Eastern Green Link 4:

Scottish Onshore Scheme

Volume 2: Main Report

Chapter 2: Project Description

December 2025

Prepared for:

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2.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) provides an overview of Eastern Green Link 4 (EGL4) (the 'Project'), and in particular presents a description of the Scottish Onshore Scheme. It outlines the main components of the Scottish Onshore Scheme including details of its design, construction, operation and decommissioning. A description of the routeing and siting process and how the Scottish Onshore Scheme was identified can be found within **Chapter 3: Site Selection and Routeing**.

This chapter is organised as follows:

- Eastern Green Link 4: Westfield to Walpole (**Section 2.2**)
- Description of the Scottish Onshore Scheme (**Section 2.3)**
  - Overview of the Scottish Onshore Scheme
  - Description of the Landfall
  - Description of the Underground DC Cable Route
  - Description of the Converter Station
  - Description of Underground AC Cable Route
- Construction of the Scottish Onshore Scheme (**Section 2.4)**
- Operation of the Scottish Onshore Scheme (**Section 2.5)**
  - Electric and Magnetic Fields.
- Decommissioning of the Scottish Onshore Scheme (**Section 2.6**)

2.2 Eastern Green Link 4: Westfield to Walpole

As set out within **Chapter 1: Introduction**, an overview of the Project is illustrated in **Figure 1-1: The Project**. The Project is a major reinforcement of the National Electricity Transmission System (NETS) which will provide additional north-south transmission capacity of up to 2 gigawatts (GW) across transmission network boundaries between Scotland and England, ensuring that renewable energy is transported from where it is produced to where it is needed. It comprises approximately 650 km of subsea and underground High Voltage Direct Current (HVDC) cables between new converter stations at each end of the electricity transmission link. These in turn are connected to the electricity transmission network via a new Walpole 400 kV substation in Norfolk, England and a new 400 kV substation adjacent to the existing Westfield 275kV substation in Fife, Scotland. Given the separate proposals to extend the existing Westfield Substation, it is referred to as the new 400 kV Westfield Substation, throughout this EIAR.

The Project is split into three major elements: the Marine Scheme, the English Onshore Scheme and the Scottish Onshore Scheme. The **Marine Scheme** comprises the subsea DC

cable route running from the landfall on the Fife coast to the landfall on the Lincolnshire coast. The **English Onshore Scheme** comprises a converter station connected to the NETS via a new Walpole Substation in west Norfolk, as well as underground DC cables from the converter station to the landfall where it connects to the Marine Scheme. This EIAR is written with specific regard to the **Scottish Onshore Scheme** which is described in detail in **Section 2.3 Description of the Scottish Onshore Scheme,** below.

2.3 Description of the Scottish Onshore Scheme

Overview of the Scottish Onshore Scheme

The Scottish Onshore Scheme is being developed by SP Energy Networks and comprises the onshore elements of EGL4 above Mean Low Water Springs (MLWS) in Scotland. The Scottish Onshore Scheme begins at the new 400 kV Westfield Substation in Fife with approximately 1 km of 400kV AC cables from the substation routed southeast where it connects to a new converter station. From the converter station approximately 16.2 km of underground HVDC cable will be installed extending broadly south/southeast to a landfall north of Kinghorn on the Fife coast. Further details on the AC cable route, converter station, DC cable route and landfall can be found within the following sections.

The Scottish Onshore Scheme has been developed through an iterative process considering environmental, technical and economic factors in line with SP Energy Network's statutory duties under the Electricity Act 1989. A routeing and siting study[1] was undertaken which identified and assessed alternative sites and routes for each of the components of the Scottish Onshore Scheme: the landfall, underground cable route and converter station. This concluded with the identification of a Preferred Option which was subject to non-statutory consultation. Following this the Preferred Option has evolved through subsequent engineering design, Environmental Impact Assessment (EIA) and statutory pre-application consultation (PAC) including landowner engagement. Further detail of the consideration of alternatives and how the design of the Scottish Onshore Scheme has evolved can be found within **Chapter 3: Site Selection and Routeing**.

Application Boundary

As set out within **Chapter 1: Introduction**, two separate planning applications are being made for the elements that comprise the Scottish Onshore Scheme. The individual boundaries can be found on **Figure 1-3 Scottish Onshore Scheme Application Boundaries**, with the EIAR covering the Scottish Onshore Scheme as a whole. The overall Application Boundary is illustrated on **Figure 1-4 Scottish Onshore Scheme Location Plan**. This illustrates the extent of the Scottish Onshore Scheme from the new Westfield 400 kV Substation, where it connects to the NETS, to the landfall north of Kinghorn where it meets the Marine Scheme. The design of the Scottish Onshore Scheme within the Application Boundary will be refined following further engineering surveys post-submission on granting of the Applications.

Subsequent sections of this chapter provide an overview of the key components which make up the Scottish Onshore Scheme as well as its construction:

[1] Routeing and Siting Consultation Document (2024), AECOM

- The Underground AC Cable Route
- The Converter Station
- The Underground DC Cable Route
- The Landfall

As noted in **Chapter 1: Introduction**, SP Energy Network's is seeking Planning Permission in Principle (PiP) for the proposed converter and full planning permission for the AC and DC underground cable routes. The level of design detail is commensurate to this approach, setting out maximum parameters within which the Scottish Onshore Scheme will be designed and installed/constructed. The finalised design of the Scottish Onshore Scheme is contractor-dependent and subject to a competitive tender process.

The Rochdale Envelope approach will be used for the converter station for which the Applicant is seeking PiP. This allows specific maximum parameters to be assessed for which the likely significant effects are established and assessed on a realistic worst case' basis. This allows sufficient flexibility for the appointed Contractor's final design to be undertaken within these parameters. Such an approach is common for major infrastructure projects and is typically referred to as a 'Rochdale Envelope' after the legal cases which established its precedent. Further details are provided in **Section 2.3 Description of the Scottish Onshore Scheme**.

Not all land within the Application Boundary will be developed. The planning application for the underground DC and AC cable routes includes a buffer typically up to 30 m either side of the working corridor, although this is wider in places where deemed appropriate. As a result, the Application Boundary is up to 100 m wide for most of the proposed underground DC route. This provides for reasonable flexibility in the planning permission for the underground cable route to avoid areas of sensitivity or risk (such as unsuitable ground conditions or previously unknown archaeological sites) identified during detailed pre-construction surveys or construction. Further details are provided in **Section 2.3 Description of the Scottish Onshore Scheme**.

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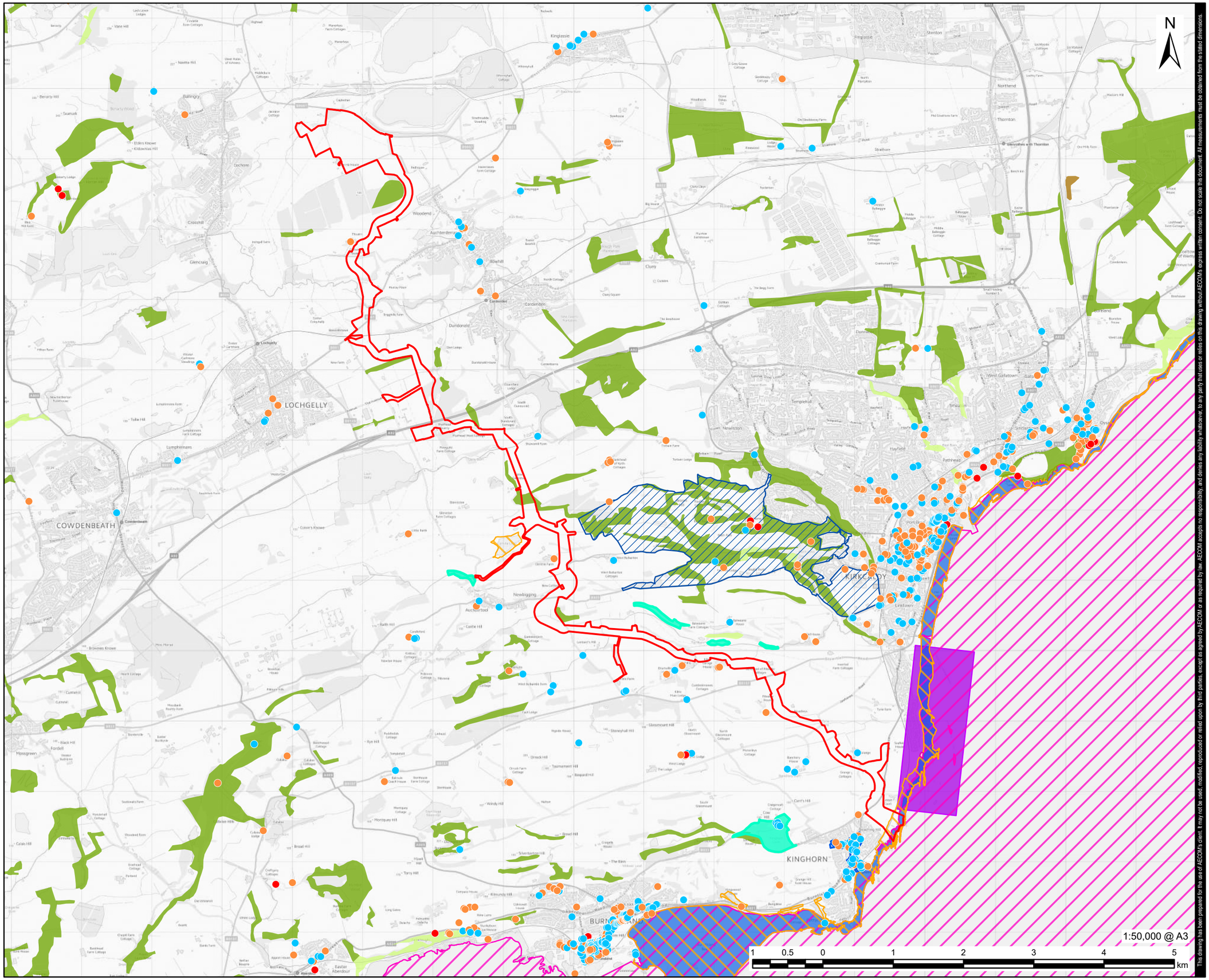

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LEGEND

- Planning Application Boundary
- Grade A Listed Building
- Grade B Listed Building
- Grade C Listed Building
- Local Wildlife Site (LWS)
- Gardens and Designed Landscape
- Conservation Area
- Scheduled Monuments
- Seal Haul-out Site (SHoS)
- Wetland of International Importance (Ramsar site)
- Special Protection Area (SPA)
- Site of Special Scientific Interest (SSSI)

Ancient Woodland Inventory (AWI)

- Ancient (of semi-natural origin)
- Long-Established (of plantation origin)
- Other (on Roy map)

NOTES

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FIGURE TITLE

Constraints

FIGURE NUMBER

Figure 2.1

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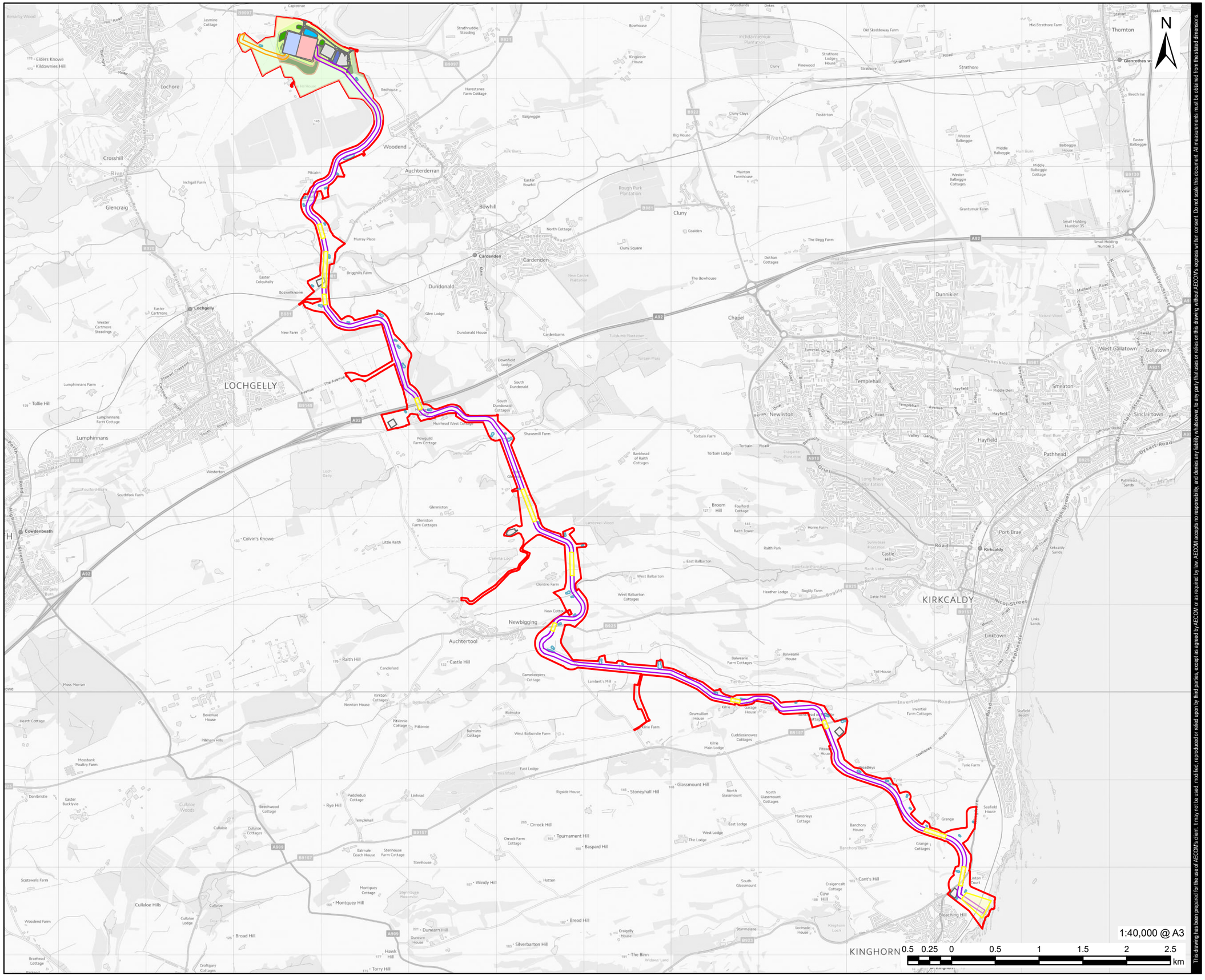

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LEGEND

- Planning Application Boundary
- Converter Station Platform - Zone 1
- Converter Station Platform - Zone 2
- Cable Route Trenchless Crossing – HDD
- Indicative AC Cable Route Alignment
- Indicative DC Cable Route Alignment
- Temporary Drainage - Attenuation Basin
- Temporary Construction Compound - Underground Route
- Converter Station - Permanent Attenuation Basin
- Converter Station - Permanent Attenuation Basin Road
- Converter Station - Temporary Car Parking
- Converter Station - Temporary Construction Compound
- Converter Station - Permanent Earthworks
- Converter Station - Temporary Earthworks
- Converter Station - Landscape Mitigation (Permanent Landform Re-profiling)
- Converter Station - Permanent Access Road
- Converter Station - Temporary Access Road
- Existing Vegetation to be Retained
- Existing Woodland to be Enhanced
- Proposed Converter Station Perimeter Strip Grassland Mix
- Proposed Shrub Planting Mix
- Proposed Species Diverse Meadow
- Proposed Swale with Wet Grassland Seed Mix
- Proposed Wet Grassland Seed Mix
- Proposed Woodland

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FIGURE TITLE

Cable Route and Converter Station

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Figure 2.2 (Sheet 1 of 6)

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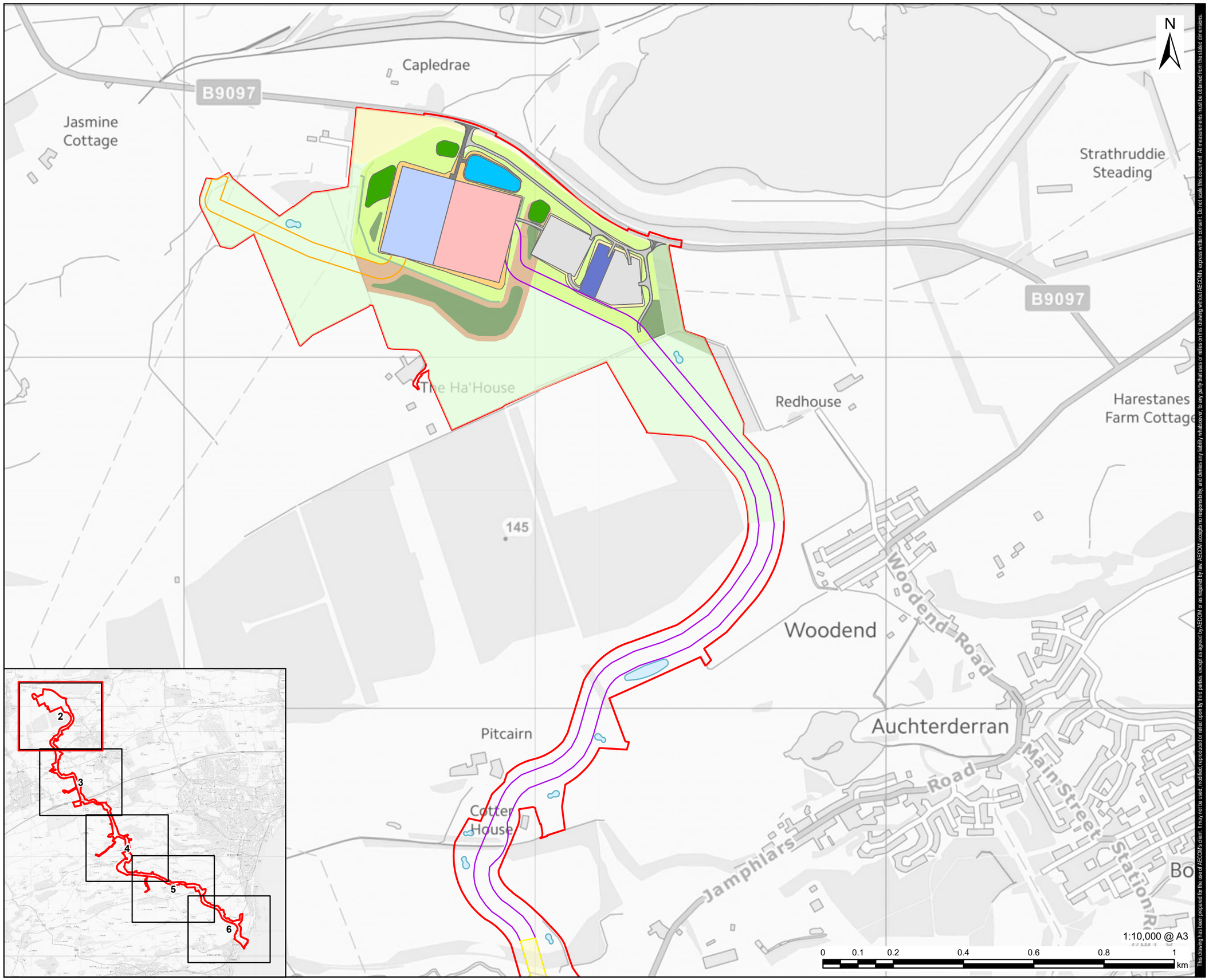

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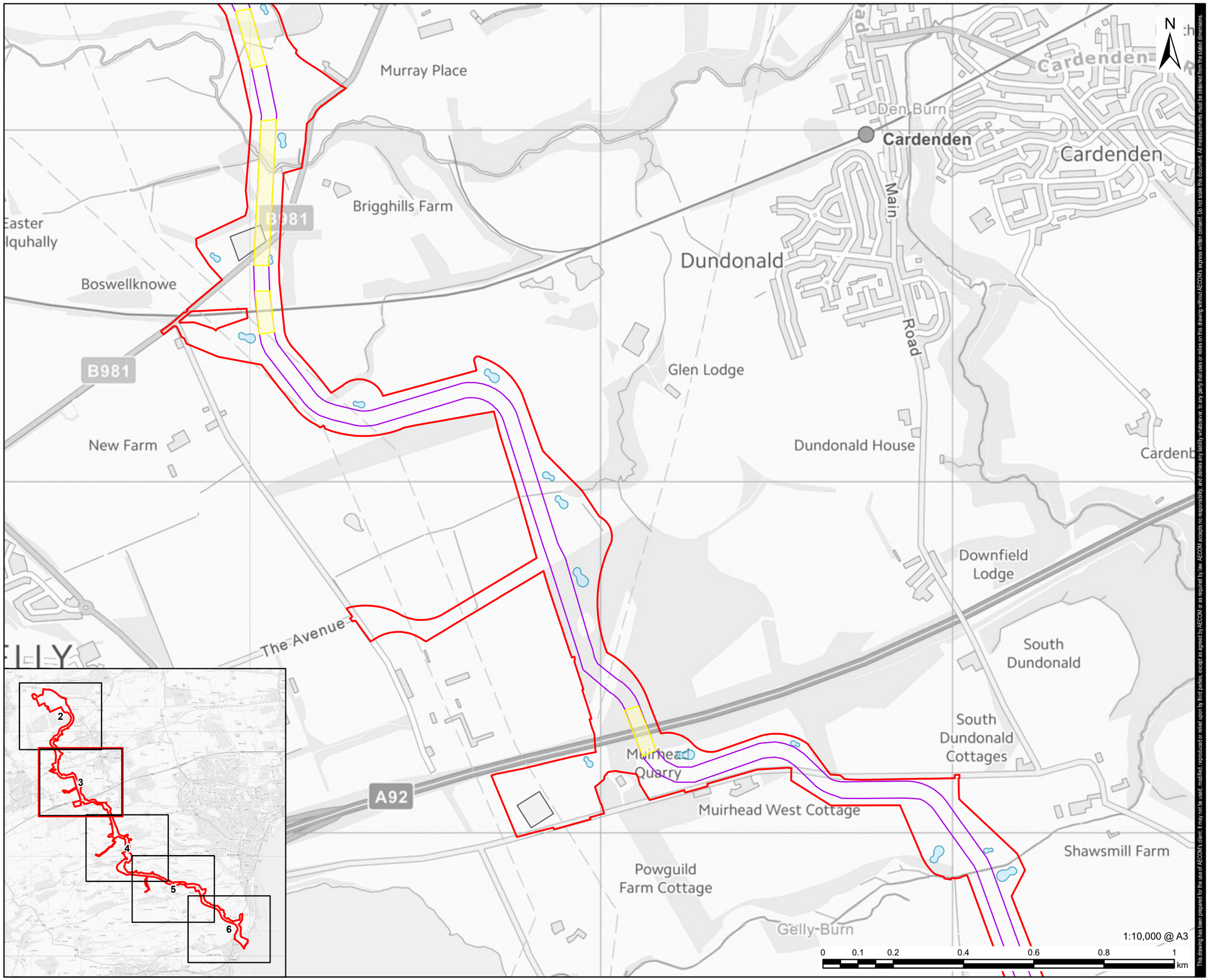

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Cable Route and Converter Station

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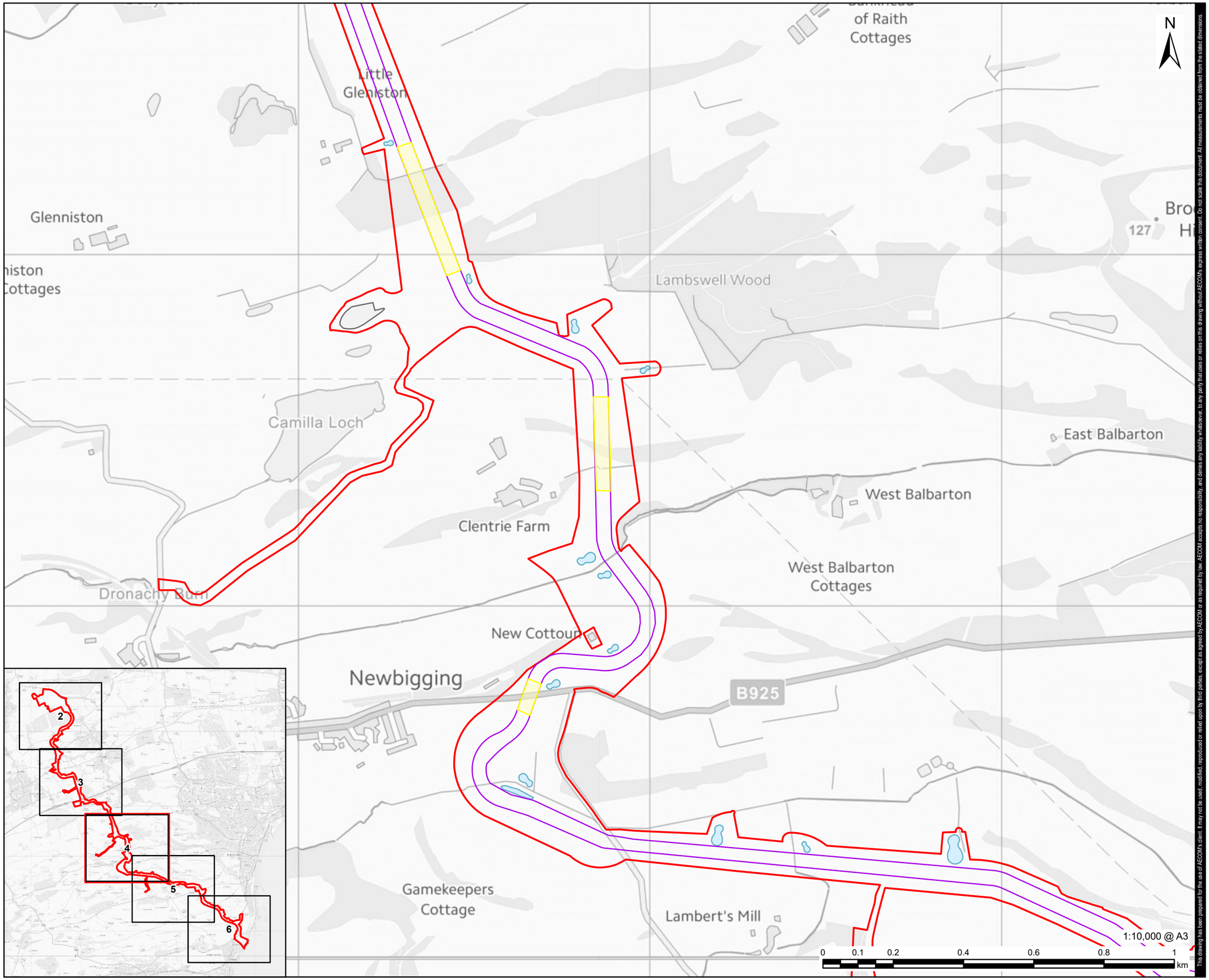

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FIGURE TITLE

Cable Route and Converter Station

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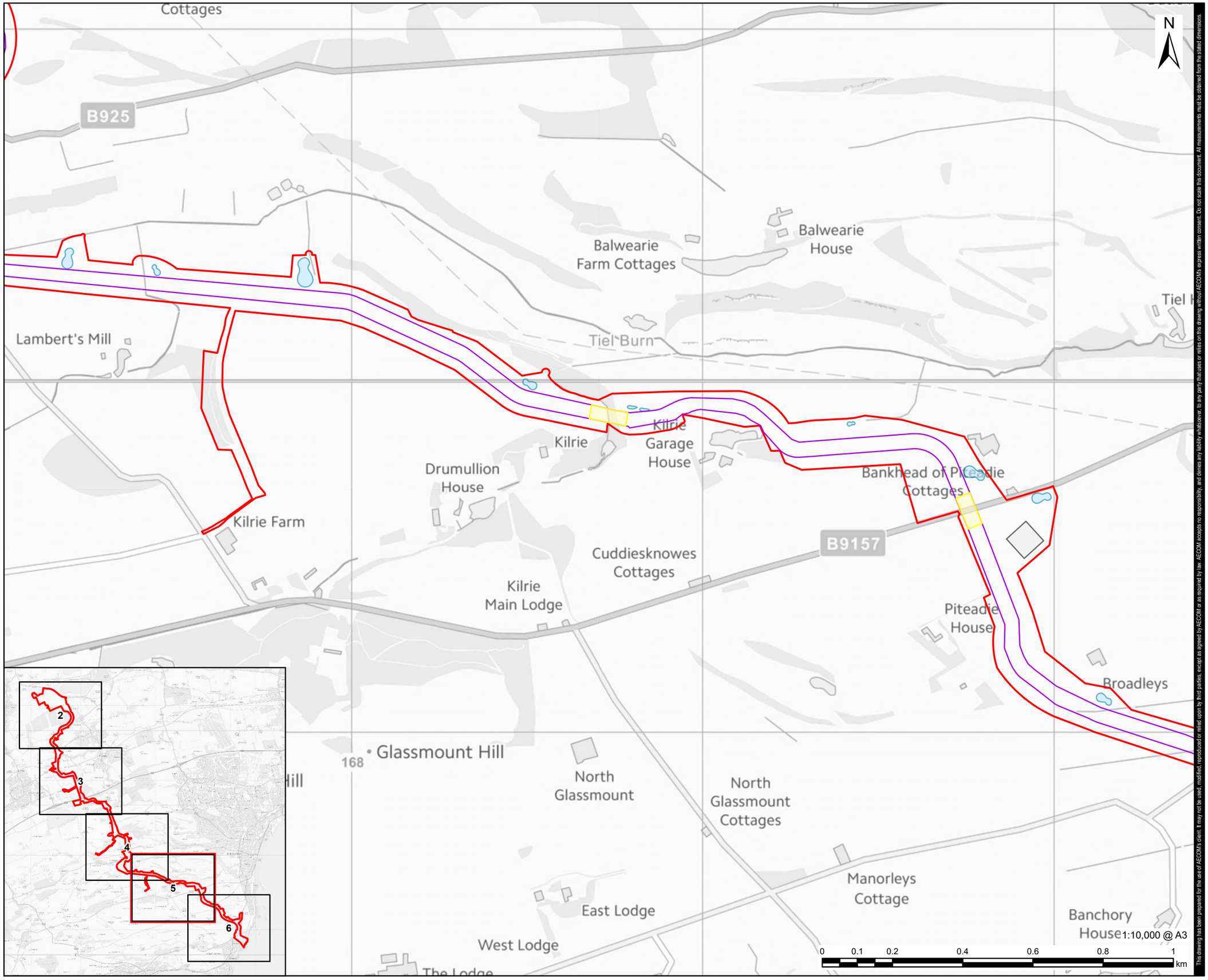

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FIGURE TITLE

Cable Route and Converter Station

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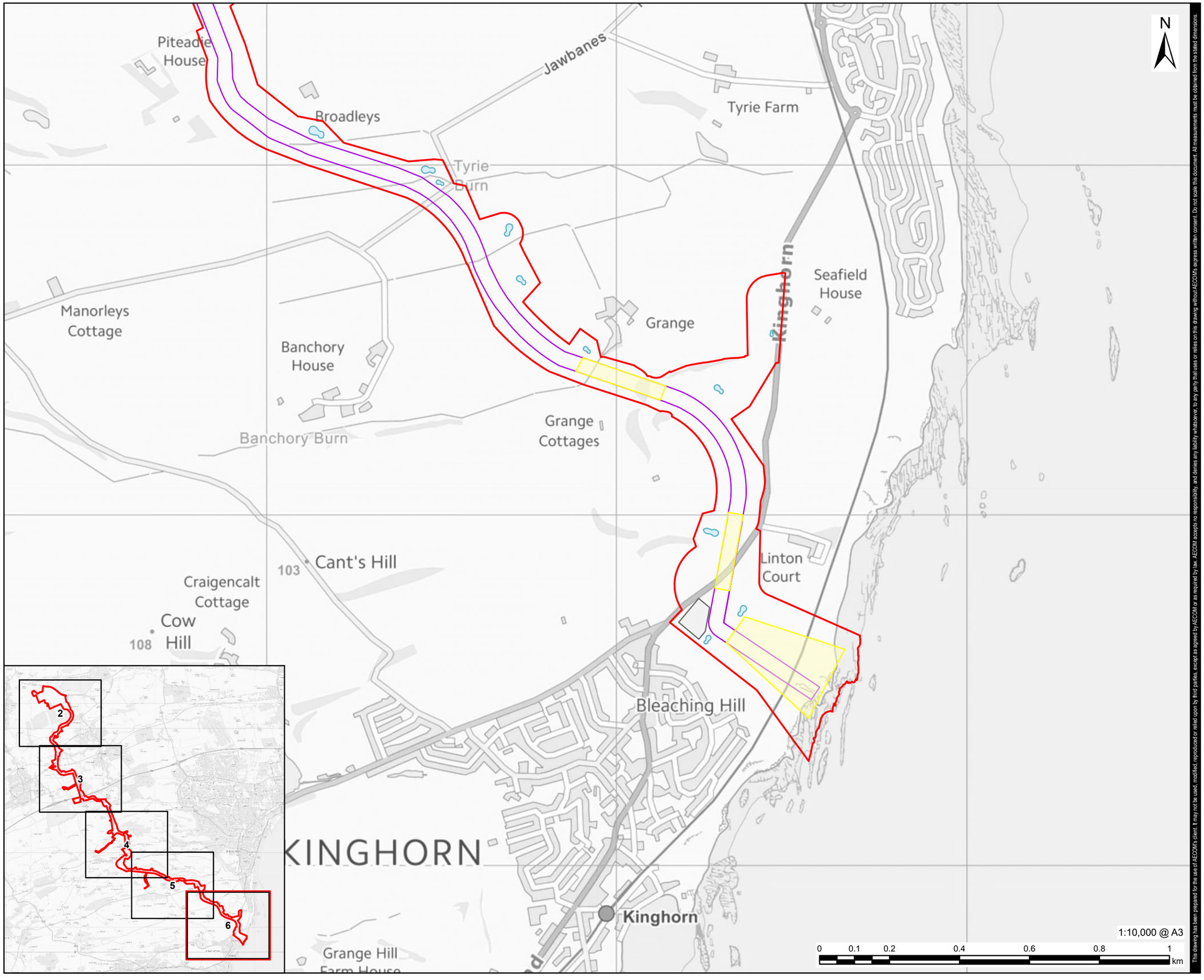

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FIGURE TITLE

Cable Route and Converter Station

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Description of the Underground AC Cable Route

Overview of the Proposed Underground AC Cables

AC underground cables will be required between the converter station and the new 400 kV Westfield Substation. The AC system will be approximately 1 km long and will comprise of 6 cables, generally installed in ducts, typically up to 300 mm in diameter, laid 3 per trench; with each trench typically 1.4 m wide by minimum 1.4 m deep (i.e. up to two trenches). To enable cable installation a working corridor up to 41.8 m wide will be required comprising temporary access, haul road, cable trench, drainage and topsoil and subsoil storage. This width is necessary due to the increased spacing required for AC cables.

Installation methods for AC cables are the same as those described below for DC cables. They will typically be installed by open cut trenching methods unless obstacles or constraints require trenchless methods to be used.

AC cables are laid in sections typically between 700 m and 1 km. Given the proximity of the converter station to the new 400 kV Westfield Substation, it is likely that one cable section will be required and therefore there is no requirement for joint bays or associated earthing link pillar, which are similar in scale and appearance to a telecommunication kiosk.

Works within the new 400 kV Westfield Substation will also be required to accommodate the AC connection to the existing electricity transmission system.

Underground AC Cable Route – Key Characteristics

A summary of the key characteristics of the underground AC cable route is outlined in **Table 2-1 Underground AC Cable Route – Summary of Key Characteristics**

Table 2-1 Underground AC Cable Route – Summary of Key Characteristics

	Description / Parameters
Length of route and cable number	Approximately 1 km between the converter station and the new 400 kV Westfield Substation. Six cables in total.
Temporary working width	41.8 m. This will include provision for the cable trench, soil storage, drainage and haul road.
Trench width/depth	1.4 m wide and minimum 1.4 m deep. Two trenches required, one for each circuit.
Cable installation method	Primarily open cut trenching to install the ducts which will then be backfilled and land reinstated (aside the haul road). Following this, cables will be pulled through the ducts.

Description of the Converter Station

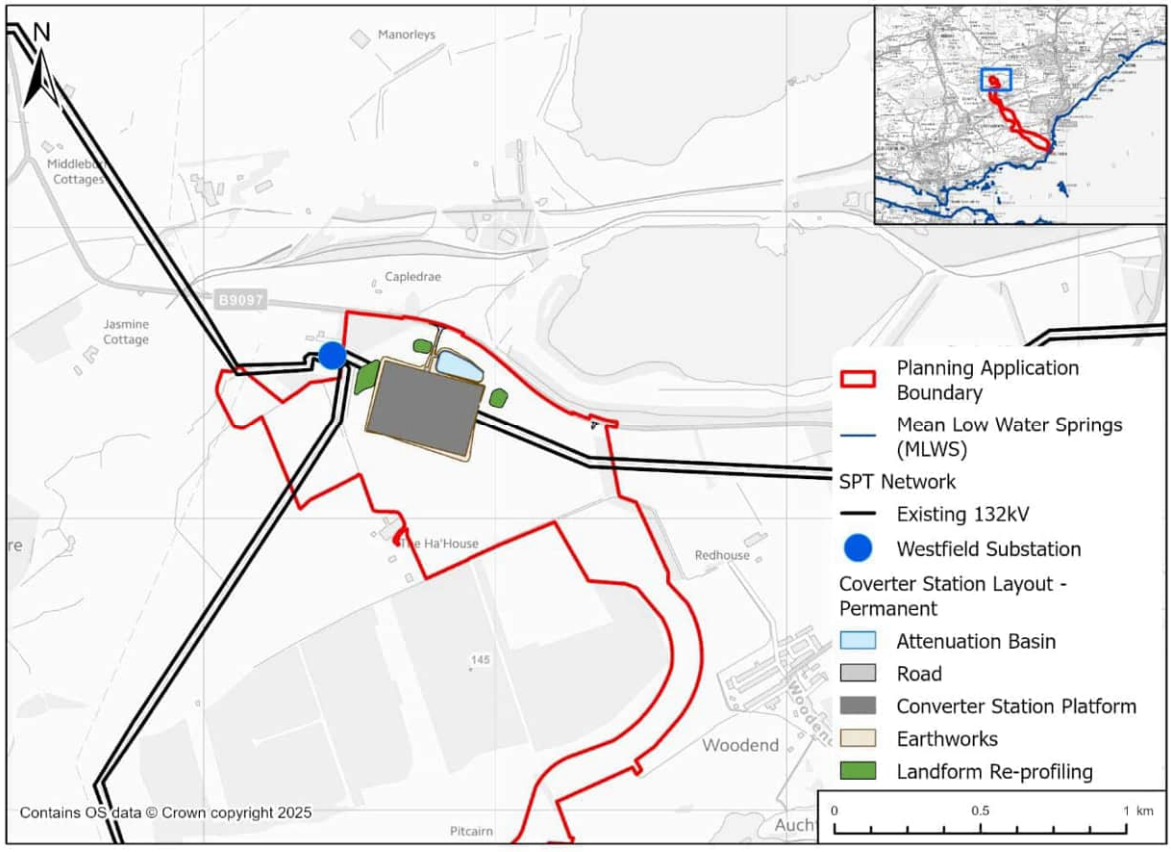
Overview of the Proposed Converter Station

Converter stations are the key components of a DC system and are required at both 'ends' of the Project. They enable electricity to be converted from AC to DC or vice versa depending on the direction of operation. The Project is bi-directional meaning that it can export or import electricity subject to the requirements of the NETS.

Converter Station Site Description

In the Scottish Onshore Scheme, the proposed converter station site is located immediately east of the new 400 kV Westfield Substation (which in turn is located adjacent to the existing Westfield Substation), within agricultural fields as illustrated on **Figure 2-3 Converter Station Site**. This location minimises the AC connection requirements whilst also locating the converter station next to existing development with similar characteristics. The converter station site will be accessed from the B9097 to the immediate north. The site comprises approximately 55 ha of agricultural land divided into five fields by hedgerows/fencing. It is bounded to the north by the B9097 and to the east, west and south by local roads. Land within the site slopes gently from south to north. With the exception of minor ditches to the north/northwest of the site there are no surface water features within the site. There is an existing 132 kV overhead line and 33 kV double circuit overhead line routed through the site and into the existing Westfield Substation (which is proposed to be replaced as the new 400 kV Westfield Substation). These circuits will be undergrounded to the north of the converter station largely following the field boundary until it crosses the existing gap in the woodland between the site and the new 400 kV Westfield Substation.

Figure 2-3: Converter Station Site



Converter stations contain specialist electrical equipment to undertake the conversion of electricity – some of this must be located indoors within buildings in order to protect the equipment. The size and number of buildings is informed by the size of the electrical equipment which they house and necessary safety clearances as well as climatic factors such as proximity to the coast and exposure to saline pollution. The largest buildings which house

the converters are up to 28.5 m tall. However, other equipment including transformers will be located outdoors. Outdoor equipment will be up to a maximum height of 18 m.

The exact number and layout of buildings varies by specialist supplier. However, the total operational footprint of 8.75 hectares (ha) (based on 350m by 250m) is broadly the same. For this reason, SP Energy Networks is seeking planning permission in principle for the converter station, with the EIA based on maximum worst-case parameters with which the final detailed design will comply. This approach is based on the Rochdale Envelope approach which allows specific maximum parameters to be identified for which the likely significant effects are assessed on a realistic 'worst case' basis. This allows sufficient flexibility for detailed design to be undertaken within these parameters. For the purposes of planning permission in principle, the converter station platform comprises two zones:

- Zone 1 – to the east of the platform formed by an area of 3.75 ha. This zone will accommodate enclosed buildings up to a maximum height of 28.5m.
- Zone 2 – to the west of the platform formed by an area of 5 ha. This zone will accommodate outdoor electrical equipment up to a maximum height of 18m

The converter station will comprise the following components:

- *DC Halls* – the underground DC cables terminate here. The switch hall also contains DC switchgear to connect to power electronics. This equipment will be enclosed in a building up to 28.5 m height. This includes the height of any lightning rods that may be required for safety. These would be located in Zone 1.
- *Valve Halls and AC Inductors* – contain high voltage power electronics equipment that converts electricity from DC to AC and vice-versa. This equipment must be located indoors in buildings up to 28.5 m height within a controlled environment. These would be located in Zone 1.
- *Control Building* – contains control panels and associated operator stations, protection and communication equipment, offices and welfare facilities and other auxiliary systems all located within an enclosed building up to 15 m high. This would be located in Zone 1.
- *Transformer bays* – these change the AC voltage to an appropriate level for transmission via the AC system/ or prior to conversion to DC. The transformers are normally sited outdoors and separated by concrete fire protection walls. Typical dimensions are up to 15 m long by 15 m wide by 16 m high. Cooling fans are also provided on transformers. Noise enclosures can be fitted around the transformers if required. These would be located within Zone 1.
- *AC Switch gear and filters ("switch yard")* – connects the converter station to the AC transmission system. It includes a range of electrical equipment including harmonic filtration and reactive compensation equipment, circuit breakers, transformers, busbars and insulators. The main function is to allow the effective integration of the DC system into the AC system. The AC switchyard and associated equipment is located outdoors with the equipment having a maximum height of up to 18 m. The AC switchyard would form Zone 2.

- *Diesel Backup Generator* – the converter station requires its own power typically provided at 11 kV, the diesel back-up generator will be used to provide back-up electricity supply in the event of a failure of the low voltage electricity supply. This could be located within either Zone 1 or 2 subject to final design.
- *Spares Building* – a building to house spare parts and components; this will be supplemented by hardstanding areas provided for storage of a spare transformer and spare cable drums. This could be located within either Zone 1 or 2 subject to final design.

The converter station site will be within a fenced compound with restricted access. An approximately 3 m high palisade fence will be erected around the platform with additional fencing around the perimeter of the earthworks. The site will also be monitored by CCTV and security gates will be in place for restricted/controlled access.

Lighting of the converter station during operation will be required for safety and security purposes. This will be minimised wherever possible and will be directional to prevent/reduce light spill. External lighting will be off as a default during the hours of darkness unless otherwise needed. The design of the lighting scheme for the converter station is subject to detailed design.

Access to the Converter Station

Access to the site during construction and operation will be via the B9097. There are two existing access points which are proposed to be upgraded and utilised:

- Temporary Access Arrangements: To the east of the site the existing junction which provides access to Torres Loan will be upgraded to enable access to the site. A one-way system will be established with egress from the site via the existing junction to the west of the site which provides access to North Pitkinny Farm. Both the western and eastern junctions will be upgraded with the eastern access removed on completion of construction.
- Permanent Access Arrangements: To the west of the site, the existing junction which provides access to North Pitkinny Farm will be upgraded and retained for the operational access. Up to 150 m of new permanent access road will be installed to provide access to the converter station platform.

Landscaping and Biodiversity Enhancement

A landscape plan illustrating the location and extent of proposed landscape planting is contained in **Figure 6.6 Outline Landscape Plan,** within **Chapter 6 Landscape and Visual Amenity.** These measures have been developed collaboratively with the ecology, forestry and heritage specialists and provide a cohesive mitigation design response that enhances opportunities for greater biodiversity as well as mitigating any visual impacts and aligning to the surrounding environment. Key aspects of the outline landscape plan include tree and scrub planting to strengthen existing hedgerow and woodland along the site boundary, notably along the B9097 road and the eastern and western boundaries. Habitat lost during the construction phase of the converter station will be replaced and overall habitat quality enhanced through the creation of native woodland, hedgerow, wet grassland, scrub planting, and species-rich meadow where appropriate, supporting the delivery of Biodiversity Net Gain. Landscape bunds are also proposed around the converter station to reinforce the site's landscape structure, enhance ecological connectivity and provide visual screening. The

highest priority bunds are on the eastern and western boundaries, followed by the southern boundary.

Extensive species-rich meadow planting is proposed across the northern and eastern parts of the site to support habitat creation and contribute to long-term landscape resilience, and the cable route will be reinstated with either species-rich meadow or wet grassland mix. Attenuation basins and swales are proposed as part of an integrated sustainable drainage system (SuDS) which will be seeded with a wetland grassland mix to provide effective surface water management while enhancing habitat diversity. New planting and seeding will be monitored and maintained to ensure successful establishment throughout the site.

Drainage and Attenuation

The drainage of the converter station site will be subject to the final design of the appointed Contractor. The principles will include two systems: one for surface water runoff and one for the collection of foul discharge during both construction and operation.

The surface water runoff will be managed through a combination of SuDS methods including swales and attenuation basins. Surface water will discharge into a burn located along the northeast field boundary. The foul water treatment system is proposed to be a septic tank and a raised soakaway on the north side of the proposed platform.

Construction of the Converter Station

Construction of the proposed converter station will be undertaken by the appointed Contractor. It is anticipated that construction activities will comprise:

- Preliminary works: This will include further site investigation and preconstruction surveys required to be undertaken in advance of construction. This will also include utilities diversions such as undergrounding the existing 132 kV and 33 kV overhead lines that cross the site;
- Site establishment: This includes vegetation clearance, soil removal and establishment of all temporary facilities including site offices, lay down and storage areas and welfare facilities, development of temporary electricity and water supplies, erection of security fencing or hoarding and implementation of external lighting for security;
- Earthworks: This will include bulk earthworks and land re-profiling in order to establish the level platform on which the proposed converter station will be constructed. Taking account of the topography within the site a cut/fill balance has been established to minimise material exports and imports as far as practicable.
- Civil engineering works: This will include construction of building foundations, development of the platforms' permanent drainage system and construction of internal roads and car parking arrangements;
- Building works: This will include the construction of building units including erection of steel frames and cladding;
- Cable installation: This will include the installation of the proposed underground DC cables entering the proposed converter station as well as proposed underground AC cables between the proposed converter station and the new 400 kV Westfield Substation;

- Provision/ installation of permanent services: This will include water supplies, foul drainage, electricity supply and telecommunications;
- Mechanical and electrical works: This will include installation of high voltage AC and DC electrical equipment and transformers within the proposed converter station;
- Commissioning: Following completion of all construction works there will be a period of commissioning and testing; and
- Site Reinstatement & Landscape Works: This will include removal of site offices and temporary facilities, land reinstatement and landscape works (note subject to detailed design some advance landscaping may be undertaken where it is feasible to do so).

The construction compounds will be lit during normal working hours as required. Temporary lighting will be provided via lighting masts and will be powered via generators or where reasonably practicable lower carbon alternatives such as battery, solar or mains. In addition, for site security reasons, the construction compounds will be fitted with electrical sensors to activate the compound lighting during the hours of darkness should movement be detected, but otherwise lighting will be limited outside working hours.

Overhead Line Works

Existing 33kV and 132kV wood pole overhead lines cross the proposed converter station site in a western/northwestern direction to the existing Westfield Substation. As part of the construction of the proposed converter station these will be diverted and undergrounded along the northern boundary of the site broadly following the B9097. These works will be undertaken as part of the construction of the converter station and have been considered in the assessment of construction impacts.

Converter Station – Key Characteristics

A summary of the key characteristics of the converter station is outlined in **Table 2-2 Converter Station – Summary of Key Characteristics**

Table 2-2 Converter Station – Summary of Key Characteristics

Component	Description / Parameters
Converter station technology	Voltage Source Converter technology / Voltage DC +/- 525kV.
Permanent footprint	Total converter station site footprint of approximately 91 ha comprising: • Converter station platform up to 250 m by 350 m (8.75 ha). Area is dependent on the exact number and layout of buildings and varies by specialist supplier. • Other hardstanding such as car parking and permanent access approximately 1 ha • Landscaping, earthworks, drainage and reinstated land approximately 81.25 ha

Component	Description / Parameters
	Note, as set out within **Section 'Application Boundary'** above, all dimensions stated are 'worst case'.
Additional temporary land take	Up to 250 m by 200 m (5 ha) to allow for laydown areas, welfare facilities, construction working area and temporary drainage.
Max. height of buildings	28.5 m (above Converter Finish Level) for the largest buildings which house the converters. however, other equipment including transformers could be located outdoors or in smaller buildings.
Converter Finish Level	88.4 m AOD
Compounds	There will be two compounds and one shared parking area - to the east of the converter platform at Westfield (one main compound for the cable contractor and one for the converter contractor).
Temporary access	Access to the converter station will be via the B9097 which is located to the north of the site. A one-way system is proposed with access from the B9097 into Torres Loan (East) and exit via a permanent junction onto the B9097 (West), with the exception of specific movements.
Permanent access	Via the B9097, bellmouth access to the Converter Site and North Pitkinny Farm Access Road
Security fencing, lighting and monitoring	The installed security fence will be a 3 m enhanced palisade with electrification. A post and wire or Ryloc stock proof demarcation fence will be installed outwith the platform earthworks. The Converter Station will have lighting and CCTV.
Construction duration	Construction of the converter station is expected to take up to six years, with enabling works (such as undergrounding existing overhead lines) taking circa 1 year and main construction 5 years. Works would typically be phased through site establishment, earthworks and other civils, building works and installation of services then mechanical and electrical works followed by commissioning.
Construction traffic programme	18 months to 2 years – Platform Civils (Earthworks, Access, and Drainage) - Assumption: up to 80 HGVs/day. 2 to 3 years – Main Civils - Assumption: up to 30 HGVs/day, with cars increasing to support construction on site. circa 2 years - Equipment Installation - Assumption: max. 30 HGVs/day, but average frequency reduces; cars again to support installation works on site. - AILs required in this period (7 transformers to the site).

Description of the Underground DC Cable Route

Overview of the Proposed Underground DC Cables

The Scottish Onshore Scheme includes DC underground cables between the converter station and the landfall. A DC system comprises two cables (i.e. a single pair is one circuit), generally installed in ducts, typically up to 300 mm in diameter. These are laid side by side within a trench typically 1.0 m wide by 1.4 m deep. To enable DC cable installation, a working corridor typically 43 m wide is required for the majority of the route, but in some locations the working corridor is wider, up to 65 m wide. The temporary working includes temporary access, haul road, cable trench, drainage and topsoil and subsoil storage.

The term underground DC cable route is used throughout this EIAR and refers to the DC cables, trench (or installation area) and associated temporary working width required for underground cable installation as described below. The configuration of the DC cable route was determined based on a number of factors including the constraints which are present, prevailing ground conditions, the length of each cable section, suitability of jointing positions and the number of bends and topography of the route.

The Application Boundary includes a buffer around the proposed cable route which provide for reasonable flexibility in the planning permission for the cable installation to avoid areas of sensitivity or risk (such as unsuitable ground or previously unknown archaeological sites) during construction. For most of the route the buffer is approximately 60 m (i.e. 30 m either side) beyond the working corridor. However, there are some sections where this is wider. As a result, the Application Boundary is up to 100 m wide for most of the proposed underground DC route.

The underground DC cable route corridor for the Scottish Onshore Scheme is illustrated on **Figure 2-2 Scottish Onshore Scheme Location** and a cross-section of a typical working width shown in **Figure 2-4 Cross section of a Typical Working Width**.

Proposed Underground DC Cable Route Description

The underground DC cable route begins at the converter station located immediately to the east of the new 400 kV Westfield Substation. From the converter station the route briefly travels southeast before turning southwest towards Pitcairn Farm and crossing Pitcairn Road. South of the farm the route crosses a decommissioned railway and an overland combined sewer pipe. The route continues south crossing the River Ore, Minto community woodland and footpaths, and the B981 road. These features are followed by a crossing of the Fife Circle railway line.

South of the railway line the cable route turns southeast, extending between two overhead lines (the 132 kV Glenniston – Westfield BC and the 275 kV Longannet – Westfield YV steel tower circuits). It then travels east, passing to the south of a group of trees and a ravine before turning south once more as it travels through arable land and crosses a Scottish Water pipe, an 11 kV wood pole SPEN OHL, a watercourse and a public right of way.

Continuing south the cable route passes perpendicularly beneath the A92 and the large embankment on which the road is set and then through the disused Muirhead Quarry. At a private farm property the route turns east, crossing Brownrigg Road followed by a private access road. Gelly Burn is then crossed as the cable route turns south again with the

proposed Glenniston Solar Farm lying to the west. The proposed solar farm spans much of the western extent of the cable route between Brownrigg Road to the north and Knockbathy Wood to the south. The presence of the solar farm requires the route to pass beneath the raised area of ancient woodland (Knockbathy), where the topography is steep and wooded, and an adjacent area of arable land. South of the woodland the route crosses a single-track windfarm access road and enters the northern extent of a wind farm.

Passing between two existing wind turbines the cable route runs southeast through arable land. With Clentrie Farm to the west, the route turns south travelling through a row of mature trees and very steep topography. It then crosses Dronachy Burn, sweeps round to the southwest and crosses the B925 road. After the B925 the route turns back to the southeast, crossing Bottom Burn followed by Tiel Burn.

The route continues southeast, paralleling Tiel Burn to the north, before passing in between a cluster of mature trees to the north and Nether Piteadie to the south. There are a series of private properties in this area associated with Nether Piteadie, Kilrie and Kilrie Farm. Here there are steep slopes and the route also crosses a ravine, over a culvert and beneath a SP Energy Network OHL before continuing eastward. The route turns south at the western boundary of a private property, continuing southeast and passing a private water supply. It then reaches the B9157 road which it passes underneath.

From the B91517 the cable route travels generally southeast towards the proposed landfall north of Kinghorn on the Fife coast. The route runs adjacent to a hedgerow south of the B9157 and crosses two British Telecom (BT) cables and a SP Energy Network OHL. It bypasses a suspected former mine/quarry, intersecting two watercourses and a single-track road, before crossing Banchory Burn and passing to the south of Grange Farm. The route briefly turns to the south to pass beneath Kinghorn Road, turning southeast again and terminating at the Transition Joint Bay (TJB) at the landfall location.

Underground DC Cable Route – Installation Methods

Cable installation is usually undertaken using open cut methods. In this method, cables will either be directly laid into an excavated trench which is then backfilled, or a duct is laid into the trench after which cables will then be pulled through the pre-laid duct. SP Energy Network proposes to use the latter method for the Scottish Onshore Scheme as this will enable ducts to be installed, for cable trenches to backfilled and some parts of the working corridor reinstated earlier. Cables will be pulled through the pre-installed ducts and adjacent sections joined together at joint bays. At some locations where obstacles or constraints such as roads, railway lines, woodland or watercourses require to be crossed trenchless methods such as HDD, augur boring or micro-tunnelling will be used and the working corridor may increase locally to enable these specialist engineering works.

The following provides a summary of cable installation methods:

- **Open cut/direct lay:** this is where a trench is excavated by a mechanical excavator and the plastic ducts laid directly into a single trench typically up to 1.4 m deep and 1.0 m wide unless ground conditions or constraints dictate otherwise (for example due to other utilities or field drainage). The trench will then be backfilled using a combination of locally excavated soils and cement bound sand and the land reinstated. Cables are then pulled through the ducts at a later time. This method of installation results in ground

disturbance for a shorter period of time, as once the ducts are installed the land can be reinstated, except for the haul road which will remain in place until the end of construction.

- **Trenchless methods such as HDD or pipe jacking:** these are used where obstacles are encountered such as major or sensitive watercourses, woodland, railways or roads. HDD involves the use of a drill to bore a route below the ground through which ducts will be pushed/pulled and cables installed. Pipe jacking is a technique for installing underground ducts and uses hydraulic jacks to push specially designed pipes through the ground behind a shield at the same time as excavation is taking place within the shield, cables are then installed in the pipes. **Table 2-3 List of Trenchless Crossings by Underground DC Cable** provides a description of each trenchless crossing within the Underground DC Cable Route and details of the features crossed. For the purposes of the EIA it has been assumed that trenchless crossings will be installed by HDD, however, the final construction methods will be confirmed in a Construction Method Statement (CMS) to be submitted to Fife Council prior to the commencement of underground cable works.

Table 2-3 List of Trenchless Crossings by Underground DC Cable

Ref	Installation method	Description / location	Features crossed
HDD #11	HDD	South of Pitcairn farm crossing below the path of a decommissioned railway.	Decommissioned railway line, River Ore tributary 6, an overland combined sewer pipe and an area of woodland.
HDD #10	HDD	Passing beneath the B981 road, the River Ore and Minto Woodland.	B981 road, River Ore and River Ore tributary 3.
HDD #9	HDD	Fife Circle Railway Line - passing beneath the active railway line between Lochgelly and Cardenden, just to the east of Lochgelly Cemetery.	Active railway line.
HDD #8	HDD	A92 - potential for tunnel crossing the A92 dual carriageway to the east of Lochgelly. This option is proposed as it is not possible to run the cable through the adjacent underpass.	A92 road.
HDD #7	HDD	Solar Farm bypass / Knockbathy Wood - proposed crossing through a	Sizeable bluff of 15-20m and Den Burn tributary 1.

Ref	Installation method	Description / location	Features crossed
		hill to avoid land covered by a solar array.	
HDD #6	HDD	Woodland at Clentrie Farm - crossing a steep wooded bank on rural arable land.	Steep wooded bank and an unnamed ditch.
HDD #5	HDD	B925 - west of Auchtertool, passing under the B925 road at an oblique angle.	B925 road.
HDD #4	HDD	Woodland to the east of Kilrie.	Cluster of mature trees and a ravine.
HDD #3	HDD	B9157 - crossing beneath the B9157 road.	B9175 road.
HDD #2	HDD	Grange Farm - passing to the south of the Grange Farm buildings.	Banchory Burn, an associated area of compressible ground, a wooded berm and an access track.
HDD #1	HDD	A921 - Crossing beneath the A921 road, to the north of Kinghorn.	A921 road.

- **Cable jointing:** joint bays are required between each cable section to join them together. The exact number of joint bays will depend on the cable route and constraints present as these will dictate the length of cable sections to be installed but sections will be up to 1 km in length. Joint bays will be formed by building a concrete plinth (or similar) in the base of the trenches up to 12 m by 5 m by 1.5 m. Joint bays must be clean and dry so temporary covers will be erected at jointing locations. Joint bays could remain open for several weeks to allow for trench and joint bay excavation, cable pulling, jointing and reinstatement. Due to the precise nature of jointing operations, it may require continuous 24-hour working for short periods whilst the jointing works are completed.
- **Watercourse crossings:** Where watercourses are encountered the crossing method used will depend on the size and sensitivity of the watercourse. As described above major or sensitive watercourses will be crossed using HDD. Minor, or less sensitive watercourses such as drains or ditches will be crossed using open cut installation methods, either with a temporary dam or bypass flume. In the case of temporary dam, a sheet pile dam is installed up and downstream of the crossing point and a pumping plant will over-pump from upstream to downstream to ensure no interruption to flow downstream. The crossing point is excavated and a concrete duct block is installed before the watercourse banks are reinstated and reprofiled, the dam is removed and

subsoil and topsoil reinstated. A bypass flume is where a pipe or series of pipes is installed to temporarily divert water around the crossing point allowing for excavation and duct installation in dry bed. **Table 2-4 Locations of open cut watercourse crossings** presents each watercourse within the Underground DC Cable Route proposed to be crossed by open cut installation methods.

Table 2-4 Locations of open cut watercourse crossings

Water feature ID	Water Feature Name	Type of Crossing	NGR
ORE28	ORE25 tributary 1	Open cut	NT 19095 96751
ORE25	ORE23 tributary 1	Open cut	NT 19534 97153
ORE17	ORE20 (Unnamed Reservoir) outflow 1	Open cut	NT 19172 96488
ORE13	River Ore tributary 7	Open cut	NT 20197 95682
ORE2	River Ore tributary 1	Open cut	NT 20244 93728
DEN1	Den Burn (inc. Gelly Burn)	Open cut	NT 20745 92525
DRO1	Dronachy Burn	Open cut	NT 20003 91223
TIE5	Tiel Burn tributary 4	Open cut	NT 20685 89174
TIE4	Tiel Burn tributary 3	Open cut	NT 23896 90299
TIE3	Tiel Burn tributary 2	Open cut	NT 24302 89572
TIE1	Tiel Burn (inc Bottom Burn)	Open cut	NT 19710 88943
COA4	Tyrie Burn tributary 1	Open cut	NT 26062 89061
COA3	Tyrie Burn	Open cut	NT 26015 88893
COA2	Banchory Burn tributary 1	Open cut	NT 26037 88605

Access during Cable Installation

Access requirements will vary during installation of the proposed underground cable route. To ensure health and safety throughout construction the working area will be demarcated using stock proof fencing or similar and access to/from this area will be managed by the contractor at all times during construction.

The following section provides an overview of access requirements including access from the local road network as well as the installation of a temporary haul road within the working corridor.

- **Construction Access Routes and Access Points**: an assessment has been carried out of the existing public road network to identify which roads are suitable for access by HGVs and cable delivery vehicles which would be classed as AILs. The assessment has taken into account various factors including the size and condition of the roads, traffic restrictions (vehicle weight, height, width or length), gradients, settlements (proximity of buildings, residential properties and community facilities) and other factors such as overhead lines (electricity and telecommunications). As an outcome of this 29 access points have been identified along the proposed underground cable route and at the proposed converter station site. Key roads to be utilised in the movement of construction traffic include the M90, A921, B9157, B925, A92 and B981.
- **Temporary Haul Road:** within the working corridor a temporary haul road will be installed to enable access for construction / installation. The temporary haul road will be maintained along the length of the working corridor for as much of its length as possible in order to minimise the use of local roads as far as practicable, only stopping up at crossing locations where it is not feasible (such as railway crossings). The temporary haul road will be up to 7m wide to allow for two-way movements. The temporary haul road will include stripping and stockpiling topsoil and laying stone. In some areas alternative methods for temporary haul road construction may be utilised depending on ground conditions. Where necessary (typically where the temporary haul road will be built up) piping will be installed to ensure natural drainage pathways are maintained across the temporary haul road.
- **Mobilisation Access Routes:** Mobilisation access routes will be utilised in the early stages of pre-construction and construction to take access for surveys and some construction works. These typically provide access into sections of the proposed underground cable route that are otherwise inaccessible, for example due to watercourses. The mobilisation accesses will also provide access to install temporary watercourse crossings, enable access into working areas, support establishment of the temporary working corridor. Construction of the haul roads and their removal at the end of the project will also be facilitated by mobilisation accesses.

Reinstatement of the Working Corridor

The working corridor will be fully reinstated. Due to the proposed installation method it is likely that reinstatement will be undertaken progressively with the cable trench reinstated following the installation of ducts. Full reinstatement of the working corridor, for example complete removal of the temporary haul road, would not occur until after cables have been pulled through the ducts, jointed and tested.

Land will then be reinstated to its former use and agricultural areas returned to the landowner for cultivation during the first available planting season following completion of construction.

Any hedgerows removed to facilitate construction activities will be replanted with an objective to enhance the boundary features where possible. The replanting would consist of a variety of native species, typical of those found within the local area. Where possible and subject to agreement, existing hedgerows may be removed, stored and replanted.

Other vegetation along the proposed route and in areas temporarily disturbed by construction would also be reinstated. Pasture, road verges and other areas temporarily affected will be seeded with an appropriate species rich wildflower or grass seed mix.

Underground DC Cable Route – Key Characteristics

A summary of the key characteristics of the underground DC cable route is outlined in **Table 2-5. Underground DC Cable Route – Summary of Key Characteristics**

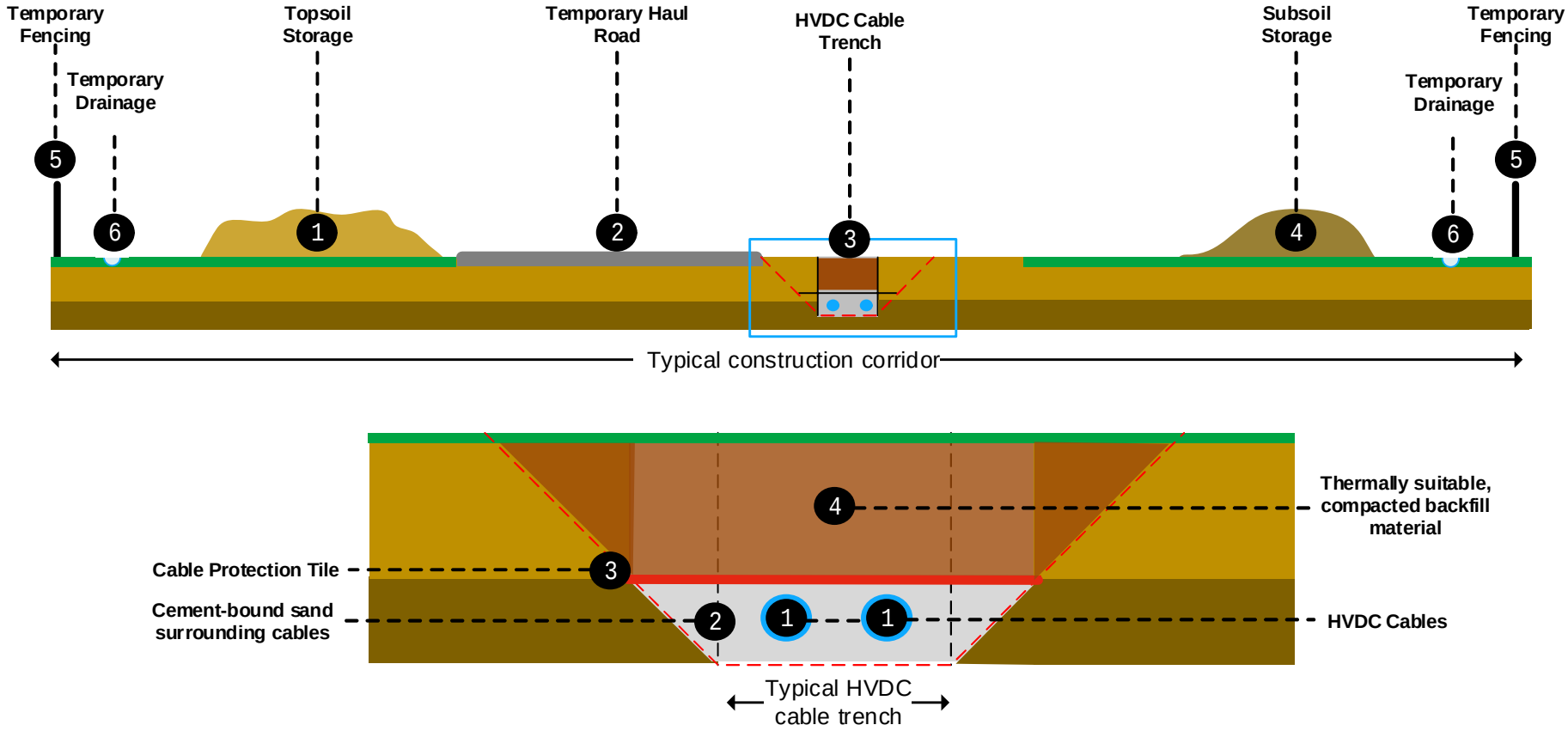
Table 2-5. Underground DC Cable Route – Summary of Key Characteristics

Component	Description / Parameters
Length of route and cable number	Approximately 16.2 km between the landfall and converter station site. The DC cable system comprises two cables laid side-by-side and a fibre optic cable for monitoring.
Temporary Working Width	Typically 43 m wide for the majority of the route but up to 65 m in places. This will include provision for the cable trench, soil storage, drainage and haul road.
Trench width/depth	Up to 1.4 m deep unless ground conditions or constraints dictate otherwise (for example due to other utilities or field drainage). The depth will increase in areas of HDD (trenchless crossings) for all rail crossings, river crossings, ancient woodland and major highways, as required. The depth depends on the minimum separation of the bores and ground conditions but for longer crossings could be up to 50 m below ground level.
Joint Bays	Subject to detailed design but required approximately every 800 to 1,000 m. Installation within working width. Joint bays will be formed by building a concrete plinth (or similar) in the base of the trenches up to 12 m by 5 m by 1.5 m.
Cable Installation Method	Primarily open cut trenching to install the ducts which will then be backfilled and land reinstated (aside the haul road). Following this, cables will be pulled through the ducts. Sections of HDD will occur where obstacles are encountered such as watercourses, ancient woodland, railways or roads.
Trenchless crossings installation method	Excluding the landfall HDD, 11 trenchless crossings are proposed. North to south these will be: • South of Pitcairn Farm - below the dismantled railway line crossing the path of a decommissioned railway. Approximate length 170 m. • B981 & River Ore - Passing beneath the B981 road, the River Ore and Minto Woodland. Approximate length 450 m. • Fife Circle Railway Line - Passing beneath the active railway line between Lochgelly and Cardenden, just to the east of Lochgelly Cemetery. Approximate length at least 120 m. • A92 - Potential for tunnel crossing the A92 dual carriageway to the east of Lochgelly. This option is proposed as it is not possible

Component	Description / Parameters
	to run the cable through the adjacent underpass. Approximate length 130 m. • Solar Farm bypass / Knockbathy Wood - Proposed crossing through a hill to avoid land covered by a solar array. Approximate length 400 m. • Woodland at Clentrie Farm - Crossing a steep wooded bank on rural arable land. Approximate length 270 m. • B925 - West of Auchtertool, passing under the B925 road at an oblique angle. Approximate length 100 m. • Woodland to the east of Kilrie. Approximate length 100 m. • B9157 - Crossing beneath the B9157 road. Approximate length at least 100 m. • Grange Farm - Passing to the south of the Grange Farm buildings, crossing small watercourse Banchory Burn, an associated area of compressible ground, a wooded berm and an access track. Approximate length 250 m. • A921 - Crossing beneath the A921 road, to the north of Kinghorn. Approximate length 220 m.
Open cut crossings of watercourses installation method	Minor non sensitive channels/watercourses will be constructed utilising either a bypass flume or a temporary dam to enable ducts to be installed between dry bed.
Construction Compounds	5 construction compounds and other working areas such as HDD set-up locations will be required at various locations along the length of route. Construction compounds from north to south include: • Satellite compound 5 circa 5.6 ha at central NGR NT19995 94685 north of the B981 • Satellite compound 4 circa 5.6 ha at central NGR NT20813 93068 north of the B9149 south of the A92 • Satellite compound 3 circa 5.3 ha at central NGR NT22172 91828 at Clentrie Wind Farm north of Camilla Loch • Satellite compound 2 circa 5.6 ha at central NGR NT2591 889549south of the B9157 • Satellite compound 1 circa 5.6 ha at central NGR NT2722 987705 south of the A921
Permanent Infrastructure	No permanent above ground infrastructure would be required along the cable route. Small marker posts may be installed to make people aware of the presence of the cable.

Component	Description / Parameters
Construction Duration	Cable installation does not require to be undertaken sequentially; as a result, installation could occur in multiple sections along the length of the proposed route in parallel and therefore installation is unlikely to be completed in a linear fashion. This will limit the extent and duration of construction activity at any given location including the length of time that land remains disturbed for. The exact programme will dependent on a number of factors including the underlying ground conditions and installation methods used. Generally construction will take place in 1 km sections with main construction lasting between 3-6 months per section. Site preparation / clearance would be separate as this may be impacted by other factors including ecological constraints. Full reinstatement is likely not to occur until all works are substantially complete. Overall cable installation will be undertaken over a 2-3 year period.
Temporary access roads	Temporary access roads will be required during installation of the underground cable route. These comprise: Mobilisation access roads: these will be used at the start of construction, to enable access to the working corridor and support establishment of the haul road, as well as the end as part of demobilisation. Up to 5.2 km of mobilisation access roads are required with the majority (up to 3.8 km utilising existing tracks). Temporary haul roads: These will be used for the duration of the installation works to enable excavation of the trench for ducts/underground cable as well as for cable delivery, installation and jointing. Up to 16.4 km of haul roads will be required during construction. The majority of this relates to the haul road within the working width with some smaller sections of temporary road required to enable access from the existing road network. The haul road will be up to a maximum of 7 m wide and unbound i.e. the road surface will be formed by crushed aggregate.
Temporary access roads crossing	12 temporary watercourse crossings (bridges and culverts) will be required where the haul road crosses watercourses. The exact design of each crossing is subject to detailed design but culverts will either be bottomless, to preserve the natural riverbed, or box type with natural substrate within the base of the culvert. Where culverts are not used, temporary clear-span bridge crossings will be installed.

Figure 2-4: Cross section of a Typical Working Width



Description of the Landfall

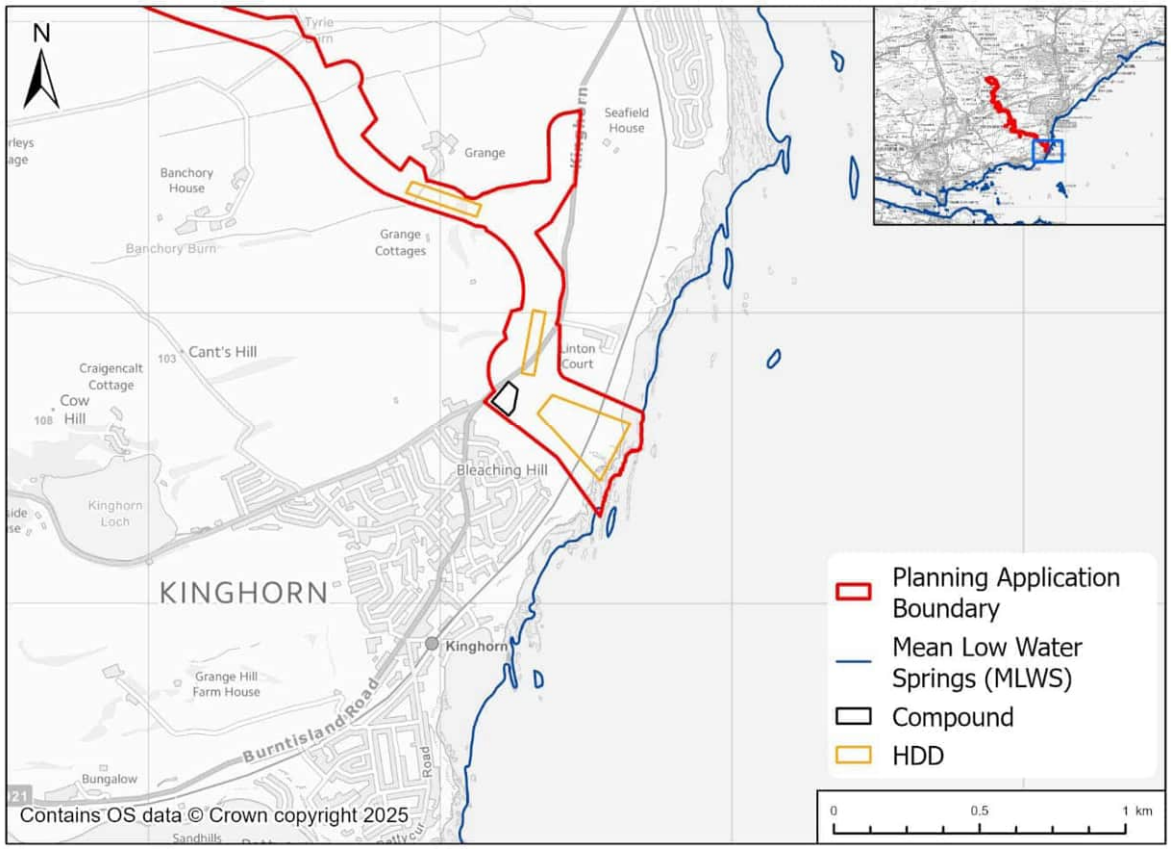
Overview of the Proposed Landfall

The Landfall is the interface between the Scottish Onshore Scheme and Marine Scheme of the Project. It is where the subsea cables come ashore and are joined to the onshore underground DC cable route at a buried Transition Joint Bay (TJB). The TJB consists of an underground concrete plinth, constructed of reinforced concrete, and a box-like structure that houses the cable joints between the subsea and onshore underground cables. The TJB will occupy an area of up to 60 m^2 (based on an indicative footprint of 15 m by 4 m) which will be buried upon completion. A manhole / inspection cover will be provided on the surface to allow access to the link boxes for inspection and maintenance purposes.

Landfall Site Description

The landfall is located on agricultural land between the settlements of Kinghorn to the south and Kirkcaldy to the north. The steep coastline is formed by rocky, vegetated cliffs which form part of the Firth of Forth Site of Special Scientific Interest (SSSI) and abut the Firth of Forth Special Protection Area (SPA) at MLWS (**Chapter 7: Ecology and Nature Conservation: Figure 7-2 Statutory Sites Designated for Nature Conservation**). The Edinburgh-Aberdeen Railway line broadly parallels the coastline in this area. The Fife Coastal Path is located to the east of the railway line, also closely following the coastline (**Figure 2-1 Constraints**).

Figure 2-5: Landfall Area



Landfall Installation Methods

Due to the constraints and topography, it is proposed that trenchless methods (i.e. Horizontal Directional Drilling (HDD)) will be utilised to construct the landfall. A temporary working area will be required to the west of the railway line with the HDD extending beneath the railway line, coastal path and cliffs such that they will not be impacted by the works. The landfall working area is set back from the railway line by approximately 240m to achieve the necessary vertical clearance when crossing it. During the HDD operations monitoring activity will be undertaken along its length. Once the works to install the landfall are completed, land will be reinstated with no permanent above ground infrastructure left in place.

Landfall – Key Characteristics

A summary of the key characteristics of the landfall are outlined in **Table 2-6 Landfall – Summary of Key Characteristics,** below.

Table 2-6 Landfall – Summary of Key Characteristics

Component	Description / Parameters
Temporary Construction Area	A temporary construction area will be established at the landfall where plant and materials can be stored and from which installation activities including HDD will be undertaken. The footprint of the temporary construction area will be up to 100 m by 80 m (0.08 ha) and will be reinstated upon completion. The temporary compound will be up to 5,650 m^2 (0.565 ha)
Transition Joint Bay	A permanent buried concrete pad would be installed where the subsea cables are joined to the underground cables. The footprint is subject to the final detailed design but is likely to be up to 4 m wide by 15 m long (i.e. up to 60 m^2) and 1-2 m deep. Land above the transition joint bay will be reinstated upon completion.
Installation Approach	Due to the constraints which are present at the landfall, installation will be by HDD. HDD is a construction technique in which a small tunnel is drilled and ducts/cables are pulled through it. At the landfall HDD will be utilised to drill small holes (at least one per cable) from the TJB to a breakout point in the Firth of Forth. Two ducts (plastic / steel pipes) would be inserted in the drilled holes and the subsea cables pulled ashore through the ducts and joined to the underground DC cables at the TJB. Depending on ground conditions, the HDD may require several attempts to successfully drill through the required length, and as such the working corridor widens at the landfall to accommodate the potential for additional drill attempts. The depth of the landfall will range from 1.4 m below existing ground level at the TJB to up to 31 m below the railway line. The maximum depth will be 42.49 m below finished ground level on the embankment to the east of the shoreline. Where the HDD passes beneath the shoreline the depth will be up to 22 m below the seabed.
Landfall length	The conceptual design requires 950 m (horizontal length) / 960 m (drilled length) from the HDD entry at the TJB in the arable fields

Component	Description / Parameters
	north of Kinghorn, to the HDD exit below MLWS in the Firth of Forth. It is assumed there will be at least 10 m separation between the two ducts/cables.
Construction Programme	It is anticipated that a minimum of two years will be required for completion of the landfall works (i.e. from site setup to installation and jointing of the cables). Typical working hours will be 08:00-18:00 Monday to Friday and 08:00-13:00 Saturday. HDD operations will require 24-hour working.
Access	Access to the landfall working area will be via a temporary bellmouth/haul road connecting to the A921.

2.4 Construction of the Scottish Onshore Scheme

Subject to securing the necessary consents, it is expected that construction of the Scottish Onshore Scheme will start in 2027 and last for approximately 6 years. This will consist of:

- Construction of the landfall: the exact timing will be influenced by installation of the Marine Scheme but it is expected that construction will occur over two periods (1. Installation of ducts, and 2. Pulling and jointing of cables);
- Construction of the DC cable route: construction will be undertaken over a 2-3 year period. Installation works are unlikely to be sequential along the route, with work undertaken at various sections of the alignment simultaneously. As noted above because installation works will be undertaken using a ducted method parts of the working corridor may be reinstated more quickly with the full corridor not reinstated until the cables have been installed and the HVDC link commissioned;
- Construction of the converter station: construction is expected to take approximately 6 years to complete from initial groundworks to completion of construction;
- Installation of the AC cables: installation of the AC cables between the converter station and the new 400 kV Westfield Substation will be undertaken simultaneously as the construction of the converter station but will likely only take place during the final year of construction; and
- Commissioning activities of the HVDC link from end to end which will include various tests to ensure individual components and the full link is operating appropriately before integrating the link into the existing electricity transmission network.

2.5 Operation of the Scottish Onshore Scheme

Once operational, the Project will form an integral part of the electricity transmission network. The anticipated operational life of the converter station is approximately 40 years. It is likely that after this period refurbishment and plant replacement will extend the life of the converter station rather than decommissioning.

It is expected that the converter station will be in operation 24 hours a day all year round. The only exception to this will be in the event of network interruptions, other unplanned network events or scheduled maintenance activities. During ordinary operation of the converter station

a small workforce (four to six people) is expected to be based at the site permanently. This will increase in the event of network interruptions, other unplanned network events or scheduled maintenance activities. As a result, operational traffic movements are expected to be limited.

Electric and Magnetic Fields

All equipment that generates, distributes or uses electricity produces Electric and Magnetic Fields (EMFs). Exposure limits for EMFs in the UK are set by the Government, and the electricity industry strictly adheres to these limits. The exposure limits for both DC and AC cables originate from the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines, published in 1994 and 1998 respectively and recently updated in March 2020. The Scottish Onshore Scheme will be designed to comply with the guidelines for exposure to EMFs.

2.6 Decommissioning of the Scottish Onshore Scheme

During the 40-year operational lifetime of the Scottish Onshore Scheme, it is likely that refurbishment and plant replacement will extend the life of the Scottish Onshore Scheme rather than decommissioning. However, in the event that the Scottish Onshore Scheme ceases to be required then it could be decommissioned. A Decommissioning Plan will be prepared and planning permission obtained, if required, in accordance with the relevant legislation in place at the time.

Dependent on specific requirements the redundant cables could either be left in-situ (which would have the least environmental effect), or all or parts of the cable could be removed for recycling. Where recycling is not possible removed cables will be disposed of in accordance with the relevant waste disposal regulations at the time of decommissioning.

The main components of the converter station will be dismantled and removed for recycling, wherever possible. Where this is not possible disposal will be undertaken in accordance with the relevant waste disposal regulations at the time of decommissioning.

The process of decommissioning will be similar to construction meaning the likely significant environmental effects will be comparable. As a result, decommissioning has not been assessed in the EIA Report.