, unparalleled in the UK as a large and complex monument.* *Historical values:* *- documentation: contemporary Roman accounts; itineraries and cartographic depictions in the early and later medieval periods;* *- associative value: a direct link with the Emperor Hadrian and ultimately the decline and eventual collapse of the western Roman Empire; antiquarian interest; and as a setting for literature.* *- illustrative value: as part of the FRE,*	1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*

Level of recognition	Heritage Values	Attributes	Sources of information
	Hadrian's Wall illustrates the history, character and culture of the Roman Empire.		
	Technological evidence The forts, fortlets, walls, ditches, linked infrastructure and civilian architecture exhibit an important interchange of human and cultural values through the development of Roman military architecture, extending the technical knowledge of construction and management to the very edges of the Empire. *Evidential values:* *- complexity: Hadrian's Wall demonstrates the evolving thoughts of the Roman army on frontier design over 300 years.* *- scale: the planning and construction of the Wall gives an insight into the organisational abilities of the Roman army, in particular the very high level of its skills in surveying, engineering and logistics.* *Historical values:* *- documentation: contemporary Roman accounts; itineraries and cartographic depictions in the early and later medieval periods;* *- associative value: the building of Hadrian's Wall was an element in the Emperor Hadrian's confirmation of the boundaries of the Roman Empire.* *- illustrative value: the history, character and culture of the Roman Empire and the complex technological and organisational abilities of the Roman Empire.*	2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*
	The frontier system Hadrian's Wall was built on the orders of the Emperor Hadrian in AD 122 as a continuous linear barrier at the then northernmost limits of the Roman province of Britannia. It constituted the main element in a controlled military zone across northern Britain. The Wall was supplemented by the ditch and banks of the vallum, supporting forts, marching camps and other features in a wide area to the north and south, linked by an extensive road network. It illustrates an ambitious and coherent system of defensive constructions perfected by engineers over the course of several generations and is outstanding for its construction in dressed stone and its excellent use of the spectacular upland terrain through which it passed. *Evidential values:* *- complexity: Hadrian's Wall demonstrates the evolving thoughts of the Roman army on frontier design over 300 years.* *- scale: the planning and construction of the Wall gives an insight into the organisational abilities of the Roman army, in particular the very high level of its skills in surveying, engineering and logistics.* *- group value: individual sites are inter-related both spatially and functionally.* *Historical values:* *- documentation: contemporary Roman accounts, and itineraries and cartographic*	3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*

Level of recognition	Heritage Values	Attributes	Sources of information
	depictions in the early and later medieval periods. *- associative value: a direct link with the Emperor Hadrian and ultimately the decline and eventual collapse of the western Roman Empire; antiquarian interest; and as a setting for literature.* *- illustrative value: the plan to build the Wall and its structures bears witness to the history, character and culture of the Roman Empire, its ambition and power and its complex technological and organisational abilities.* *Aesthetic values:* *- setting: taken together, the remains of the frontier and their landscape setting provide a rich aesthetic experience.*		
	<u>Development and occupation of the frontier</u> Hadrian's Wall is an outstanding example of Roman military architecture and building techniques and of their technological development, perfected by engineers over the course of several generations. The Wall demonstrates the variety and sophistication of the Romans' responses to the specific topography and climate as well as to the political, military and social circumstances and thereby shaped much of the subsequent development in northern Britain. *Evidential values:* *- complexity and scale of the frontier.* *- group value: individual sites are inter-related both spatially and functionally.* *- archaeological evidence: research, including survey, geophysics and excavation, has shown that the Site contains a wealth of evidential material that forms the basis of our understanding of the frontier's function and development, its environmental context, and its material culture.* *- landscape value: the geology and morphology of the landscape directly influenced the location of the frontier* *Historical values:* *- documentation: contemporary Roman accounts; itineraries and cartographic depictions in the early and later medieval periods;* *- associative value: a direct link with the Emperor Hadrian and ultimately the decline and eventual collapse of the western Roman Empire; antiquarian interest; and as a setting for literature.* *- illustrative value: the history, character and culture of the Roman Empire.* *Aesthetic values:* *- setting: taken together, the remains of the frontier and their landscape setting provide a rich aesthetic experience.*	4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*

Level of recognition	Heritage Values	Attributes	Sources of information
	Archaeological remains The property includes both visible remains and buried archaeological features. Their state of survival has been researched in many areas. Several areas of the frontier have been built over, but where significant archaeological remains have been proven to exist they have been included in the property. *Evidential values:* *- archaeological evidence: research, including survey, geophysics and excavation, has shown that the Site contains a wealth of evidential material that forms the basis of our understanding of the frontier's function and development, its environmental context, and its material culture. In addition to its exposed and buried structures, the WHS contains a great deal of environmental evidence.* *Communal values:* *- academic value: the Site's value as a research resource includes reconsideration of the records of excavations and surveys, the further study of the visible structures, and of the finds that have been recovered over several centuries.* *- educational value: the many and complex issues related to protecting, conserving and valuing the Wall, and its status as a WHS, provide a wide range of learning opportunities.*	5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*
	Landscape setting of the frontier The form and design of Hadrian's Wall, in particular its linear character, and its architectural and military elements are still easy to understand and its location and setting in the landscape can be clearly appreciated. *Evidential values:* *- landscape value: the presence of the Wall has had a lasting effect on the landscape and perceptions of it, and on the evolution of ways of life.* *- scale: when it was complete, Hadrian's Wall would have dominated the landscape and its upstanding masonry and earthwork remains are still a significant element in the modern countryside.* *Historical values:* *- illustrative value: the plan to build the Wall and its structures bears witness to the ambition and power of the Roman Empire and its complex technological and organisational abilities* *Aesthetic values:* *- setting: taken together, the remains of the frontier and their landscape setting provide a rich aesthetic experience.* *Communal values:* *- recreational value: the Site's high level of authenticity, its surrounding landscape, and the constant development of its presentation to meet modern expectations, all contribute to its value as a destination for visitors.* *- economic value: tourism generated by the fame and significance of Hadrian's Wall, and by facilities such as the National Trail,*	6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*

Level of recognition	Heritage Values	Attributes	Sources of information
	supports a network of related businesses in a wider corridor.		
	Economic impact of the frontier The extant remains of Hadrian's Wall reflect the imposition of a complex frontier system on the existing societies of northern Britain, introducing for the first time military installations and related civilian settlements, linked through an extensive supporting network. The frontier did not constitute an impregnable barrier, but controlled and allowed the movement of peoples: not only the military units, but also civilians and merchants, triggering exchange of cultural values through movement of soldiers and civilians. *Evidential values:* *- complexity: associated sites included civilian settlements, cemeteries, and temples.* *- group value: this includes the relationship of the Roman frontier works to the landscape and settlement patterns onto which they were imposed, and their subsequent influence on the development of that landscape; the clustering of civilian settlements around forts, and the initial exclusion of civilian structures from the area between the Wall and the Vallum.* *- landscape value: the presence of the Wall has had a lasting effect on the landscape and perceptions of it, and on the evolution of ways of life.*	7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*
	Influence of the Wall on landscape development The frontier did not constitute an impregnable barrier, but controlled and allowed the movement of peoples: not only the military units, but also civilians and merchants, triggering exchange of cultural values through movement of soldiers and civilians. This entailed profound changes and developments in terms of settlement patterns, landscape design and spatial organization. The frontier still today forms a conspicuous part of the landscape. *Evidential values:* *- group value: the relationship of the Roman frontier works to the landscape and settlement patterns onto which they were imposed, and their subsequent influence on the development of that landscape.* *- landscape value: the presence of the Wall has had a lasting effect on the landscape and perceptions of it, and on the evolution of ways of life.* *Aesthetic values:* *- setting: taken together, the remains of the frontier and their landscape setting provide a rich aesthetic experience.*	8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*

Level of recognition	Heritage Values	Attributes	Sources of information
	Associated sites Some lengths of the Wall and of the other linear features, and some areas of the forts and other structures, are not scheduled and are therefore not formally included in the WHS but remain protected through the provisions of the Town and Country Planning Act 1990. However, such features and areas which are not covered by the WHS boundary may nevertheless contribute to the attributes of OUV of the WHS. *Evidential values:* *- archaeological evidence: un-investigated or undiscovered archaeological deposits have high potential to develop further understanding of the frontier. (evidential and historical value)* *- group value: the relationship of the Roman frontier works to the landscape and settlement patterns onto which they were imposed, and their subsequent influence on the development of that landscape.* *- landscape value: the presence of the Wall has had a lasting effect on the landscape and perceptions of it, and on the evolution of ways of life.*	9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*
	Integrity About four fifths of the line of Hadrian's Wall runs through open country. Within the central 45 km of its course, the remains are in an exceptionally good state of preservation, surviving as part of a landscape which still contains significant visible traces of the Roman military presence. Even outside this central zone, many individual sites are well-preserved. *Evidential values:* *- archaeological evidence: research, including survey, geophysics and excavation, has shown that the Site contains a wealth of evidential material that forms the basis of our understanding of the frontier's function and development, its environmental context, and its material culture. In addition to its exposed and buried structures, the WHS contains a great deal of environmental evidence.* *- group value: individual sites described above are inter-related, both spatially and functionally.*	The integrity of the property is demonstrated through its visible remains and buried archaeological features. Their state of survival has been researched in many areas. Several areas of the frontier have been built over, but where significant archaeological remains have been proven to exist they have been included in the property.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*

Level of recognition	Heritage Values	Attributes	Sources of information
	Authenticity The inscribed component parts have been verified through extensive study and research. The materials and substance of underground archaeological remains are well-preserved, as are upstanding and visible remains. The form and design of Hadrian's Wall, in particular its linear character, and its architectural and military elements are still easy to understand and its location and setting in the landscape can be clearly appreciated. Upstanding parts of the property have been conserved in accordance with the highest standards and are in a good state of repair. *Evidential values:* *- archaeological evidence: research, including survey, geophysics and excavation, has shown that the Site contains a wealth of evidential material that forms the basis of our understanding of the frontier's function and development, its environmental context, and its material culture. In addition to its exposed and buried structures, the WHS contains a great deal of environmental evidence.* *- group value: individual sites described above are inter-related, both spatially and functionally.* *Communal values:* *- academic value: the Site's value as a research resource includes reconsideration of the records of excavations and surveys, the further study of the visible structures, and of the finds that have been recovered over several centuries.* *- educational value: the many and complex issues related to protecting, conserving and valuing the Wall, and its status as a WHS, provide a wide range of learning opportunities.* *- recreational value: the Site's high level of authenticity, its surrounding landscape, and the constant development of its presentation to meet modern expectations, all contribute to its value as a destination for visitors.* *- economic value: tourism generated by the fame and significance of Hadrian's Wall, and by facilities such as the National Trail, supports a network of related businesses in a wider corridor.*	The authenticity of the property is demonstrated through the extensive research and good preservation and conservation of underground and visible remains. The form and linear character of the frontier and its architectural and military elements are readily appreciated in the landscape.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*
Associated Scheduled Monuments not forming part of the inscribed property	Some lengths of the Wall and of the other linear features, and some areas of the forts and other structures, are not scheduled and are therefore not formally included in the WHS but remain protected through the provisions of the Town and Country Planning Act 1990. However, such features and areas which are not covered by the WHS boundary may nevertheless contribute to the attributes of OUV of the WHS. *Evidential values:* *- archaeological evidence: un-investigated or undiscovered archaeological deposits have high potential to develop further understanding of the frontier.*	Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.	*World Heritage Committee (2016) Adopted Retrospective Statement of Outstanding Universal Value. (Decision 40 COM 8E; WHC/16/40.COM/19)* *Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*

Level of recognition	Heritage Values	Attributes	Sources of information
National Parks	Northumberland National Park Hadrian's Wall and its landscape are associated with a variety of recreational activities. Access to and appreciation of the historic environment is enjoyed by thousands of visitors each year. The Hadrian's Wall Path National Trail and the Hadrian's Cycleway have significantly added to ways of accessing and enjoying the Site. *Aesthetic values:* *- the remains of Hadrian's Wall run through varied landscapes which include two National Parks and a National Landscape, the United Kingdom's highest landscape designations. Taken together, the remains of the frontier and their landscape setting provide a rich aesthetic experience.* *Communal values:* *- recreational value: the Site's high level of authenticity, its surrounding landscape, and the constant development of its presentation to meet modern expectations, all contribute to its value as a destination for visitors.*	The remains of Hadrian's Wall run through varied landscapes which include two National Parks and a National Landscape. The views of the Wall from the north and the south, and along its length, are impressive and help the visitor to appreciate Roman military planning and the relationship of the Wall to the physical and human landscape.	*Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*
National Landscapes	North Pennines National Landscape Hadrian's Wall and its landscape are associated with a variety of recreational activities. Access to and appreciation of the historic environment is enjoyed by thousands of visitors each year. The Hadrian's Wall Path National Trail and the Hadrian's Cycleway have significantly added to ways of accessing and enjoying the Site. *Aesthetic values:* *- the remains of Hadrian's Wall run through varied landscapes which include two National Parks and a National Landscape, the United Kingdom's highest landscape designations. Taken together, the remains of the frontier and their landscape setting provide a rich aesthetic experience.* *Communal values:* *- recreational value: the Site's high level of authenticity, its surrounding landscape, and the constant development of its presentation to meet modern expectations, all contribute to its value as a destination for visitors.*	The remains of Hadrian's Wall run through varied landscapes which include two National Parks and a National Landscape. The views of the Wall from the north and the south, and along its length, are impressive and help the visitor to appreciate Roman military planning and the relationship of the Wall to the physical and human landscape.	*Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*
Site of Special Scientific Interest	Roman Wall Escarpment Site of Special Scientific Interest Hadrian's Wall and its landscape are associated with a variety of recreational activities. Access to and appreciation of the historic environment is enjoyed by thousands of visitors each year. The Hadrian's Wall Path National Trail and the Hadrian's Cycleway have significantly added to ways of accessing and enjoying the Site. *Aesthetic values:* *- the remains of Hadrian's Wall run through varied landscapes which include two National Parks and a National Landscape, the United Kingdom's highest landscape designations. Taken together, the remains of the frontier and their landscape setting provide a rich aesthetic experience.* *Communal values:* *- recreational value: the Site's high level of*	The remains of Hadrian's Wall run through varied landscapes which include two National Parks and a National Landscape. The views of the Wall from the north and the south, and along its length, are impressive and help the visitor to appreciate Roman military planning and the relationship of the Wall to the physical and human landscape.	*Hadrian's Wall Partnership (2024), Hadrian's Wall Management Plan 2024-2029.*

Level of recognition	Heritage Values	Attributes	Sources of information
	authenticity, its surrounding landscape, and the constant development of its presentation to meet modern expectations, all contribute to its value as a destination for visitors.		

Appendix C: Elements of a new OHL that may interact with one or more attributes of the WHS (with reference to Tool 2 of the 2022 UNESCO HIA Guidelines)

Table 11: Elements of a new OHL that may interact with one or more attributes of the WHS (with reference to Tool 2 of the 2022 UNESCO HIA Guidelines): Construction

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	Establishment of temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values. There is also the potential for permanent effects as a result of physical impacts on archaeological remains.	Excavation for and installation of new pylon tower bases could have a permanent effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.	Laydown and assembly of new pylon towers could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.	Erection of new pylon towers could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.	Layout and stringing of new overhead cable could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.	Works to remove temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	Establishment of temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army. There is also the potential for permanent impacts as a result of physical impacts on archaeological remains.	Excavation for and installation of new pylon tower bases could have a permanent effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.	Laydown and assembly of new pylon towers could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.	Erection of new pylon towers could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.	Layout and stringing of new overhead cable could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.	Works to remove temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.	Establishment of temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected. There is also the potential for permanent impacts as a result of physical impacts on archaeological remains.	Excavation for and installation of new pylon tower bases could have a permanent effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.	Laydown and assembly of new pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.	Erection of new pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.	Layout and stringing of new overhead cable could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.	Works to remove temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and	Establishment of temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its	Excavation for and installation of new pylon tower bases could have a direct physical impact on archaeological remains and a permanent effect on the evidential and aesthetic values of	Laydown and assembly of new pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including	Erection of new pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including the wealth of	Layout and stringing of new overhead cable could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and a permanent effect on the evidential and

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
decay.	landscape setting, which taken together provide a rich aesthetic experience. There is also the potential for permanent impacts as a result of physical impacts on archaeological remains.	the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.	the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.	archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.	the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.	aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.
5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.	Establishment of temporary site access and works compounds could have a direct physical impact on archaeological remains and a permanent effect on the evidential and communal values embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	Excavation for and installation of new pylon tower bases could have a direct physical impact on archaeological remains and a permanent effect on the evidential and communal values embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	Laydown and assembly of new pylon towers is unlikely to result in any direct physical impact on archaeological remains, nor would it affect the evidential and communal values embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	Erection of new pylon towers is unlikely to result in any direct physical impact on archaeological remains, nor would it affect the evidential and communal values embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	Layout and stringing of new overhead cable is unlikely to result in any direct physical impact on archaeological remains, nor would it affect the evidential and communal values embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	Works to remove temporary site access and works compounds could have direct physical impact on archaeological remains and a permanent effect on the evidential and aesthetic values of the remains of the frontier and their landscape setting, which taken together provide a rich aesthetic experience.

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	Establishment of temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.	Excavation for and installation of new pylon tower bases could have a permanent effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.	Laydown and assembly of new pylon towers could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.	Erection of new pylon towers could affect the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values. Any effect would be temporary during the erection process but permanent for the lifespan of the scheme once the towers are erected.	Layout and stringing of new overhead cable could affect the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values. Any effect would be temporary during the erection process but permanent for the lifespan of the scheme once the towers are erected.	Works to remove temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.	Establishment of temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value. There is also the potential for permanent impacts as a result of physical impacts on archaeological remains.	Excavation for and installation of new pylon tower bases could have a direct physical impact on archaeological remains and a permanent effect on the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.	Laydown and assembly of new pylon towers could have a temporary effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.	Erection of new pylon towers could have a temporary effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.	Layout and stringing of new overhead cable could have a temporary effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and a permanent effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.	Establishment of temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including the setting. There is also the	Excavation for and installation of new pylon tower bases could have a direct physical impact on archaeological remains and a permanent effect on the ability to appreciate the evidential and aesthetic values that	Laydown and assembly of new pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent	Erection of new pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the	Layout and stringing of new overhead cable could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and a permanent effect on the ability to appreciate the evidential and

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
	potential for permanent impacts as a result of physical impacts on archaeological remains.	demonstrate the influence of the frontier zone on the subsequent development of the landscape, including its setting.	development of the landscape, including its setting.	landscape, including its setting.	development of the landscape, including its setting.	aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including its setting.
9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.	Establishment of temporary site access and works compounds could have a direct physical impact on archaeological remains and permanent and temporary effects on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription.	Excavation for and installation of new pylon tower bases could have a direct physical impact on archaeological remains and a permanent effect on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription	Laydown and assembly of new pylon towers could have a temporary effect on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription	Erection of new pylon towers could have a temporary effect on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription	Layout and stringing of new overhead cable could have a temporary effect on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and permanent and temporary effects on the ability to appreciate evidential values represented by the associated sites that do not form part of the WHS inscription

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
Integrity The integrity of the property is demonstrated through its visible remains and buried archaeological features. Their state of survival has been researched in many areas. Several areas of the frontier have been built over, but where significant archaeological remains have been proven to exist, they have been included in the property.	Establishment of temporary site access and works compounds could have a direct physical impact on archaeological remains and permanent and temporary effects on the evidential values that demonstrate the integrity of the WH property, respectively the archaeological evidence and the spatial and functional relationships between components of the inscribed property.	Excavation for and installation of new pylon tower bases could have a direct physical impact on archaeological remains and a permanent effect on the evidential values that demonstrate the integrity of the WH property, notably the archaeological evidence.	Laydown and assembly of new pylon towers could have a temporary effect on the evidential values that demonstrate the integrity of the WH property, notably the spatial and functional relationships between components of the inscribed property.	Erection of new pylon towers could have a temporary effect on the evidential values that demonstrate the integrity of the WH property, notably the spatial and functional relationships between components of the inscribed property.	Layout and stringing of new overhead cable could have a temporary effect on the evidential values that demonstrate the integrity of the WH property, notably the spatial and functional relationships between components of the inscribed property.	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and permanent and temporary effects on the evidential values that demonstrate the integrity of the WH property, respectively the archaeological evidence and the spatial and functional relationships between components of the inscribed property.
Authenticity The authenticity of the property is demonstrated through the extensive research and good preservation and	Establishment of temporary site access and works compounds could have a direct physical impact on archaeological remains and permanent and temporary effects on the evidential and communal values that	Excavation for and installation of new pylon tower bases could have a direct physical impact on archaeological remains and a permanent effect on	Laydown and assembly of new pylon towers could have a temporary effect on the evidential and communal values that demonstrate the	Erection of new pylon towers could have a temporary effect on the evidential and communal values that demonstrate the authenticity of the	Layout and stringing of new overhead cable could have a temporary effect on the evidential and communal values that demonstrate the authenticity of the	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and

ATTRIBUTES OF OUV	CONSTRUCTION: Establishment of temporary site access and works compounds, (TEMPORARY & PERMANENT IMPACTS)	CONSTRUCTION: Excavation for and installation of new pylon tower bases (PERMANENT IMPACTS)	CONSTRUCTION: Laydown & assembly of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Erection of new pylon towers (TEMPORARY IMPACTS)	CONSTRUCTION: Layout and stringing of new overhead cable (TEMPORARY IMPACTS)	CONSTRUCTION: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
conservation of underground and visible remains. The form and linear character of the frontier and its architectural and military elements are readily appreciated in the landscape.	demonstrate the authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic values. The form and design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	permanent and temporary effects on the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.

Table 12: Elements of a new OHL that may interact with one or more attributes of the WHS (with reference to Tool 2 of the 2022 UNESCO HIA Guidelines): Operation

ATTRIBUTES OF OUV	OPERATION: Inspection & maintenance (planned works to apparatus in situ) (TEMPORARY / TRANSIENT IMPACTS)	OPERATION: Overhaul & repair (planned or responsive works such as renewal and replacement of apparatus) (TEMPORARY / TRANSIENT IMPACTS)
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values. Any effect would be transient and localised.	Overhaul and repair activities could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values. Any effect would be transient and localised.
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire, and is a reflection of the way that resources were deployed by the Roman army.	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army. Any effect would be transient and localised.	Overhaul and repair activities could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army. Any effect would be transient and localised.
3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships, due to change to their settings; the relative completeness of the system as a whole would not be affected. Any effect would be transient and localised.	Overhaul and repair activities could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships, due to change to their settings; the relative completeness of the system as a whole would not be affected. Any effect would be transient and localised.

ATTRIBUTES OF OUV	OPERATION: Inspection & maintenance (planned works to apparatus in situ) (TEMPORARY / TRANSIENT IMPACTS)	OPERATION: Overhaul & repair (planned or responsive works such as renewal and replacement of apparatus) (TEMPORARY / TRANSIENT IMPACTS)
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience. Temporary changes to the setting of components of the inscribed property during operation would not diminish these values. Any effect would be transient and localised.	Overhaul and repair activities could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience. Temporary changes to the setting of components of the inscribed property during operation would not diminish these values. Any effect would be transient and localised.
5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data about the palaeo-environment – is still extensive and is a significant attribute of the OUV.	Inspection and maintenance activities are unlikely to have direct impact on archaeological remains and would not affect the evidential and communal values embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	Overhaul and repair activities are unlikely to have direct impact on archaeological remains and would not affect the evidential and communal values embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.
6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. Any effect would be transient and localised.	Overhaul and repair activities could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. Any effect would be transient and localised.
7. The settlements associated with the frontier illustrate the impact and attraction of the Roman economy.	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value, due to change to their settings. Any effect would be transient and localised.	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value, due to change to their settings. Any effect would be transient and localised.

ATTRIBUTES OF OUV	OPERATION: Inspection & maintenance (planned works to apparatus in situ) (TEMPORARY / TRANSIENT IMPACTS)	OPERATION: Overhaul & repair (planned or responsive works such as renewal and replacement of apparatus) (TEMPORARY / TRANSIENT IMPACTS)
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including its setting. Any effect would be transient and localised.	Overhaul and repair activities could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including its setting.
9. Extensive stretches of the frontier within urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.	Inspection and maintenance activities could have a temporary effect on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription, due to change to their settings. Any effect would be transient and localised.	Overhaul and repair activities could have a temporary effect on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription, due to change to their settings. Any effect would be transient and localised.
Integrity The integrity of the property is demonstrated through its visible remains and buried archaeological features. Their state of survival has been researched in many areas. Several areas of the frontier have been built over, but where significant archaeological remains have been proven to exist, they have been included in the property.	Inspection and maintenance activities could have a temporary effect on the evidential values that demonstrate the integrity of the WH property, notably the spatial and functional relationships between components of the inscribed property. Any effect would be transient and localised.	Overhaul and repair activities could have a temporary effect on the evidential values that demonstrate the integrity of the WH property, notably the spatial and functional relationships between components of the inscribed property. Any effect would be transient and localised.
Authenticity The authenticity of the property is demonstrated through the extensive research and good preservation and conservation of underground and visible remains. The form and linear character of the frontier and its architectural and military elements are readily	Inspection and maintenance activities could have a temporary effect on the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. Any effect would be transient and localised:	Overhaul and repair activities could have a temporary effect on the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. Any effect would be transient and localised: the form and

ATTRIBUTES OF OUV	OPERATION: Inspection & maintenance (planned works to apparatus in situ) (TEMPORARY / TRANSIENT IMPACTS)	OPERATION: Overhaul & repair (planned or responsive works such as renewal and replacement of apparatus) (TEMPORARY / TRANSIENT IMPACTS)
appreciated in the landscape.	the form and design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.

Table 13: Elements of a new OHL that may interact with one or more attributes of the WHS (with reference to Tool 2 of the 2022 UNESCO HIA Guidelines): Decommissioning

ATTRIBUTES OF OUV	DECOMMISSIONING: Establishment of temporary site access and works compounds (TEMPORARY AND PERMANENT IMPACTS)	DECOMMISSIONING: Removal of overhead cables (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Dismantling and removal of pylon towers (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Removal of pylon tower bases, ground restoration (TEMPORARY OR PERMANENT IMPACTS)	DECOMMISSIONING: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
1. Hadrian's Wall is a frontier which was designed and constructed to protect the Roman Empire. It is a symbol of a common heritage [in respect of inscription as part of the Frontiers of the Roman Empire].	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values. There is also the potential for permanent impacts as a result of physical impacts on archaeological remains.	Activities to remove overhead cables could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.	Dismantling and removal of pylon towers could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.	Works to remove pylon tower bases and restore land to its original use could have a permanent effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.	Works to remove temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS as a frontier designed and constructed to protect the Roman Empire, and a symbol of a common heritage, in terms of its landscape value, scale, illustrative values and communal values.
2. In its engineering and construction it illustrates the technological and organisational ability of the Roman Empire,	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a temporary effect on the ability to appreciate the evidential and historical	Activities to remove overhead cables could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which	Dismantling and removal of pylon towers could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and complexity, which	Works to remove pylon tower bases and restore land to its original use could have a permanent effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale	Works to remove temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and historical values of the WHS in terms of its scale and

ATTRIBUTES OF OUV	DECOMMISSIONING: Establishment of temporary site access and works compounds (TEMPORARY AND PERMANENT IMPACTS)	DECOMMISSIONING: Removal of overhead cables (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Dismantling and removal of pylon towers (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Removal of pylon tower bases, ground restoration (TEMPORARY OR PERMANENT IMPACTS)	DECOMMISSIONING: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
and is a reflection of the way that resources were deployed by the Roman army.	values of the WHS in terms of its scale and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army. There is also the potential for permanent impacts as a result of physical impacts on archaeological remains.	demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.	demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.	and complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.	complexity, which demonstrate the technological and organisational ability of the Roman Empire and the way that resources were deployed by the Roman army.
3. Hadrian's Wall displays the complexity and variety of the elements of the frontier system, their inter-relationships, and the relative completeness of the system as a whole.	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected. There is also the potential for permanent impacts as	Activities to remove overhead cables could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.	Dismantling and removal of pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.	Works to remove pylon tower bases and restore land to its original use could have a permanent effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.	Works to remove temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential and aesthetic values embodied in the complexity and variety of the elements of the frontier system, most notably in their inter-relationships; the relative completeness of the system as a whole would not be affected.

ATTRIBUTES OF OUV	DECOMMISSIONING: Establishment of temporary site access and works compounds (TEMPORARY AND PERMANENT IMPACTS)	DECOMMISSIONING: Removal of overhead cables (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Dismantling and removal of pylon towers (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Removal of pylon tower bases, ground restoration (TEMPORARY OR PERMANENT IMPACTS)	DECOMMISSIONING: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
	a result of physical impacts on archaeological remains.				
4. The frontier was occupied by the Romans for three centuries; its remains therefore display considerable evidence of repair, rebuilding, re-use, re-planning, and decay.	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience. There is also the potential for permanent impacts as a result of physical impacts on archaeological remains.	Activities to remove overhead cables could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.	Dismantling and removal of pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.	Works to remove pylon tower bases and restore land to its original use could have a direct physical impact on archaeological remains and a permanent effect on the evidential and aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and a permanent effect on the evidential and aesthetic values of the remains of the frontier, including the wealth of archaeological evidence, and its landscape setting, which taken together provide a rich aesthetic experience.
5. The retrievable archaeological information that survives – in the form of buried structures, artefacts, ecofacts, and data	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a direct physical impact on archaeological remains and a permanent effect on the evidential and	Activities to remove overhead cables are unlikely to result in any direct physical impact on archaeological remains, nor would they affect the evidential and communal values embodied in the buried structures,	Dismantling and removal of pylon towers is unlikely to result in any direct physical impact on archaeological remains, nor would it affect the evidential and communal values embodied in the buried structures,	Works to remove pylon tower bases and restore land to its original use could have a direct physical impact on archaeological remains and a permanent effect on the evidential and communal values	Works to remove temporary site access and works compounds could have direct physical impact on archaeological remains and a permanent effect on the evidential and aesthetic values of the remains of the frontier and

ATTRIBUTES OF OUV	DECOMMISSIONING: Establishment of temporary site access and works compounds (TEMPORARY AND PERMANENT IMPACTS)	DECOMMISSIONING: Removal of overhead cables (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Dismantling and removal of pylon towers (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Removal of pylon tower bases, ground restoration (TEMPORARY OR PERMANENT IMPACTS)	DECOMMISSIONING: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
about the palaeo-environment – is still extensive and is a significant attribute of the OUV.	communal values embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	embodied in the buried structures, artefacts, ecofacts, and data about the palaeo-environment that form the corpus of retrievable archaeological information.	their landscape setting, which taken together provide a rich aesthetic experience.
6. The setting of the WHS offers the opportunity to understand and appreciate Roman military planning and operations.	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.	Activities to remove overhead cables could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.	Dismantling and removal of pylon towers could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.	Works to remove pylon tower bases and restore land to its original use could have a permanent effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.	Works to remove temporary site access and works compounds could have a temporary effect on the ability to appreciate the evidential, historical, aesthetic and communal values embodied in the setting of the WHS. The setting of the WHS is important to its landscape value which, together with its scale, expresses the power and ambition of the Roman empire, underpinning its recreational and economic values.
7. The settlements associated with the frontier	Establishment of temporary site access and works compounds for decommissioning of an	Activities to remove overhead cables could have a temporary effect on the ability to appreciate the	Dismantling and removal of pylon towers could have a temporary effect on the ability to appreciate the	Works to remove pylon tower bases and restore land to its original use could have a direct	Works to remove temporary site access and works compounds could have a direct physical

ATTRIBUTES OF OUV	DECOMMISSIONING: Establishment of temporary site access and works compounds (TEMPORARY AND PERMANENT IMPACTS)	DECOMMISSIONING: Removal of overhead cables (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Dismantling and removal of pylon towers (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Removal of pylon tower bases, ground restoration (TEMPORARY OR PERMANENT IMPACTS)	DECOMMISSIONING: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
illustrate the impact and attraction of the Roman economy.	OHL could have a temporary effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value. There is also the potential for permanent impacts as a result of physical impacts on archaeological remains.	evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.	evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.	physical impact on archaeological remains and a permanent effect on the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.	impact on archaeological remains and a permanent effect on the ability to appreciate the evidential values embodied in the settlements associated with the frontier, including their complexity, group value and landscape value.
8. The course and extent of the frontier zone, its massive size, and its infrastructure, all influenced the subsequent development of the landscape, both in open country and in urban areas.	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including the setting.	Activities to remove overhead cables could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including its setting.	Dismantling and removal of pylon towers could have a temporary effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including its setting.	Works to remove pylon tower bases and restore land to its original use could have a direct physical impact on archaeological remains and a permanent effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including its setting.	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and a permanent effect on the ability to appreciate the evidential and aesthetic values that demonstrate the influence of the frontier zone on the subsequent development of the landscape, including its setting.
9. Extensive stretches of the frontier within	Establishment of temporary site access and works compounds for	Activities to remove overhead cables could have a temporary effect on	Dismantling and removal of pylon towers could have a temporary effect on the	Works to remove pylon tower bases and restore land to its original use	Works to remove temporary site access and works compounds could

ATTRIBUTES OF OUV	DECOMMISSIONING: Establishment of temporary site access and works compounds (TEMPORARY AND PERMANENT IMPACTS)	DECOMMISSIONING: Removal of overhead cables (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Dismantling and removal of pylon towers (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Removal of pylon tower bases, ground restoration (TEMPORARY OR PERMANENT IMPACTS)	DECOMMISSIONING: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
urban areas, and some other discrete associated elements, are not yet designated as Scheduled Monuments; they are therefore not included in the WHS but they represent an associated attribute of considerable significance which is worthy of protection.	decommissioning of an OHL could have a direct physical impact on archaeological remains and permanent and temporary effects on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription.	the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription	ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription	could have a direct physical impact on archaeological remains and a permanent effect on the ability to appreciate the evidential values represented by the associated sites that do not form part of the WHS inscription	have a direct physical impact on archaeological remains and permanent and temporary effects on the ability to appreciate evidential values represented by the associated sites that do not form part of the WHS inscription
Integrity The integrity of the property is demonstrated through its visible remains and buried archaeological features. Their state of survival has been researched in many areas. Several areas of	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a direct physical impact on archaeological remains and permanent and temporary effects on the evidential values that demonstrate the integrity of the WH property, respectively the archaeological evidence	Activities to remove overhead cables could have a temporary effect on the evidential values that demonstrate the integrity of the WH property, notably the spatial and functional relationships between components of the inscribed property.	Dismantling and removal of pylon towers could have a temporary effect on the evidential values that demonstrate the integrity of the WH property, notably the spatial and functional relationships between components of the inscribed property.	Works to remove pylon tower bases and restore land to its original use could have a direct physical impact on archaeological remains and a permanent effect on the evidential values that demonstrate the integrity of the WH property, notably the archaeological evidence.	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and permanent and temporary effects on the evidential values that demonstrate the integrity of the WH property, respectively the archaeological evidence and the spatial and functional relationships

ATTRIBUTES OF OUV	DECOMMISSIONING: Establishment of temporary site access and works compounds (TEMPORARY AND PERMANENT IMPACTS)	DECOMMISSIONING: Removal of overhead cables (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Dismantling and removal of pylon towers (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Removal of pylon tower bases, ground restoration (TEMPORARY OR PERMANENT IMPACTS)	DECOMMISSIONING: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
the frontier have been built over, but where significant archaeological remains have been proven to exist, they have been included in the property.	and the spatial and functional relationships between components of the inscribed property.				between components of the inscribed property.
Authenticity The authenticity of the property is demonstrated through the extensive research and good preservation and conservation of underground and visible remains. The form and linear character of the frontier and its architectural and military elements are readily appreciated in the landscape.	Establishment of temporary site access and works compounds for decommissioning of an OHL could have a direct physical impact on archaeological remains and permanent and temporary effects on the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, architectural and military elements and its location and setting in	Activities to remove overhead cables could have a temporary effect on the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	Dismantling and removal of pylon towers could have a temporary effect on the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	Works to remove pylon tower bases and restore land to its original use could have a direct physical impact on archaeological remains and a permanent effect on the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic values. The form and design of Hadrian's Wall, its linear character, its architectural and military elements and its location and setting in the landscape and the ability to appreciate these would not be diminished.	Works to remove temporary site access and works compounds could have a direct physical impact on archaeological remains and permanent and temporary effects on the evidential and communal values that demonstrate the authenticity of the WH property, notably the archaeological evidence and academic, educational, recreational and economic values. The form and design of Hadrian's Wall, its linear character, architectural and military elements and its location and setting in the landscape and the

ATTRIBUTES OF OUV	DECOMMISSIONING: Establishment of temporary site access and works compounds (TEMPORARY AND PERMANENT IMPACTS)	DECOMMISSIONING: Removal of overhead cables (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Dismantling and removal of pylon towers (TEMPORARY / TRANSIENT IMPACTS)	DECOMMISSIONING: Removal of pylon tower bases, ground restoration (TEMPORARY OR PERMANENT IMPACTS)	DECOMMISSIONING: Removal of temporary site access and works compounds (TEMPORARY & PERMANENT IMPACTS)
	the landscape and the ability to appreciate these would not be diminished.				ability to appreciate these would not be diminished.

Appendix D: Gazetteer of Components of the World Heritage Site

The gazetteer below provides details of all designated assets that are components of the World Heritage Site. This data was primarily sources from the National Heritage List for England (NHLE), and details such as level or survival have been noted where it is recorded in the descriptions. Details regarding the 'Heritage at Risk' status is also provided if it is known.

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
1014585	Boothby Roman fort	Monument includes site of Boothby Roman fort which is located at a strategic position on edge of a scarp overlooking River Irthing to north. Fort was part of the Stanegate system, the first Roman defence system running across the Tyne-Solway route. Existence of fort has been proven by combination of an aerial photograph, which highlights features such as infilled defensive ditch on fort's south and east sides, and limited archaeological excavation undertaken by Simpson in 1933 who found evidence of fort's ditch and rampart. A trench dug across defences revealed that ditch measured 5.2m wide by 1.8m deep while behind the ditch remains of a beaten clay rampart were located. Roman pottery found during this excavation was dated to the late first/early second century AD. The aerial photograph shows existence of a gateway on mid-point of the fort's southern side. Only surface evidence of the fort's existence is a slight hollow which marks position of ditch as it curves around south east corner of fort.	NY 54455 62969	Cropmarks, excavation	Not listed in register
1010979	Hadrian's Wall and vallum between Baron's Dike and Birky Lane at Walby, in wall miles 60, 61 and 62.	Monument includes section of Hadrian's Wall and vallum and their associated features between Baron's Dike in east and west side of Birky Lane at Walby in west. Hadrian's Wall survives as a buried feature throughout this section. Wall ditch survives as an intermittent earthwork visible in east half of this section, which also serves as a reliable guide to course of Wall here. Where visible the partly silted ditch averages 0.3m-0.8m deep with a modern drain cut into its base. Elsewhere ditch is visible as a broad and shallow depression in fields averaging 0.2m deep, also with a drain cut into its base. Its course has been confirmed in places through geophysical survey in 1981. In this section, ditch upcast mound, usually referred to as the glacis, survives as a feature faintly visible on ground; elsewhere it survives as a buried feature. Exact location of milecastle 61 has not yet been confirmed. On basis of usual spacing, it is expected to be located near Wallhead. A geophysical survey in 1981 located probable remains of the milecastle. Locations of milecastle 62 and turrets 61a and 61b have not yet been confirmed. On basis of usual spacing, milecastle 62 is expected to be situated approximately 300m east of Walby Grange. Turrets 61a and 61b are expected to be situated at usual distances between milecastles 61 and 62.	NY 44952 60674	Earthworks, inferred	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		Course of Roman road known as Military Way has been identified for a short distance to east of Wallhead. No remains visible on surface except for a short section of a turf covered mound, 4m-5m wide and up to 0.4m high. South east of Wallhead, vallum survives as a slight earthwork visible on ground as four parallel mounds, the most prominent ones being up to 1.2m high. Elsewhere, vallum survives as a buried feature with no remains visible on ground except for a slight depression over vallum ditch in a field 600m east of Walby Grange.			
1010980	Hadrian's Wall and vallum between Birky Lane at Walby and the east side of the M6 in wall miles 62 and 63	Monument includes section of Hadrian's Wall and vallum and their associated features between west side of Birky Lane at Walby in east and east side of M6 motorway in west. Hadrian's Wall survives as a buried feature throughout this section with no remains visible above ground except for a low amorphous turf covered mound at Brunstock Park. Wall ditch survives intermittently as an earthwork in this section. At Brunstock Park ditch is 8m-9m wide and 1.2m deep. Elsewhere ditch is silted up but can be traced as a very faint depression in fields, 0.15m deep. Milecastle 63 probably survives as a buried feature. The exact locations of turrets 62a, 62b, 63a and 63b have not yet been confirmed. They are expected to be located at usual spacings between milecastles, approximately 500m apart. Position of Roman road known as the Military Way has not yet been confirmed throughout this section. Only part of it which is known is a short section found during excavation by Haverfield in 1894 approximately 80m west of minor road between Houghton Hall and B6264 road, 40m south of extant wall ditch. Elsewhere its remains survive as buried features. Vallum survives as slight earthwork visible on ground in Brunstock Park. Broad line of ditch averages 0.4m deep and ploughed down north and south mounds stand 0.2m high. Elsewhere in this section, its remains survive as buried features with no remains visible above ground.	NY 42812 59342	Earthworks, inferred, excavation	Not listed in register
1010982	Hadrian's Wall between the road to Garthside and The Centurion Inn, Walton, in wall miles 54 and 55	Monument includes section of Hadrian's Wall and its associated features between west side of road to Garthside in east and Centurion Inn at Walton in west. Hadrian's Wall survives as a buried feature throughout this section with few traces visible on ground. Between Howgill and turret 55a, Wall survives as a	NY 53262 64395	Earthworks, inferred	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		substantial turf covered bank, up to 1.4m high, surmounted by a fence and hedge. West of Dovecote Bridge a section of Wall 20m long stands to an average height of 1m. It is now covered by a protective mound of earth. Between this section of Wall and Walton, its line here is visible on ground as an intermittent slight rise in grassland. Elsewhere in this section, Wall survives as a buried feature with no remains visible above ground except for occasional rise seen in a hedgeline. Wall ditch survives as a feature visible on ground as a slight depression, averaging 0.5m deep, throughout most of this section. It is best preserved to east of turret 55a where it is 2.4m deep. Ditch upcast mound, usually referred to as the glacis, which lies to north of ditch has been ploughed out in this section. The only visible remains of this feature are to the east of turret 55a where it survives as a slight mound. Milecastle 55 survives as a low turf covered platform visible as a slight rise in the hedgeline. It measures 22m east to west but its north-south length is indeterminate because its extent to south is unclear. Milecastle 56 is located to north east of Centurion Inn at Walton. It survives as a buried feature with no traces visible above ground. Turret 54b is situated about 150m north east of Howgill House. It survives as a buried feature with no remains visible above ground. Turret 55a is situated about 170m to north of High Dovecote. It survives as a buried feature with no remains visible above ground. Turret 55b is situated about 40m west of Dovecote Bridge. Its exact location has not yet been confirmed as it survives as a buried feature with no remains visible above ground. The turret was located by Miss Kate Hodgson in 1959 but it has not been located since. Exact course of Roman road known as the Military Way has not been confirmed in this section. However, it is expected to be situated parallel to the Wall about 20m-30m south of it.			
1010983	The vallum between the road to Garthside and the track east of Castlesteads in wall miles 54, 55 and 56	Monument includes section of vallum and its associated features between road to Garthside in east and track to east of Castlesteads in west. Vallum survives as buried feature throughout most of this section. It is best preserved to west of Low Wall where ditch is visible as a slight depression which deepens as it descends to stream. Otherwise, only surface traces	NY 52861 64215	Earthworks, inferred, excavations	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		are slight rises and dips in hedgelines where they cross ploughed down mounds and ditch of vallum. Elsewhere, vallum mounds have been reduced by ploughing leaving no trace above ground. Similarly, vallum ditch has been entirely silted up leaving no obvious remains on surface. Where there are no surface traces, course of vallum is known from excavations by Haverfield during 1900-1901.			
1010984	Hadrian's Wall between Eden Vale house and the Cam Beck in wall mile 56	Monument includes section of Hadrian's Wall and its associated features between Eden Vale house at Walton in east and Cam Beck in west. Hadrian's Wall survives as a buried feature in east half of this section with few traces visible above ground. In woodland on east and west sides of Sandysike, Wall is visible as an earth covered bank, 5.6m wide and 0.3m-0.5m high, with trees growing out of it. Either side of Cam Beck there are no upstanding remains of Wall. Wall ditch survives as intermittent earthwork visible on ground throughout this section. East of Sandysike Wood, ditch is silted up leaving no surface traces. In wood ditch survives as a visible feature, averaging between 1.4m and 1.7m deep, with a drain occupying its base. West of wood, ditch is partly overlain by a hedgeline before fading as it approaches Cam Beck in boggy ground. Ditch upcast mound, usually referred to as the glacis, which lies to north of ditch has been ploughed out throughout most of this section. Exact location of turret 56a has not been confirmed as there are no upstanding remains visible above ground. However, on basis of usual spacing it is expected to be located just to east of Sandysike. Although not included in scheduling, there is a Roman altar built into an outbuilding of Sandysike farm. It is made from red sandstone and measures 0.34m by 0.14m. Turret 56b is situated about 140m east of Cam Beck on a river terrace. Turret survives as a buried feature with no remains visible above ground. Exact course of Roman road known as the Military Way has not been confirmed in this section. It is expected to be located parallel to Wall, 20m-30m to south of it. Track from Sandysike farm to Walton, which lies parallel to the Wall, may overlie course of the Military Way.	NY 51570 64066	Earthworks, inferred	Not listed in register
1010985	Castlesteads Roman fort and the vallum between the track to	Monument includes Roman fort and its associated remains at Castlesteads and section of vallum between track to east of	NY 51229 63431	Earthworks and buried features	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
	the east of Castlesteads fort and the Cam Beck in the west	Castlesteads and Cam Beck in west. Castlesteads fort, known to the Romans as `Camboglanna', is detached from Wall line, being located 350m to south of Wall. This is accounted for by strength of position fort occupies and also need for Wall line to take more gentle descent of gorge to cross Cam Beck. Fort is situated on a high bluff and was built here to command Cam Beck valley. Fort survives as a low platform with most of its remains surviving as buried features. Fort is now overlain by ornamental gardens. Stone fort measures about 114m square internally and encloses an area of at least 1.3ha. North west side of fort has been eroded by Cam Beck so that east and west gateways was now lie just 15m from lip of gorge. Large quantities of inscribed and sculptured stones have been found during landscaping and stone robbing, many of which are housed in summer house at west side of rose garden. These sculptured stones which are not included in the scheduling, include three altars dedicated to Persian god Mithras and ten dedicated to worship of official state gods. Bath house associated with fort lies to north east of fort platform in dense woodland (SM 26081). Remains of civil settlement, or vicus, which is usually associated with Roman forts, are not visible as upstanding features at Castlesteads. Remains of vicus will survive as buried features below ploughed field to south and east of Castlesteads. Vallum survives as a buried feature throughout this section with no remains visible above ground.			
1010986	Hadrian's Wall between the Cam Beck and Newtown Farm in wall miles 56 and 57	Monument includes section of Hadrian's Wall and its associated features between Cam Beck in east and Newtown Farm in west. Hadrian's Wall survives as a buried feature throughout this section with no remains visible above ground. Its course is indicated in this section by a broad swelling in field to south west of Cambeckhill farm and as occasional rises in hedgelines which cross its course. No surface trace at The Beck Farm or Heads Wood house. Wall ditch survives as an intermittent earthwork visible on ground. Where extant it averages 2m deep in east half of section and 1m deep in west half. Ditch upcast mound, usually referred to as the glacis, has been ploughed out in this section and only survives faintly visible in field south west of The Beck Farm. Exact location of milecastle 57 has not yet been confirmed	NY 50583 63497	Earthworks, inferred	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		as no upstanding remains surviving above ground. However, on basis of usual spacing it is expected to be located below farm at Cambeckhill. Turret 57a is situated about 180m south west of Dodgson's Beck. It survives as a buried feature with a slight swelling visible above ground, 0.15m high, in turf cover. Exact location of turret 57b has not yet been confirmed. However, on basis of usual spacing it is expected to be situated about 110m north east of Newtown Farm. Exact course of Roman road known as the Military Way has not been confirmed in this section. It is probably positioned parallel to Wall about 20m-30m south of it throughout section as there are no topographical constraints.			
1010987	The vallum between the field boundary south east of Heads Wood and the A6071 road in wall mile 57	Monument includes section of vallum between field boundary to south east of Heads Wood in east and A6071 road in west. Vallum survives as a buried feature throughout this short section with no upstanding remains visible above ground. However, vague traces of silted ditch are marked by slight depressions in hedgelines which cross its course.	NY 50292 62915	Earthworks	Not listed in register
1010988	Hadrian's Wall and vallum from A6071 to The Cottage in the case of the Wall, and to the road to Oldwall, for the vallum, in wall miles 57, 58 and 59	Monument includes section of Hadrian's Wall and vallum and their associated features between A6071 road in east to The Cottage at Oldwall in case of Wall and to road to Laversdale at Oldwall in west in case of vallum. Hadrian's Wall survives as a buried feature throughout this section with no upstanding remains. Occasional rises in hedge lines and field walls are only traces left on surface. A centurial stone was discovered in this section of Wall to south of Cumrenton. Another centurial stone is known to be incorporated into wall of Cumrenton farmhouse (not included in scheduling). Between Chapel Field and Oldwall, course of Wall is overlain by a hedge on top of an earth and stone bank, almost 2.5m wide. Wall ditch survives as an intermittent earthwork visible on ground throughout this section. In north east half of this section, ditch survives as a slight depression traceable on surface. Further to south west, ditch survives in better condition, averaging 1.6m-1.8m deep. Ditch upcast mound, usually referred to as the glacis, does not survive as a feature visible above ground in this section. Milecastle 58 is situated about 180m south west of Newtown on north side of a hedge which has traces of a platform below it and contains a large	NY 49074 61908	Earthworks, inferred	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		quantity of masonry. The milecastle's remains survive as buried features below the turf cover. Milecastle 59 is situated about 450m east of Oldwall on almost level ground. It survives as a buried feature with no remains visible above ground. Exact position of turret 58a has not yet been confirmed as there are no upstanding features visible above ground. However, on basis of usual spacing it is expected to be located about 300m east of Cumrenton. Exact position of turret 58b has not been confirmed in recent times. On basis of usual spacing, it is expected to be situated in field immediately north east of Chapel Field. Exact position of turret 59a has not yet been confirmed as there are no upstanding features visible above ground. On basis of usual spacing it is expected to be located immediately east of Oldwall. Exact course of Roman road known as the Military Way has not been confirmed in this section. It probably lies parallel to Wall line, but 20m-30m to south. Where Wall line changes course near Chapel Field the Wall and vallum run close together and it is likely that the Military Way occupies north mound of vallum. Vallum survives as a buried feature for most of its course in this section with few remains visible on ground. Ditch is visible as a depression enhanced by a modern drain to north east of Chapel Field. Around Chapel Field, ditch is visible as a slight depression, averaging 0.5m deep. Elsewhere its remains survive as buried features below the turf cover, with only visible traces being slight depressions and rises in hedgelines which cross its course.			
1010989	Hadrian's Wall between the road to Laversdale at Oldwall and Baron's Dike in wall miles 59 and 60	Monument includes section of Hadrian's Wall and its associated features between road to Laversdale at Oldwall in east and Baron's Dike in west. Wall survives as a buried feature throughout this section with no upstanding remains visible above ground, apart from a low scarp 0.2m high in area to north of Bleatarn. Wall ditch survives as an earthwork visible on ground throughout this section, between 1m and 1.6m deep with a modern drain occupying its base for most of its course. Ditch upcast mound, usually referred to as the glacis, does not survive as a feature visible on ground in this section. Exact location of milecastle 60 has not yet been confirmed. No features visible above ground. On basis of usual spacing, it is expected to be located about 450m	NY 47042 61357	Earthworks, inferred	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		north east of Bleatarn Farm on line of the Wall. Exact locations of turrets 59b, 60a and 60b have not yet been confirmed. No upstanding remains visible above ground. Course of Roman road known as the Military Way has not been confirmed in this section.			
1010990	The vallum between the road to Laversdale at Oldwall and Baron's Dike in wall miles 59 and 60	Monument includes section of vallum and its associated features between road to Laversdale at Oldwall in east and west side of Baron's Dike in west. Vallum survives as a buried feature throughout most of this section. Its course is recognisable on ground as slight depressions in fields and as distinct depressions in hedgelines which cross its course in eastern half of this section. East of Baron's Dike vallum survives as a slight earthwork visible as four parallel flat-topped mounds, 0.7m high. Elsewhere there are no surface traces of vallum.	NY 47083 61223	Earthworks	Not listed in register
1014582	Written Rock of Gelt: Roman quarry inscriptions	Monument includes Written Rock of Gelt, a group of nine Roman inscriptions, of which only six are now legible, cut into sandstone rock face of a Roman Quarry about 9m above river on north side of River Gelt. Quarry lies c.5.5km south of Hadrian's Wall and was used as a source of building material during repair work to wall in early years of third century AD. Reading from left to right, that is from west to east, first inscription is VEX LI EG II AVG OF APR SVB AGRICOLA OPTIONE. It is 1.6m long and is translated as 'A detachment of the Second Legion Augusta; the working face of Apr... under Agricola', the word OPTIONE indicates the rank of Agricola; each centurion had an 'optio', so called because he was originally nominated by the centurion. Above first letter of inscription there is a carved face which is slightly larger than lettering. It consists merely of an outline, two dots for the eyes, and a straight line for the mouth, and is clearly a representation of Agricola, the NCO in charge of the working party. About 0.3m beyond end of inscription just described is inscription APRO ET MAXIMO CONSVLIBVS OFICINA MERCATI. It covers an area measuring 1.02m by 0.23m and is translated as 'In the consulship of Aper and Maximus, the working face of Mercatius'. This inscription can be dated to AD 207 and states that that part of the quarry was the working face of Mercatius, the officer in charge. It is the earliest dated inscription from Cumbria concerned with the repair and rebuilding of the frontier system under Emperor	NY 52629 58735	Inscriptions in quarry face	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		Severus in early third century. Mercatius is mentioned again in the next inscription which lies 0.3m further to east. It measures 0.79m long and reads MERCATIUS FERNI. About 0.3m further to east the faint inscription N I S IIV III was recorded at some time before 1867 but this is now largely illegible. About 7.6m beyond the MERCATIUS FERNI inscription is the inscription EPPIVSM. It measures 0.61m long and is translated as the individual's name 'Eppius M'. A short distance below first inscription here described, faint inscription AVD was recorded at some time before 1867 but this also is now largely illegible. About 1.09m below second inscription here described is inscription IVLIN. Text is 0.46m long with deep cut letters 0.1m tall. It is translated as the individual's name 'Juli(a)nus'. About 0.46m below third inscription here described is inscription C IVL PECVLIARIS VEXILATIO LEG XX VV. It measures 0.61m long and is translated as 'The century of Julius Peculiaris; detachment of the Twentieth Legion Valeria Victrix'. The final inscription of this group, IX X, was recorded at some time before 1732 but is now largely illegible.			
1014586	Brampton Old Church Roman fort and the medieval Church of St Martin	Monument includes late first/early second century AD Roman fort at Brampton Old Church, and upstanding and buried remains of medieval Church of St Martin which is located within northern half of Roman fort. Fort is part of the Stanegate system, first Roman defensive system running across the Tyne-Solway route. It is located on a spur of ground which falls steeply to River Irthing on north and west sides. Fort is visible as a low rectangular platform measuring approximately 125m north-south by 118m east-west and would have held a military unit of 500 men. Local tradition states that a church dedicated to St Martin, teacher of late fourth century/early fifth century AD Scottish saint, Ninian, used abandoned Roman fort as a shelter. Earliest documentary evidence for church dates to 1169 when it is mentioned as a gift at dedication of Lanercost Priory. It was partly constructed of reused stone from Hadrian's Wall. A fortified tower was added to west end of the church during 14th century as defence during the Border Wars and this tower is depicted in a sketch made during a survey of Hawkhirst in 1753. After Dissolution of the Monasteries, church was granted initially to Dacre family in 1536 and then	NY 50983 61495	Earthworks, structural remains upstanding	Condition: Generally satisfactory but with significant localised problems. Principal Vunerability: Animal burrowing – moderate. Trend: Declining.

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		Howard family after 1569. Construction of a new chapel in Brampton town centre led to closure and part demolition of St Martin's old church in 1789. Tower and nave were demolished leaving only the chancel which was modified and continued in use as church. The old oval churchyard, whose eastern boundary still remains as present churchyard boundary, also continued in use and this was extended in 1861 and 1889. During these extensions a number of discoveries were made including Roman foundations and amphorae. In 1861 chancel was extended at its eastern end and a porch added at its western end. During 1960s churchyard was closed and in 1978 church was declared redundant. In early 1980s consolidation work was undertaken on church. Prior to this work a survey of the graveyard gave an idea of the size of medieval church prior to demolition.			
1010610	Watchclose Roman temporary camp	Monument includes Roman temporary camp known as Watchclose. Survives as a series of features, including ditches, buried below modern ground surface and is clearly recognisable on aerial photographs. The camp lies 275m south of Stanegate Roman road and 1.3km south of line of Hadrian's Wall. Site is now within boundaries of Carlisle airport, and occupies part of a level plateau with sloping ground to north and south east. Horsley visited site in early 18th century and described earthworks as `very fair and visible'. Above ground remains had been levelled by 1833 due to cultivation. North west half of camp is overlain by south west end of main runway of airport. Plan of camp as revealed by excavations in 1935 by Richmond and Hodgson has been confirmed by crop marks seen on aerial photographs. Excavation revealed ditch to be 2.4m wide and 0.9m deep, enclosing an area of 0.5ha. None of the sides appeared exactly parallel, the west one bowing outwards and changing its alignment at the gateway. Gateways exist at central points of north, east and west sides and were all protected by external defence banks.		Cropmarks	Not listed in register
1007158	The Stangate at Crosby Lodge	Monument includes remains of a 230m long section of Roman road, situated on level ground. The road was discovered during an excavation in 1935. It measures 6.4m in width and includes a slight cambered embankment, or agger, flanked by two ditches.	NY 45350 59684	Excavation	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		The monument lies within the Hadrian's Wall World Heritage Site.			
1010957	Moss Side 1 and 2 Roman temporary camps	Monument includes Roman temporary camps known as Moss Side 1 and 2 which lie to east of Sandy Lane, 400m south of Hadrian's Wall vallum and 300m north of the Stanegate Roman road. Camp 1, the smaller of two camps, is mostly contained within area of camp 2. They survive as a series of buried features, including defence ditches, clearly visible on aerial photographs as crop marks. Camps occupy flat top of an elevated plateau which affords uninterrupted views in all directions. Ground falls away gently on north, south and west sides. Camp 1, is a parallelogram in plan, measuring about 114m east to west and 86m north to south, enclosing an area of slightly less than 1ha. Centrally placed gateways in east and west sides, each guarded by external defences opposite them. Camp 2, is rectangular measuring 210m north to south by 187m east to west, enclosing an area of about 3.9ha, excluding its annexe. Opposing gateways interrupt east and west ditches at their centres, while opposing gateways in north and south sides at their east ends. Immediately north of camp 2 is a rectangular enclosure, probably an annexe of camp, enclosing an area of about 1.2ha. West ditch here appears to be a continuation of west ditch of camp 2. Position of east side of annexe was clearly intended to avoid northern gateway of main camp implying that annexe was contemporary with camp. Possible gateways were traced in middle of east and west sides.	NY 45677 60337	Cropmarks	Not listed in register
1017942	Hadrian's Wall between the M6 motorway and the property boundaries to the east of Houghton Road in wall mile 64	Monument includes section of Hadrian's Wall and its associated features between west side of M6 motorway in east and property boundaries to east of Houghton Road in west. Hadrian's Wall survives as a buried feature throughout this section with no remains visible above ground. Course of Wall has been confirmed by observations by Simpson in 1941 and subsequent excavations in 1961 by Colonel Fane Gladwin. Hadrian's Wall in this section was initially built of turf before it was rebuilt in stone in second half of second century AD, and 1961 excavations recorded remains of turf surviving below remains of the stone wall. Milecastle 64 was located in 1962 during excavations by Fane Gladwin, 104m west of Brunstock Beck. It was of short axis type, being wider east-west than north-south, and measured internally 17.83m across	NY 41590 58635	Inferred, excavations	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		east-west and 14.63m north-south. Its walls were found to have been extensively robbed but part of the north wall survived as far as first course of facing stones. North gateway, which was 3m wide, had been blocked at some stage. Remains of Milecastle 64 survive below turf cover as buried remains. Precise location of turret 64a has not yet been confirmed but its remains are expected, on basis of usual spacing, to survive approximately 150m west of Centurion's Walk, where Wall changes direction. Course of Roman road, known as the Military Way, has not yet been confirmed in this section. However, a cobbled road at least 9m wide was found in excavations of 1961 by Fane Gladwin to rear of Wall which was thought to be medieval in date, but which may have been utilising line of the Military Way. Remains of the Military Way are expected to survive below turf cover as buried remains.			
1017943	Hadrian's Wall vallum between the M6 motorway and Drawdykes Castle in wall mile 64	Monument includes short section of vallum between west side of M6 motorway in east and Drawdykes Castle in west. Course of vallum is known in this section from visible sections to east and west, although throughout this section it survives entirely as buried remains below turf with no indications visible on ground.	NY 41939 58608	Inferred	Not listed in register
1017944	Hadrian's Wall vallum between Drawdykes Castle and Whiteclosegate in wall mile 64	Monument includes section of Hadrian's Wall vallum between Drawdykes Castle in east and Whiteclosegate in west. Vallum is visible as an earthwork throughout this section, although profile of vallum has been reduced by cultivation in past especially towards western end. Ditch is visible as a broad linear depression up to 9m wide and 1m deep. Vallum banks have been reduced and dispersed by past ploughing and are faintly visible above ground as broad swellings either side of vallum ditch. Mounds survive mainly as buried features.	NY 41568 58297	Earthworks	Not listed in register
1017945	Hadrian's Wall between Houghton Road and Tarraby in wall mile 64	Monument includes section of Hadrian's Wall and its associated features between eastern side of Houghton Road in east and Tarraby hamlet in west. Hadrian's Wall survives as a buried feature throughout this section. Line of wall ditch is visible for most of its length as a linear depression approximately 1m deep. A green lane runs along centre of ditch in western part of this section. Course of Wall itself runs on north edge of fields which	NY 41125 58246	Inferred, earthworks, excavation	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		have been subjected to ploughing in past, which has removed any traces of Wall on ground and it survives only as a buried feature. Precise location of turret 64a has not yet been confirmed, but on basis of usual spacing it is anticipated that its remains will survive as a buried feature approximately 100m east of road from Whiteclosegate to Tarraby. Course of Roman road known as the Military Way has not yet been confirmed in this section, but it is likely that it ran parallel to Wall close to its south face. A metalled road in use in medieval period which may have been using line of the Military Way was found close to south side of Wall further west in excavations between Tarraby and Knowefield by Smith in 1976.			
1017946	Hadrian's Wall between Tarraby and Beech Grove, Knowefield in wall miles 64 and 65	Monument includes section of Hadrian's Wall and its associated features between west side of Tarraby in east and west edge of Beech Grove, Knowefield in west. From high point at Tarraby, line of Wall runs downhill across open fields as far as east end of Tarraby Lane. From here Tarraby Lane follows line of Wall westwards as far as crest of Wall Knowe, where Tarraby Lane veers to south while line of Wall continues in a straight line to where it is crossed by Beech Grove. Hadrian's Wall survives throughout this length solely as buried remains with no visible remains of Wall itself above ground. Ditch to north of Wall is however visible as a broad shallow depression up to 10m wide and 0.3m deep. Remains of Wall and ditch were confirmed to survive as buried remains by excavations carried out by Smith in 1976. Up to two courses of foundations of Wall together with core were found to survive. There were no remains however of preceding Turf Wall apart from dispersed turf traces south of Wall. 1976 excavations revealed pre-Roman cultivation at Wall Knowe, which was shown by a grid of drainage ditches, one of which had been infilled where Wall crossed it. Position of Milecastle 65 has been confirmed by geophysical survey followed by a trial excavation at its south west corner in 1976 by Smith and Austen. It is situated on westward-facing slope 150m west of Tarraby. At least two courses of foundations were found to survive in situ, and geophysical survey indicated that internal floor or road cobbling survives as buried remains. In plan	NY 40651 57738	Inferred, earthworks, excavations	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		milecastle appears to be of `short axis' type, where its length north-south is shorter than its width east-west. No upstanding remains of milecastle above ground and it survives wholly as a buried feature. Roman altar dedicated to native god Cocidius who was equated with Roman god of war, Mars, was found in 1804 when a drain was cut across line of Wall 50m east of Milecastle 65, and is now in Tullie House Museum. Precise location of turret 65a has not yet been confirmed but on basis of usual spacing it is anticipated it will survive as a buried feature near crest of Wall Knowe, 250m east of Beech Grove. Course of Roman road, known as the Military Way has not been confirmed in this section. However, a metalled road up to 10m wide was identified in excavations by Smith in 1976 south of and close to line of Wall. Road was in use in medieval period and is shown on a map of 1610, but it may have followed line of the Roman Military Way, spreading with continued use. This road survives as buried remains. A dump of clay up to 0.6m deep, laid over an earlier ground surface and sealing plough marks and a military ditch, extending across dip in land immediately east of fort at Stanwix has been interpreted as the parade ground of the fort. Parade ground, which was discovered during excavations in 1992 and 1993 by Carlisle Archaeological Unit, had a cobbled surface. Feature survives below turf cover as buried remains except for small area removed in 1992 excavations.			
1017947	Hadrian's Wall vallum between the boundaries north of the properties on Whiteclosegate and the field boundary west of Wall Knowe in wall miles 64 and 65	Monument includes section of vallum between boundaries north of properties on Whiteclosegate in east and field boundary west of Wall Knowe in west. Vallum in this length runs through open fields on south side of Wall Knowe, approximately 160m south of Hadrian's Wall. Line of vallum ditch is visible in eastern part of this section as a broad depression 10m wide and 0.5m deep. Vallum's banks have been reduced and dispersed by cultivation in past and survive as buried remains.	NY 40837 57676	Earthworks	Not listed in register
1017948	Hadrian's Wall and vallum between the field boundary west of Wall Knowe and Scotland Road including the Roman fort at Stanwix in wall mile 65	Monument includes section of Hadrian's Wall and associated features including a significant area of site of Roman fort at Stanwix, and vallum between field boundary west of Wall Knowe in east and the east side of Scotland Road in the west. Wall, vallum and fort at Stanwix are situated on crest of a ridge on north	NY 40298 57034	Inferred, excavations	Not listed in register

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		side of River Eden, with extensive views to south across city of Carlisle towards northern Pennines, Eden valley, and Lake District fells, and also with views to north for up to 5km. Hadrian's Wall survives as a buried feature throughout this section with no indications of Wall or wall ditch visible on ground. Wall in this section was initially built in turf, and later converted into a stone wall, possibly in second half of second century AD. Precise location of turret 65b has not yet been confirmed but on grounds of usual spacing it is likely to have been replaced by fort at Stanwix when latter was constructed. It would have been constructed at same time as Turf Wall and would have been identical in form to other Turf Wall turrets as a square tower the same width (6m) as Turf Wall. It has not yet been confirmed whether turret 65b was replaced by fort before or after replacement of Turf Wall by Stone Wall. Roman fort on Wall at Stanwix is known from excavations which have established extent of its defences. It is thought the fort faced east, with its long axis parallel to Hadrian's Wall. Its measurements until recently were considered to be 176m north-south by 213m east-west, arising from evidence of excavations by Simpson in 1932 and Simpson and Richmond in 1940. Excavations in 1984 by Carlisle Archaeological Unit discovered a previously unknown north fort wall and interval tower 18m north of wall found by Simpson, which suggests that fort was at some time enlarged northwards, giving an overall north-south dimension of 194m. This would have made it the largest fort on Hadrian's Wall extending over an area of 3.96ha. Details of internal layout are only partly known. Excavations in 1932 by Simpson revealed buildings parallel to fort's north wall although their function is unknown, and excavations in 1940 by Simpson and Richmond revealed part of a granary and a further unknown building. All remains of fort survive only as buried features with no remains visible on ground surface. A clay feature, interpreted as parade ground attached to fort, has been identified in excavations by Carlisle Archaeological Unit in 1991 and 1992 in land east of fort in grounds of Cumbria College of Art. It consisted of a dump of clay up to 0.6m deep with a metalled surface. Full extent of parade ground has not yet been defined. Parade ground is not visible on ground surface and			

List Entry	Name	Description	NGR (where provided)	Survival	Heritage at Risk
		survives wholly as a buried feature. Full extent of civil settlement, known as a vicus, belonging to fort at Stanwix has not yet been confirmed, but it is known from excavations to have extended both to east and west of fort. No remains visible above ground and it survives entirely as buried remains. It is possible that civil settlement may have extended further towards Carlisle although this has not yet been confirmed. It is unlikely that area south of fort below steep river cliff was occupied because of flood plain of river. Cemetery belonging to fort lay east of the fort and is known from chance discovery of cremation urns in Croft Road in 1872 and again from construction of houses in Croft Road in 1936. Full extent of cemetery has not yet been confirmed. Two tombstones originating from cemetery at Stanwix have been recovered, one of Marcus Troianus Augustus and other of a cavalryman. Course of road, known as the Military Way, has not been confirmed in this section. However, a metalled road up to 10m wide was identified in excavations by Smith in 1976, in adjoining scheduling to east. The deviation of Tarraby Lane from line of Wall west of Wall Knowe to run straight towards probable position of east gate of fort would suggest that it follows line of the Military Way. Line of road on west side of fort has not yet been identified. Military Way is not visible on ground and it survives as a buried feature. Course of vallum is known at either end of monument from excavations. Vallum was located by excavation 100m east of Dykes Terrace by Simpson in 1932, and again immediately west of Dykes Terrace in excavations by English Heritage Central Excavation Unit under Smith in 1976. Excavation in Rickerby Park by Simpson in 1934 has confirmed course of vallum west of fort, including turn of ditch towards Hadrian's Wall before it descends Stanwix Bank towards river. Course of vallum was unsuccessfully sought south of fort in excavations by Simpson in 1933 and 1934, when a ditch that was found and initially thought to be vallum ditch turned out to be south ditch of fort. Course of vallum south of fort has not yet been confirmed although it is possible that erosion of steep cliff above river flood plain may have resulted in loss of some of vallum south of fort.			

Appendix E: Figures

Figure 1: Proposed Development

N

Langholm
Lochmaben
Lockerbie
Annan
Longtown
Brampton
Haltwhistle
Carlisle
Silloth
Wigton
Aspatria
Alston
A74(M)
A75
A595
A596
A689
A69
M6
A7

0 5 10 15 KM

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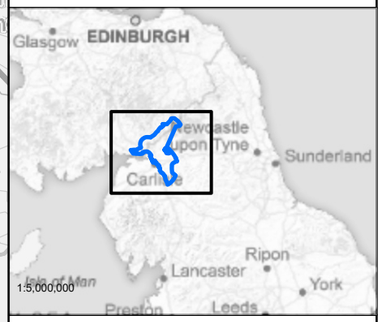
CMN3 LEGEND



Legend
- Study Area OHL
- Harker Substation

Rev	Date	Description	GIS	Chk	App
A	30/06/2025	First Issue	HW	CC	JS

nationalgrid

Purpose: WHSCA					
Scheme: CMN3					
Document Title: FIGURE 1 PROPOSED DEVELOPMENT					
Creator: HW	Date: 30/06/2025	Checker: CC	Date: 30/06/2025	Approver: JS	Date: 30/06/2025
Document Type: FIGURE	Scale: 1:240,000	Format: A3	Sheets: OF		Rev: A

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Figure 2: Proposed Development Study Area

N

Lochmaben
Lockerbie
Langholm
Longtown
Annan
Carlisle
Brampton
Haltwhistle
Alston
Silloth
Wigton
Aspatria

CMN3 LEGEND

Legend

- Study Area OHL
- Harker Substation
- Railway Station
- Railway Line
- Overhead Line
- Road
- Airport

World Heritage Site

- Frontiers of the Roman Empire (Hadrian's Wall) - Core Area
- Frontiers of the Roman Empire (Hadrian's Wall) - Buffer Zone

Rev	Date	Description	GIS	Chk	App
A	30/06/2025	First Issue	HW	CC	JS

nationalgrid

Purpose:	WHSCA
Scheme:	CMN3
Document Title:	FIGURE 2 PROPOSED DEVELOPMENT STUDY AREA, WORLD HERITAGE SITE AND EXISTING INFRASTRUCTURE

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HW	30/06/2025	CC	30/06/2025	JS	30/06/2025

Document Type:	Scale:	Format:	Sheets:	Rev:
FIGURE	1:240,000	A3	OF	A

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Figure 3: Proposed Development WHSCA Study Area

N

Langholm
Lochmaben
Lockerbie
Annan
Longtown
Brampton
Carlisle
Haltwhistle
Alston
Silloth
Wigton
Aspatria
Northum
Nation

A74(M)
A75
A7
A69
A689
M6
A595
A596

CMN3 LEGEND

Legend

- Study Area OHL
- Harker Substation

World Heritage Site

- Frontiers of the Roman Empire (Hadrian's Wall) - Core Area
- Frontiers of the Roman Empire (Hadrian's Wall) - Buffer Zone
- World Heritage Site - 3km Buffer

0 5 10 15 KM

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Purpose:	WHSCA
Scheme:	CMN3
Document Title:	FIGURE 3 PROPOSED DEVELOPMENT WHSCA STUDY AREA

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HW	30/06/2025	CC	30/06/2025	JS	30/06/2025

Document Type:	Scale:	Format:	Sheets:	Rev:
FIGURE	1:240,000	A3	OF	A

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Figure 4: Hadrian's Wall – Scheduled Monuments

N

Longtown

Annan

Carlisle

Wigton

Brampton

A74(M)

A75

A6071

A7

A689

A69

M6

A6

A596

A595

SM1010984
SM1010983
SM1010985
SM1010986
SM1010987
SM1010988
SM1010957
SM1010990
SM1010979
SM1010980
SM1010989
SM1017942
SM1017945
SM1007158
SM1017943
SM1010610
SM1017946
SM1017944
SM1017947
SM1008635
SM1010982
SM1014585
SM1014586
SM1014583

0 5 10 KM

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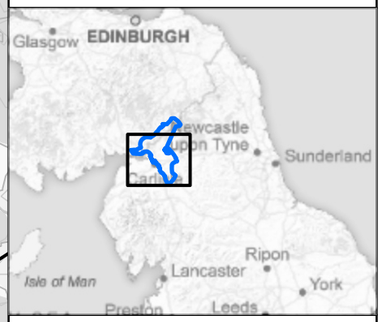

Legend

- Study Area OHL
- Harker Substation

World Heritage Site

- Frontiers of the Roman Empire (Hadrian's Wall) - Core Area
- Frontiers of the Roman Empire (Hadrian's Wall) - Buffer Zone
- World Heritage Site - 3km Buffer

Rev	Date	Description	GIS	Chk	App
A	01/07/2025	First Issue	HW	CC	JS

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Purpose:	WHSCA
Scheme:	CMN3
Document Title:	FIGURE 4 WHS HADRIAN'S WALL SCHEDULED MONUMENTS

Creator:	Date:	Checker:	Date:	Approver:	Date:
HW	01/07/2025	CC	01/07/2025	JS	01/07/2025

Document Type:	Scale:	Format:	Sheets:	Rev:
FIGURE	1:150,000	A3	OF	A

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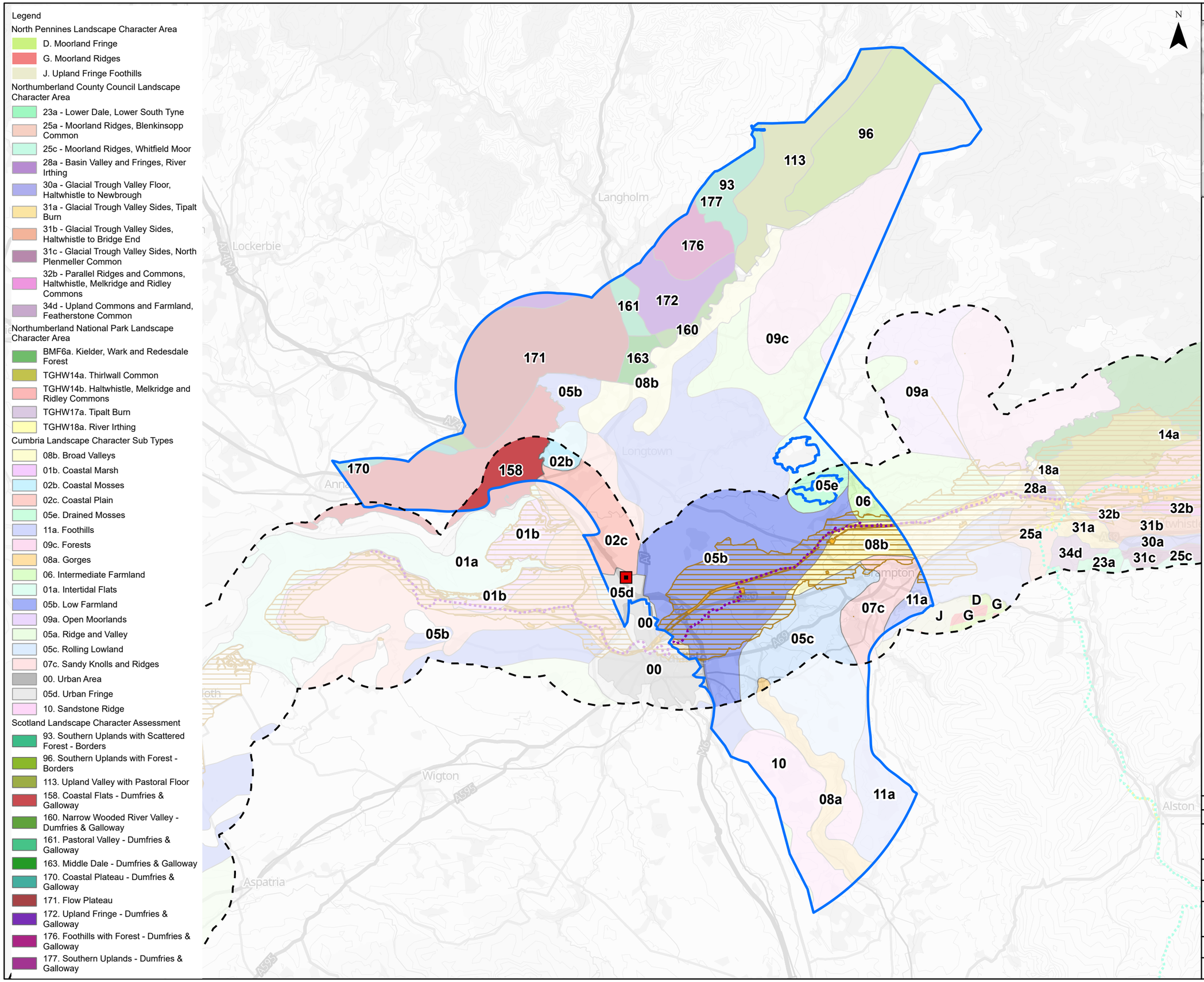
Figure 5: Landscape and visual character areas



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Purpose:	WHSCA
Scheme:	CMN3
Document Title:	FIGURE 5 LANDSCAPE AND VISUAL CHARACTER AREAS

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HW	04/07/2025	CC	04/07/2025	JS	04/07/2025

Document Type:	Scale:	Format:	Sheets:	Rev:
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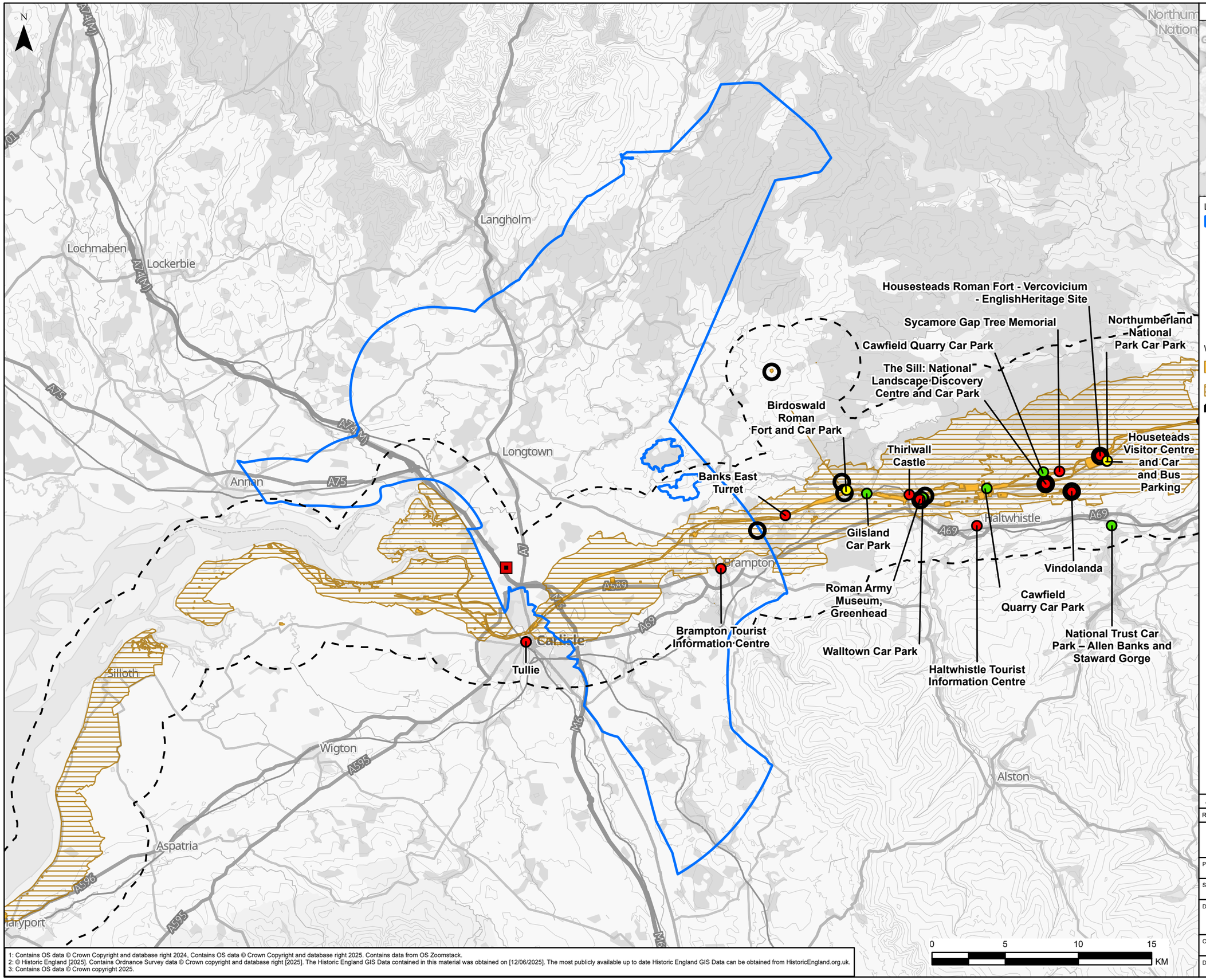
Figure 6: Key viewpoints and tourist attractions



CMN3 LEGEND

Legend

- Study Area OHL
- Harker Substation
- Interpretation Framework Point (Identified within Hadrian's Wall Interpretation Framework)
- Museum, Visitor Centre and Other Attraction
- Museum, Visitor Centre, Other Attraction and Car Park
- Car Park

World Heritage Site

- Frontiers of the Roman Empire (Hadrian's Wall) - Core Area
- Frontiers of the Roman Empire (Hadrian's Wall) - Buffer Zone
- World Heritage Site - 3km Buffer

Rev	Date	Description	GIS	Chk	App
A	30/06/2025	First Issue	HW	CC	JS

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Purpose:	WHSCA
Scheme:	CMN3
Document Title:	FIGURE 6 KEY VIEWPOINTS AND TOURIST ATTRACTIONS

Creator:	Date:	Checker:	Date:	Approver:	Date:
HW	30/06/2025	CC	30/06/2025	JS	30/06/2025

Document Type:	Scale:	Format:	Sheets:	Rev:
FIGURE	1:240,000	A3	OF	A

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Figure 7: Proposed Development Capacity Assessment Results

N

Langholm
Lochmaben
Lockerbie
Annan
Longtown
Wigton
Aspatria
Silloth
Haltwhistle
Alston
Ripon
Lancaster
York
Leeds
Preston
Isle of Man
Glasgow
EDINBURGH
Sunderland

A74(M)
A75
A595
A596
A69
M6

1
2
3
4
5
6

CMN3 LEGEND

Legend
- Study Area OHL
- Harker Substation

World Heritage Site
- Frontiers of the Roman Empire (Hadrian's Wall) - Core Area
- Frontiers of the Roman Empire (Hadrian's Wall) - Buffer Zone
- World Heritage Site - 3km Buffer

WHSCA Potential
- Red
- Amber
- Green

0 5 10 15 KM

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A	30/06/2025	First Issue	HW	CC	JS

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Purpose:	WHSCA
Scheme:	CMN3
Document Title:	FIGURE 7 PROPOSED DEVELOPMENT CAPACITY ASSESSMENT RESULTS

Creator:	Date:	Checker:	Date:	Approver:	Date:
HW	30/06/2025	CC	30/06/2025	JS	30/06/2025

Document Type:	Scale:	Format:	Sheets:	Rev:
FIGURE	1:240,000	A3	OF	A

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Appendix F: Contemporary Landscape Character Baseline

The table below provides an analysis of the contemporary landscape character derived from the following published Landscape Character Assessments across the study area:

- Cumbria Landscape Character Guidance and Toolkit (2011)
- North Pennies Area of Outstanding Natural Beauty Management Plan 2019-24

The Landscape Character Areas of relevance to the study area are included and should be read in conjunction with Figure 5. Key landscape and visual characteristics are identified for each Landscape Character Area, along with focal points from Hadrian's Wall Interpretation Framework[14] . Focal points have been identified which fall within the study area and which have a specific relationship with the WHS. Observations from fieldwork have also been added where relevant.

[14] 5.-HWIF_The-natural-and-cultural-landscape-of-Hadrians-Wall-Appendices.pdf

Banks to Solway Firth

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
Sub type 8b Broad Valleys *Cumbria Landscape Character Guidance and Toolkit* Within WHS and WHS buffer zone	Wide and deep valleys with open floodplains Rural farmland comprising significant areas of improved pasture Pockets of scrub, woodland and coniferous plantations Hedges and stone walls form a matrix of field boundaries Roads and railway lines often follow the linear valley contours The broad valleys of the area have been popular locations for artists. The Lune Valley and the upper Lune Valley in Ravenstone dale were painted by J.M W. Turner, Norman Adams, and David Morris. The Eden Valley is the location for one of Andy Goldsworthy's sheepfold sculpture walks. These landscapes are generally medium in scale with a lot of variety along the length of the valleys. The narrow enclosed wooded sections can feel remote and wild due to the lack of development and speed and character Low level views are often intimate, contained by the valley sides and woodland. More expansive views are possible from the top of some valley sides towards the Scottish hills, Lakeland fells and the North Pennines.	In Irthing Valley Hadrian's Wall and forts such as Birdoswold form the most significant archaeological components. The Wall and associated earthworks follow a prominent ridge running along the northern rim.	Low level views are often intimate, contained by the valley sides and woodland. More expansive views are possible from the top of some valley sides towards the Scottish hills, Lakeland fells and the North Pennines.	Within WHS Birdoswald Roman Fort (Interpretation Framework point): Views from this location are focused on LCA 8b Broad Valleys and LCA 6 Intermediate Farmland, with longer distance views towards LCA 9a Open Moorlands and LCA 9c Forests to the north. To the south, views are more contained due to intervening landform and vegetation in this location. Banks East Turret: Open views to the south are available across the broad valley, towards LCA 11a Foothills and the North Pennines National Landscape in the distance. Views to the north are contained by intervening landform and vegetation in this location. Within WHS buffer zone Lanercost Priory (Interpretation Framework point): Located within an enclosed valley landform with intervening vegetation, which means there does not appear to be a strong visual connection to other LCAs or the World Heritage Site.

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
	of the river and hanging woodlands. Close to large towns and roads there is a busier feeling but the rural qualities still dominate. The remoteness and wildness associated with the rivers, and the sense of calm associated with the more open farmland, are sensitive to changes in land management. Woodlands, orchards and the matrix of hedges and hedgerow trees and open meandering undeveloped river plains are sensitive to changes in land management.			
Sub type 6 Intermediate Farmland *Cumbria Landscape Character Guidance and Toolkit* Partly within WHS buffer zone (southern part) and partly within 3km study area	Transitional farmland between the lowland and upland landscapes Extensive areas of improved pasture with some arable farming Planned villages with greens displaying topographical and archaeological evidence of their medieval origins In parts the landscape is dissected by the deeply incised or open river valleys Wooded valleys and ghylls Sandstone and limestone vernacular Higher parts are open and rolling with wide views, stone walls and few hedges. At lower levels land becomes more undulating and enclosed with a regular pattern of hedges and hedgerow trees. Blocks of woodland reinforce the	N/A	Hedges, trees and the undulating nature of the land can limit views and provide a more intimate feel to the landscape. Where land rises and opens out, there are extensive views to the Lakeland Fells and North Pennines, giving a more open and exposed feel linked to the dramatic backdrop.	Within WHS buffer Slackhouse Farm (Interpretation Framework point): Views to the south towards the World Heritage Site within LCA 8b Broad Valleys. LCA 11a Foothills and the North Pennines National Landscape is visible in the distance. Long distance views are also available to the north towards LCA 9c Forests.

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
	regular field patterns and are complemented by wooded ghylls and stream and river banks. Lightly settled with small nucleated villages and dispersed farms. M6 motorway and railway line provide modern linear features running through the Eden and the telecommunications masts at Skelton form a distinctive vertical feature and modern landmark. A large scale mainly open working farmed landscape. The woodland, valleys, farmland and strong but varied vernacular give interest to the general rural character. The intersecting open valleys and deeply incised rivers are sensitive to valley side development.			
Sub type 11a, Foothills *Cumbria Landscape Character Guidance and Toolkit* Northern part of the LCA within the WHS buffer zone and southern part within 3km study area	Rolling, hilly or plateau farmland and moorland Occasional rocky outcrops Hills are dissected by numerous streams and minor river valleys Areas of improved grassland, unimproved heathland and extensive conifer plantations Semi natural woodland in the small valleys Large areas of farmland are bounded by stone walls and hedges	*N/A*	At lower levels the feeling is more intimate due to the topography and woodland cover containing views in some places. On higher land open views to the surrounding fells and sea give an expansive feeling to the area. In some cases the views open across valleys where farmland and towns, such as Kendal and Appleby, are framed in the landscape.	N/A

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
	Villages, hamlets and farms are often discrete features, concealed by the rolling topography sited along the base of slopes following the grain of the land. Lines of pylons, the A66 and the M6, large scale modern agricultural buildings, quarrying, spoil heaps and coniferous plantations form large scale man made features in some parts of the landscape. These can detract from the overall character of the landscape. Upstanding archaeological remains are widespread and include prehistoric stone circles and cairns, medieval shielings and droveways, remnants of late medieval deer parks and the prolific remains of past industries. The landscape is transitional and is often seen against a backdrop of the larger fells and pikes of the Lake District and North Pennines. The contrast in scale with Pennine Scarps and Lakeland Fells and more intimate farms and woodland are sensitive to large scale infrastructure development.			
Sub type 7c Sandy Knolls and Ridges *Cumbria Landscape Character Guidance*	Regular knolls and ridges The land cover is generally pasture Field patterns are irregular Significant amounts of woodland cover	N/A	· Most views are framed by woodland or topography.	N/A

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
and Toolkit Predominantly within the 3km study area with a small part of the northern part of the LCA within the WHS buffer zone	in the form of hanging woods, coniferous plantations and semi natural woods Fields are usually bounded by hedges, with hedgerow trees. This is a pleasant farmed landscape. It is a generally small to medium scale, enclosed landscape which opens out on the edges. The combination of knolls and ridges with mature woodland and pasture creates an enclosed parkland like appearance. Semi natural woodlands, hanging woodlands and parkland are sensitive to changes in land management.			
Sub type 5c Rolling Lowland *Cumbria Landscape Character Guidance and Toolkit* Predominantly within the 3km study area with a small part of the northern part of the LCA within the WHS buffer zone	Open undulating and rolling topography Lowland agricultural landscape dominated by pasture Hedges and hedgerows trees are common on lower ground and sparse on higher ground Some scrub woodland In lower lying area the landscape is generally undulating and fields bounded by a strong matrix of hedgerows and hedgerow trees. On higher ground land is more rolling and open and the topography is the distinctive characteristic.	N/A	Views are limited by undulating topography.	N/A

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
	Villages are generally nucleated and some retain a strong vernacular. In parts quarrying, sand extraction and waste landfill sites inject a developed and industrial character. This is a typical working farmed landscape punctuated by quarrying activities Rolling, open and undeveloped higher ground is sensitive to tall infrastructure or large scale development. Tranquillity is greatest along rivers and is sensitive to development or farming intensification.			
Sub type 5e Drained Mosses *Cumbria Landscape Character Guidance and Toolkit* Within the 3km study area	Mainly flat open landscape Extensive areas of lowland raised bog Distinctive geometric field patterns Low ridges with linear woodland planting Mossy fields, sparse hedges and relict woodlands Areas of peat extraction This is a peaceful landscape with a feeling of remoteness due to the lack of settlement. The relict woodlands, raised mire, bog and fen areas are sensitive ecological areas that could be affected by changes to drainage and other land management.	N/A	There are open views, particularly southwards from the low ridges.	N/A

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
	The lack of settlements and openness of the mosses provides a sense of remoteness and tranquility that is sensitive to land management changes and medium to large scale development.			
Sub type 8a Gorges *Cumbria Landscape Character Guidance and Toolkit* Within the 3km study area	A deep linear sandstone gorge Fast flowing river with waterfalls Outcrops of steep rocky cliffs Hanging woodlands cling to the gorge sides Large concentrations of ancient semi-natural birch woodland and occasional coniferous Large concentrations of ancient semi-natural birch woodland and occasional coniferous. The landscape is picturesque and can feel wild, natural and invigorating with its steep sides, heavily lined by swathes of woodland, looming over the fast flowing river in the gorge bottom.	N/A	Impressive views into the gorge from adjacent high ground Views along the gorge are enclosed and snake along the rivers course.	N/A
Sub type 5b Low Farmland *Cumbria Landscape Character Guidance and Toolkit* Within the 3km study area and the central	Undulating and rolling topography Intensely farmed agricultural pasture dominates Patchy areas of woodland provide contrast to the pasture Woodland is uncommon west towards the coast Fields are large and rectangular	Other archaeological and historical interest in the landscape includes Hadrian's Wall. Hadrian's Wall and associated Romano British settlements	The open and uninterrupted views to the Solway Firth and Lakeland Fells are sensitive to tall infrastructure development	N/A

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
part of the LCA is within WHS and WHS buffer zone	Hedges, hedgerow trees and fences bound fields and criss-cross up and over the rolling landscape Pylons and telegraph poles are generally subtle elements, but pylons can sometimes dominate, especially where there is more than one line of them. The matrix of interlocking hedges, woodlands, trees along rivers and fields and wind sculpted trees in hedges in coastal areas are sensitive to changes in land management.	are sensitive to infrastructure and other development.		
Sub type 2c Coastal Plain *Cumbria Landscape Character Guidance and Toolkit* Within the 3km study area and the central part of the LCA is within WHS and WHS buffer zone	Flat and slightly undulating coastal plain Long and narrow fields in undulating areas with larger fields in flat areas Intersected by shallow rivers and watercourses Hedges form main field boundaries Scarce tree cover Predominantly pasture with some arable in drier areas Historic field pattern strongly linked to settlements Coastal villages tend to be vernacular in character and nucleated and closely knit with stone walls for shelter. They are usually the most prominent feature on the skyline. Telecommunications masts and pylons	World Heritage Site is a significant archaeological feature in the Solway The most significant archaeological feature is Hadrian's Wall, which, west of Carlisle, runs through the Solway Plain.	Open, flat, larger scale landscapes with big expansive skies and long views of the sea and Lakeland and Scottish Fells contrast with undulating enclosed and intimate landscapes. The open views across adjacent marshes and flats out to sea and inland to the Lakeland Fells are sensitive to large scale infrastructure development.	N/A

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	**Specific reference to the WHS within published study**	**Visual characteristics within published study**	**WHS focal points within the character area and visual characteristic observations informed by fieldwork**
	provide prominent and contrasting vertical features in some of the areas. All areas have the appearance of peaceful backwaters relatively unspoilt by 20th century development. The open character of the exposed coastal farmland is sensitive to development.			
Sub type 2b Coastal Mosses *Cumbria Landscape Character Guidance and Toolkit* Within the 3km study area	Lowland raised mosses A mosaic of heath, Willow Carr, Birch scrub woodland and pasture High ecological value Field shapes vary, bounded by hedges and fences Some woodland around the Duddon Estuary Picturesque backdrop of the Lakeland Fells/open flat panoramic views Distinct raised edges Sense of remoteness and tranquility The open remnant patches of moss provide a rich note of interest in surrounding agricultural landscapes. The sense of remoteness and naturalness, the rich habitats and presence of birds, and the flat dark and open areas that contrast with green farmland, large skies and seaward views could be sensitive to significant changes in land management and	N/A	The small, yet open and undeveloped nature of the mosses contributes to broader seascape views across the Solway Firth and along the Duddon Estuary. The Duddon Mosses have the benefit of the backdrop of the Lakeland Fells and uninterrupted views along the Duddon Estuary. In the Solway views tend to be limited and discrete, and the remaining uninterrupted views to the sea are important to the sense of remoteness associated with these landscapes.	N/A

Character Area	Landscape Characteristics		Visual Characteristics	
	Landscape characteristics within published study	Specific reference to the WHS within published study	Visual characteristics within published study	WHS focal points within the character area and visual characteristic observations informed by fieldwork
	large scale infrastructure development.			

Appendix G: Site Photographs

The photographs below are included to a general view of the landscape, as well as the WHS within the Study Area.

Photograph 1: General views north across the WHS buffer towards the WHS from the northern limits of Aglionby. The WHS lies beyond the operations OHL visible in the distance

Photograph 2: Views east from the Wall to the east of Turret 5A. The earthwork bank on which the field boundary to the left stands is potentially a spread of material from the Wall. The area of Milecastle 54 is located wihtin the pasture corridor to the left of the woodland in the distance

Photograph 3: View east along the Wall to the west of Turret 54A. Note the earthwork to the left of the flag path is a later feature and not part of Hadrian's Wall WHS.

Photograph 4: General view east along the Hadrian's Wall Path in the area of The Beck Farm to the east of Turret 57A. The line of the Wall ditch can be seen as a shallow waterlogged depression in the distance near Cambeckhill Farm.

Photograph 5: View south towards the Vallum from the Wall west of Heads Wood Farm, with the high ground of the North Pennines visible on the horizon.

Photograph 6: Brampton Old Church Roman Fort, with the medieval chapel and associated cemetery located in the northeast corner of the Roman fort.

Photograph 7: View northwest towards the Wall from the junction of Carlisle Road and the A689 west of Brampton from the southern limit of the WHS buffer. The Wall is located approximately 2.5km to the northwest beyond the treeline on the horizon.

Photograph 8: Views northwest towards the WHS from within the buffer near Moss Side. Moss Side 1 and 2 Temporary Camps lie immediately beyond the hedgerow, with the Wall beyond.

Photograph 9: View north towards the Wall from the A69 within the WHS buffer west of Low Crosby Bridge. Walby can be seen in the distance beyond the trees and the operational OHL. The Wall is located between the two towers on the left, while the line of the Vallum is located between the second and third towers.

Photograph 10: Views east along the line of Hadrian's Wall in the area of Milecastle 62 near Walby Farm Park. Note lack of any visible earthworks.

Photograph 11: Views east along the Wall to the west of Milecastle 63, and near the point at which the A689

Appendix B Graduated Swathe Drawings

nationalgrid

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Section 1
England-Scotland Border to the B6318

Section 2
B6318 to the Rae Burn

Section 3
Rae Burn to the Woodlands Industrial Park

Section 4
Woodlands Industrial Park to the A689

Emerging Preferred Substation Siting Zone Option A

Metres
0 1,000 2,000 4,000

- Corridor Section
- Emerging Preferred Corridor - Option A
- Emerging Preferred Substation Siting Zone - Option A
- Substation Siting Area Option A
- England Scotland Border
- Existing 132kV OHL
- Existing 275kV OHL
- Existing 400kV OHL
- Harker Substation Site

Graduated Swathe – Option A
- Higher Likelihood
- Lower Likelihood

Metres
0 1,500 3,000 6,000

Assumed Width of Overhead Line (OHL) up to 100m

100m	OHL in map scale
400m × 720m	Substation footprint in map scale
400m × 720m	Substation footprint in inset scale

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Drawing Title
Overhead Line Graduated Swathe Option A

Overview

Scale at A2
1:80,000

Role

Suitability
Information

Project Number
101074

Rev
P02

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000001b

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Section 1
England-Scotland Border to the B6318

Section 2
B6318 to the Rae Burn

Section 3
Rae Burn to the Woodlands Industrial Park

Section 4
Woodlands Industrial Park to the A689

Emerging Preferred Substation Siting Zone Option A

Metres
0 1,000 2,000 4,000

Corridor Section
Emerging Preferred Corridor - Option A
Emerging Preferred Substation Siting Zone - Option A
Substation Siting Area Option A
England Scotland Border
North West Ethylene Pipeline
Existing 132kV OHL
Existing 275kV OHL
Existing 400kV OHL
Harker Substation Site
Listed Building
Grade I
Grade II*
Grade II
Existing Substation Site
Important Bird Area

RSPB Reserve
Priority Habitat
Scheduled Monument
Sites of Special Scientific Interest
Registered Battlefield
Ancient Woodland
Conservation Area
World Heritage Site Buffer Zone
Ramsar
Special Areas of Conservation
Special Protection Areas
Local Nature Reserves
Graduated Swathe – Option A
Higher Likelihood
Lower Likelihood

Metres
0 1,500 3,000 6,000

Assumed Width of Overhead Line (OHL) up to 100m

100m — OHL in map scale

400m × 720m — Substation footprint in map scale

400m × 720m — Substation footprint in inset scale

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Drawing Title
Overhead Line Graduated Swathe Key Constraints - Option A

Overview

Scale at A2
1:80,000

Role

Suitability
Information

Project Number
101074

Rev
P02

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000001

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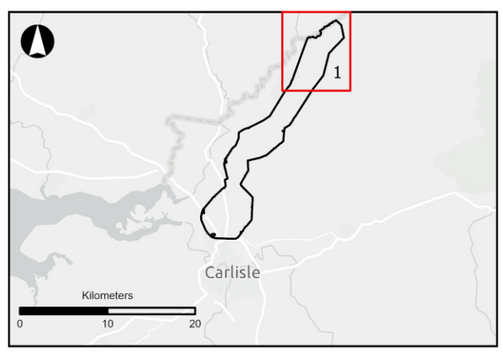
Corridor Section
Emerging Preferred Corridor - Option A
England Scotland Border
Listed Building
Grade II*
Grade II
Priority Habitat
Scheduled Monument
Sites of Special Scientific Interest
Ancient Woodland
Overhead Line Graduated Swathe – Option A
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option A

Section 1 of 4

Scale at A2
1:20,000

Role

Suitability
Information

Project Number
101074

Rev
P02

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000002

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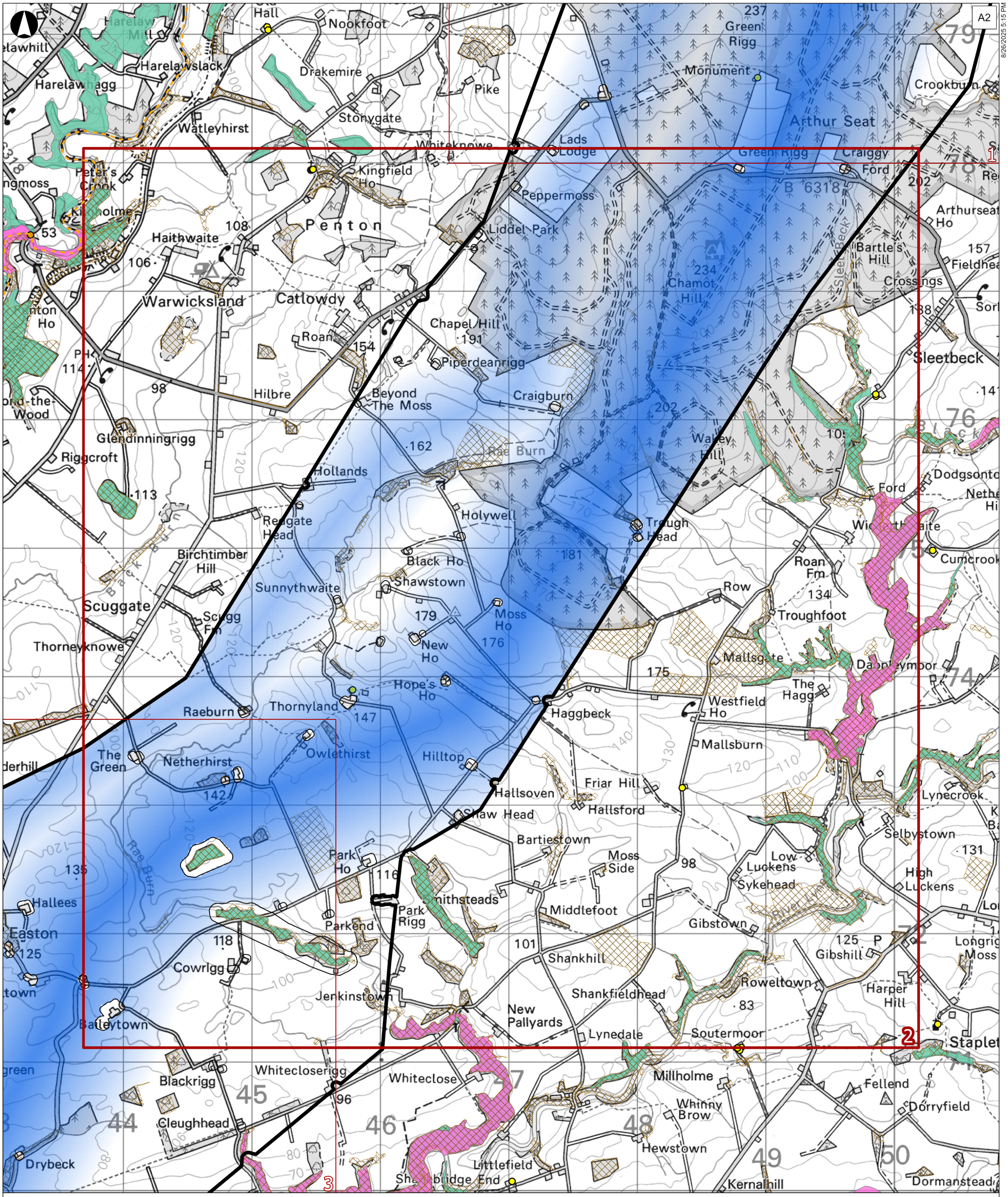

Corridor Section
Emerging Preferred Corridor - Option A
England Scotland Border
Listed Building
Grade II*
Grade II
Priority Habitat
Sites of Special Scientific Interest
Ancient Woodland
Overhead Line Graduated Swathe – Option A
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale

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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option A

Section 2 of 4

Scale at A2
1:20,000

Role

Suitability
Information

Project Number
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- Corridor Section
- Emerging Preferred Corridor - Option A
- England Scotland Border
- North West Ethylene Pipeline
- Existing 132kV OHL

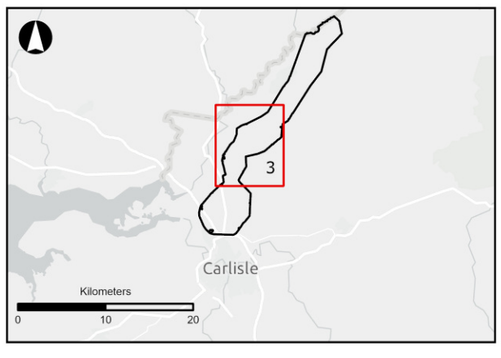
Listed Building
- Grade II*
- Grade II

- Priority Habitat
- Scheduled Monument
- Sites of Special Scientific Interest
- Registered Battlefield
- Ancient Woodland

Overhead Line Graduated Swathe – Option A
- Higher Likelihood
- Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option A

Section 3 of 4

Scale at A2
1:20,000

Role

Suitability
Information

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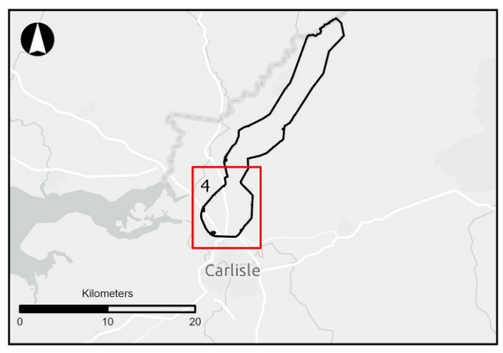
Fauld Mill
Howend
1542
Brisco Hill
Whitesyke
A6071
Francismoor Wood
Woodhead
Millstown
Stubb Fm
The Fauld
dismantled railway
River Esk
Burnfoot
Hornickhill
Bush-on-Lyne Fm
Holmfoot
Fergushill
East Cliff
Clift Ho
Sandysike
Randalinton
Willow Hill
Parcelstown
Alstonby Hall
Newbiggin
Alstonby Villa
Lynefoot
Metal Br
Fingbank
Justicetown
Westlinton
Alstonby Grange
The Gill
Howberry
Standingstone Rigg
Barrockstown
Young's Close
Well Sike
ROMAN ROAD
Down By Rigg
Bents Fm
Hespin Wood
Moor Ho
Ross Castle
The Boggs
Jerrymstown
Whamtown
Dykehead
Dyke Nook
Todhills
Newtown of Rockcliffe
Rockcliffe Moss
Keysmount
Moorcock Plantn
Wide open Dykes
Hotel MS
Blackdyke
Blackford
The Mount Fm
Tewfaitegreen
Longpa
Rockcliffe
Becklands
PH
Heathlands
The Hill
Crosshill
Green Acres
Dykeside
Crookdyke
Harker
Houghton
High Knells
Brunstock Beck
High Crindledyke
Bankend
Harker
Harker Grange
Knells Ho
Cargohill
Houghton Hall
Greymoorhill
Hotel
Brunstock
Cargo
Kingstown
Houghton
Industrial Estate
Shortdale
KCIIIEC Path
MILECASTLE 64 (NE)
VALLUM (course of)

Corridor Section
Emerging Preferred Corridor - Option A
England Scotland Border
North West Ethylene Pipeline
Existing 132kV OHL
Existing 275kV OHL
Existing 400kV OHL
Harker Substation Site
Listed Building
Grade I
Grade II*
Grade II
Existing Substation Site
Priority Habitat
Scheduled Monument
Sites of Special Scientific Interest
Registered Battlefield
Ancient Woodland
World Heritage Site Buffer Zone
Special Areas of Conservation
Local Nature Reserves
Overhead Line Graduated Swathe – Option A
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option A

Section 4 of 4

Scale at A2
1:20,000

Role

Suitability
Information

Project Number
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CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000005

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Emerging Preferred Substation Siting Zone - Option A
Substation Siting Area Option A
North West Ethylene Pipeline
Existing 132kV OHL
Existing 275kV OHL
Existing 400kV OHL
Harker Substation Site
Listed Building
Grade II*
Grade II
Existing Substation Site
Priority Habitat

Scheduled Monument
Sites of Special Scientific Interest
Registered Battlefield
Ancient Woodland
Conservation Area
World Heritage Site Buffer Zone
Special Areas of Conservation
Local Nature Reserves
Substation Graduated Swathe – Option A
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

400m
720m
Substation footprint in map scale

Carlisle
Kilometers
0 10 20

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Drawing Title
Substation Graduated Swathe Key Constraints - Option A

Scale at A2
1:18,000

Role

Suitability
Information

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Section 1
England-Scotland Border to the B6318

Section 2
B6318 to the Rae Burn

Section 3
Rae Burn to the Woodlands Industrial Park

Section 4
Woodlands Industrial Park to the A689

Section 5
A689 to Scotby

Section 6
Scotby to Cocklakes Yard

Emerging Preferred Substation Siting Zone Option B

Metres
0 1,000 2,000 4,000

- Corridor Section
- Emerging Preferred Corridor - Option B
- Emerging Preferred Substation Siting Zone - Option B
- England Scotland Border
- Existing 132kV OHL
- Existing 275kV OHL
- Existing 400kV OHL
- Harker Substation Site

Graduated Swathe – Option B
- Higher Likelihood
- Lower Likelihood

Metres
0 2,000 4,000 8,000

Assumed Width of Overhead Line (OHL) up to 100m

100m — OHL in map scale

400m × 720m — Substation footprint in map scale

400m × 720m — Substation footprint in inset scale

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Drawing Title
Overhead Line Graduated Swathe Option B

Overview

Scale at A2
1:100,000

Role

Suitability
Information

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Section 1
England-Scotland Border to the B6318

Section 2
B6318 to the Rae Burn

Section 3
Rae Burn to the Woodlands Industrial Park

Section 4
Woodlands Industrial Park to the A689

Section 5
A689 to Scotby

Section 6
Scotby to Cocklakes Yard

Emerging Preferred Substation Siting Zone Option B

Metres
0 1,000 2,000 4,000

Corridor Section
Emerging Preferred Corridor - Option B
Emerging Preferred Substation Siting Zone - Option B
England Scotland Border
North West Ethylene Pipeline
Existing 132kV OHL
Existing 275kV OHL
Existing 400kV OHL
Harker Substation Site
Listed Building
Grade I
Grade II*
Grade II
Existing Substation Site
Important Bird Area
RSPB Reserve
Priority Habitat
Scheduled Monument
Sites of Special Scientific Interest
Registered Battlefield
Ancient Woodland
Conservation Area
World Heritage Site Buffer Zone
Ramsar
Special Areas of Conservation
Special Protection Areas
Local Nature Reserves
Graduated Swathe – Option B
Higher Likelihood
Lower Likelihood

Metres
0 2,000 4,000 8,000

Assumed Width of Overhead Line (OHL) up to 100m

100m — OHL in map scale

400m × 720m — Substation footprint in map scale

400m × 720m — Substation footprint in inset scale

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Drawing Title
Overhead Line Graduated Swathe Key Constraints - Option B

Overview

Scale at A2
1:100,000

Role

Suitability
Information

Project Number
101074

Rev
P02

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000007

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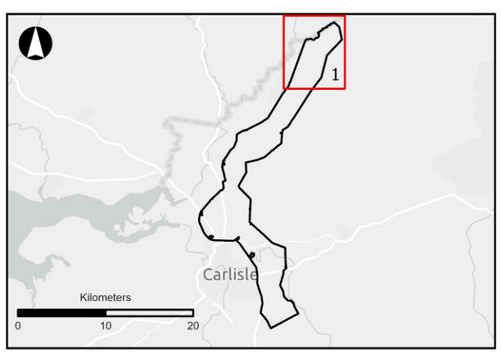
Corridor Section
Emerging Preferred Corridor - Option B
England Scotland Border
Listed Building
Grade II*
Grade II
Priority Habitat
Scheduled Monument
Sites of Special Scientific Interest
Ancient Woodland
Overhead Line Graduated Swathe – Option B
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option B

Section 1 of 6

Scale at A2
1:18,000

Role

Suitability
Information

Project Number
101074

Rev
P01

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000008

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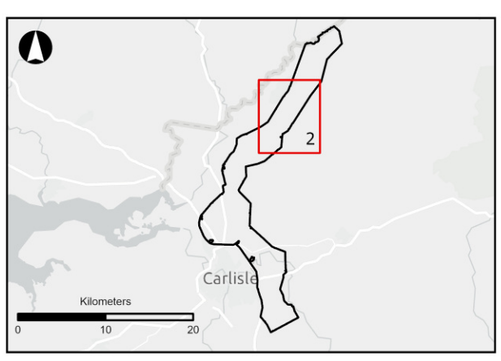
Corridor Section
Emerging Preferred Corridor - Option B
England Scotland Border
Listed Building
Grade II
Priority Habitat
Sites of Special Scientific Interest
Ancient Woodland
Overhead Line Graduated Swathe – Option B
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



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Client
National Grid Electricity Transmission

Project Name
Cross Border Connection (CMN3)

Coordinate System: British National Grid

Credits:
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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option B

Section 2 of 6

Scale at A2
1:18,000

Role

Suitability
Information

Project Number
101074

Rev
P01

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000009

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A2

8/26/2025 5:15 PM

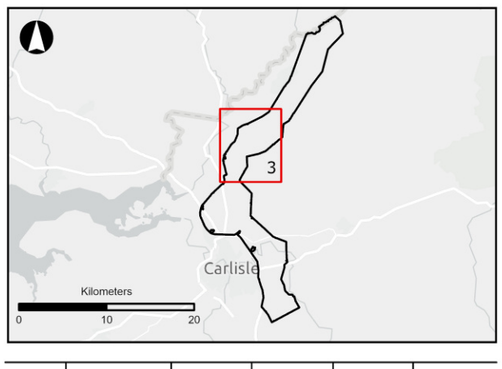
- Corridor Section
- Emerging Preferred Corridor - Option B
- England Scotland Border
- North West Ethylene Pipeline
- Existing 132kV OHL

Listed Building
- Grade II*
- Grade II
- Priority Habitat
- Scheduled Monument
- Sites of Special Scientific Interest
- Registered Battlefield
- Ancient Woodland

Overhead Line Graduated Swathe – Option B
- Higher Likelihood
- Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



Rev	Date	By	Chkd	Appd	Authd
P02	8/26/2025	AC	SL	GM	IB

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Client
National Grid Electricity Transmission

Project Name
Cross Border Connection (CMN3)

Coordinate System: British National Grid

Credits:
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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option B

Section 3 of 6

Scale at A2
1:18,000

Role

Suitability
Information

Project Number
101074

Rev
P01

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000010

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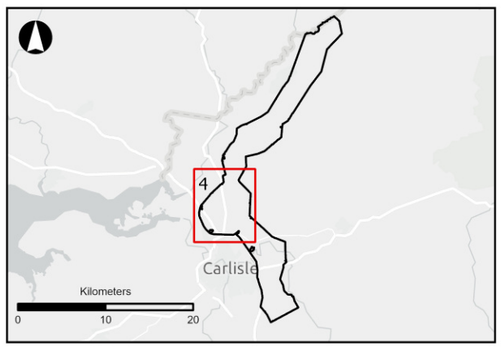
Corridor Section
Emerging Preferred Corridor - Option B
North West Ethylene Pipeline
Existing 132kV OHL
Existing 275kV OHL
Existing 400kV OHL
Harker Substation Site
Listed Building
Grade II*
Grade II
Existing Substation Site
Priority Habitat
Scheduled Monument
Sites of Special Scientific Interest
Registered Battlefield
Ancient Woodland
World Heritage Site Buffer Zone
Special Areas of Conservation
Overhead Line Graduated Swathe – Option B
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



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Coordinate System: British National Grid

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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option B

Section 4 of 6

Scale at A2
1:18,000

Role

Suitability
Information

Project Number
101074

Rev
P01

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000011

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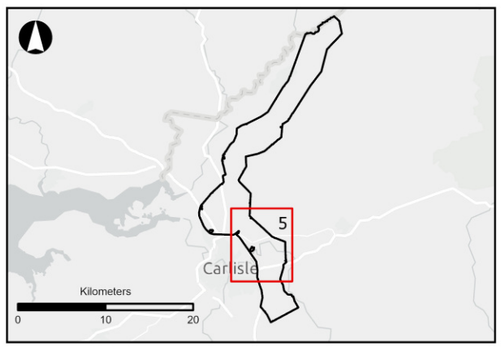
Corridor Section
Emerging Preferred Corridor - Option B
North West Ethylene Pipeline
Existing 275kV OHL
Existing 400kV OHL
Listed Building
Grade I
Grade II*
Grade II
Priority Habitat
Scheduled Monument
Sites of Special Scientific Interest
Ancient Woodland
Conservation Area
World Heritage Site Buffer Zone
Special Areas of Conservation
Overhead Line Graduated Swathe – Option B
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



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Coordinate System: British National Grid

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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option B

Section 5 of 6

Scale at A2
1:18,000

Role

Suitability
Information

Project Number
101074

Rev
P01

Drawing Number
CMN3-AAJ-XXXX-XXXXXX-DRW-ES-000012

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- Corridor Section
- Emerging Preferred Corridor - Option B
- North West Ethylene Pipeline
- Existing 400kV OHL

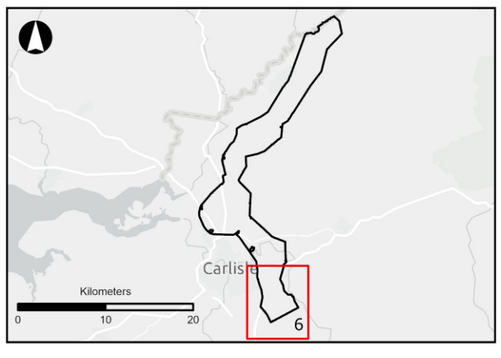
Listed Building
- Grade I
- Grade II*
- Grade II
- Priority Habitat
- Scheduled Monument

- Sites of Special Scientific Interest
- Ancient Woodland
- Conservation Area
- World Heritage Site Buffer Zone
- Special Areas of Conservation

Overhead Line Graduated Swathe – Option B
- Higher Likelihood
- Lower Likelihood

Metres
0 400 800 1,600

Assumed Width of Overhead Line up to 100m
100m in map scale



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Drawing Title
Overhead Line Graduated Swathe Key Constraints Series - Option B

Section 6 of 6

Scale at A2
1:18,000

Role

Suitability
Information

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Drawing Number
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Emerging Preferred Substation Siting Zone - Option B
North West Ethylene Pipeline
Existing 400kV OHL
Listed Building
Grade I
Grade II*
Grade II
Priority Habitat
Scheduled Monument
Sites of Special Scientific Interest
Ancient Woodland
Conservation Area
Special Areas of Conservation
Substation Graduated Swathe – Option B
Higher Likelihood
Lower Likelihood

Metres
0 400 800 1,600

400m
720m
Substation footprint in map scale

Kilometers
0 10 20

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Drawing Title
Substation Graduated Swathe Key Constraints - Option B

Scale at A2
1:18,000

Role

Suitability
Information

Project Number
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Drawing Number
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