1 Introduction

1.1 Ofgem and National Grid have agreed a new set of price controls and incentives for the period from April 2013 to March 2021. This includes a provision of £500 million for electricity transmission owners to mitigate the visual impact of existing electricity infrastructure in nationally protected landscapes in Great Britain. For National Grid, which is the transmission owner in England and Wales, this means mitigating the effects of existing infrastructure on the visual amenity and landscapes of National Parks and Areas of Outstanding Natural Beauty (AONBs). Use of this provision is known as the Visual Impact Provision (VIP) Project.

1.2 Following the results of a landscape and visual impact assessment in 2014, covering all 571km of overhead line (OHL) within the scope of the VIP Project, those sections of OHL which had the greatest visual impact on the surrounding landscape were identified. In September 2015, a Stakeholder Advisory Group (consisting of stakeholders with national remits for England and Wales) decided that four sections of OHL should be prioritised for detailed assessment.

1.3 The locations of the stakeholder driven projects were Dorset (OHL 4YA), New Forest (OHL 4YB), Peak District (East) (OHL 4ZO) and Snowdonia (OHL 4ZC).

1.4 This joint Screening and Scoping Report relates specifically to the VIP, Snowdonia Project which aims to relocate a section of OHL 4ZC underground (hereafter referred to as the VIP subsection) within, and adjacent to, Snowdonia National Park.

1.5 This joint Screening and Scoping Report is intended to facilitate further discussion between National Grid and consenting authorities in order to ensure all areas of concern are identified prior to the environmental assessment being undertaken. The key objectives of this report are summarised as follows:

- To seek a screening opinion on the need for a formal Environmental Impact Assessment (EIA).
- To provide initial details on the Proposed Project.
- Identify the key potential impacts of the Proposed Project and outline the scope of further studies to be undertaken.
- Obtain agreement on the scope of work, which will be undertaken to ensure that the level of environmental studies and mitigation satisfies the needs of all interested parties.

The Snowdonia 4ZC 'VIP Subsection'

1.6 The existing 4ZC OHL connects Pentir and Trawsfynydd 400kV substations and was granted consent under the Town and Country Planning Act 1962 in February 1964. The OHL was constructed in 1966 with standard lattice pylon design with twin and quad conductor bundles along various sections. Currently, the pylons in the VIP subsection operate with one circuit at 400kV, while the circuit on the other side operates at 132kV as part of the distribution network operators (DNO) system. There is an existing section of underground cables across the Glaslyn Estuary to the west of the VIP subsection. The location of the VIP subsection in relation to the Snowdonia National Park boundary is shown in Figure 1.1.

1.7 The VIP subsection runs from National Grid's existing Garth Sealing End Compound (SEC) near Minffordd (to the east of Porthmadog) across the Dwyryd Estuary where it enters the western edge of the Snowdonia National Park. It then continues past the small settlement of Cilfor. This VIP subsection is approximately 3km in length.

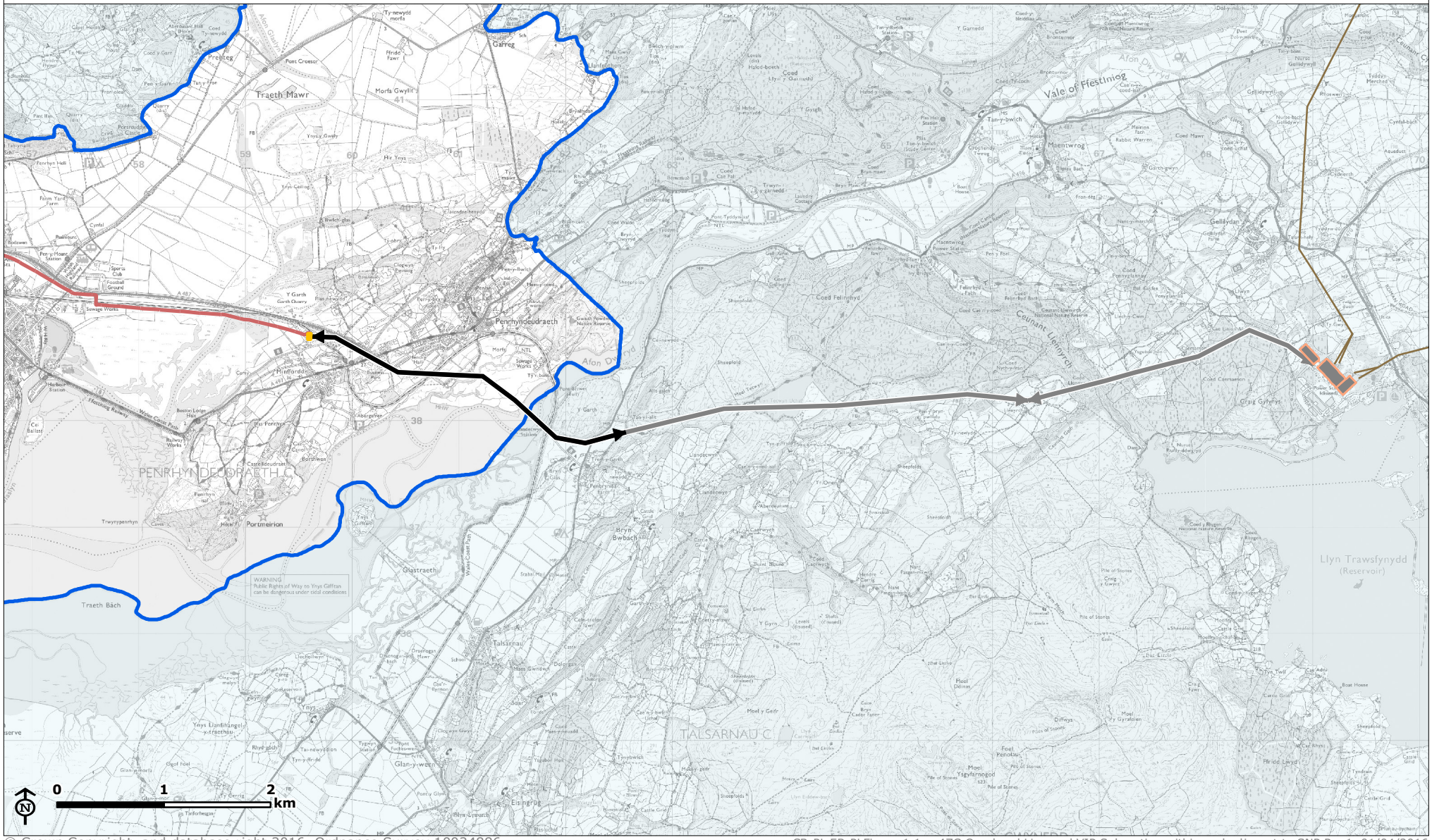
NATIONAL GRID
SNOWDONIA NP
VIP PROJECT

Snowdonia NP
VIP subsection
4ZC overhead line
Other OHL
National Grid Garth SEC
Trawsfynedd Power Station
Underground cable route

nationalgrid

Source: Natural Resources Wales, National Grid

Figure 1.1: 4ZC Overhead Line and VIP Subsection within and adjacent to Snowdonia NP



1.8 The focus of the VIP Project is on the mitigation of landscape and visual impacts, and the assessment of these impacts is set out in the landscape and visual impact assessment Technical Report[1]. The OHL in this area is judged to have:

- **landscape impacts of very high importance** on the *Ardudwy Coastal Hinterland* and a small part of *Morfa Harlech* landscape character areas. The OHL runs through a complex and dramatic landscape which represents the sharp contrast between the popular tourist coastline of the National Park and the adjacent upland areas. The special qualities of the National Park are clearly expressed in this landscape which also displays high scenic quality, conservation interests and recreational value. The OHL conflicts with the character of the landscape, eroding valued characteristics and forming an intrusive feature which is highly visible and consequently has a widespread influence on the perception of the landscape.
- **visual impacts of a high importance** particularly on people using the Wales Coast Path regional trail, National Cycle Route 8, local rights of way and Open Access Land because close up and frequent views of the OHL are experienced. There are also some high impacts on the local community, in particular at Cilfor.

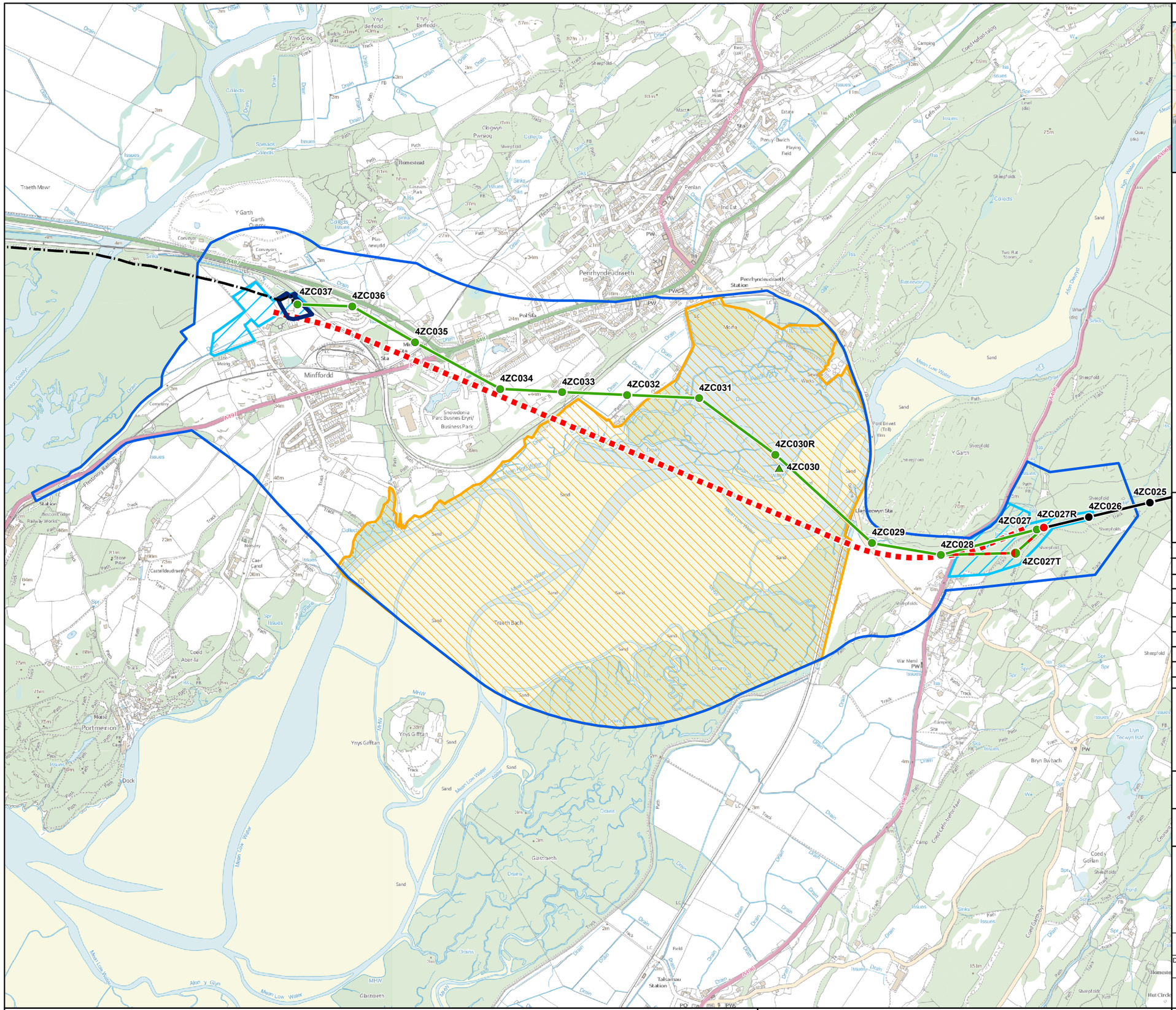
[1] National Grid (2014) Visual Impact Provision: Landscape and Visual Impact Assessment Technical Report. National Grid. Available at http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=37291

2 The Proposed Project

2.1 In early project conception National Grid submitted a screening letter to Gwynedd Council (15 December 2015) which considered two technical options for cable undergrounding. As a result of further technical studies and stakeholder engagement the two initial options have now been discounted. The Proposed Project now being developed is to underground the VIP subsection using a tunnelling solution from National Grid's existing Garth SEC to Cilfor on the eastern side of the Dwyryd Estuary. The Proposed Project will comprise of the following elements which have been divided into the different planning jurisdictions:

- *Equipment on the Western Side of the Dwyryd Estuary (within Gwynedd)*
  - Reconfiguration of equipment and extension of the existing Garth SEC (this will include the removal of the current gantry at Garth SEC, there will therefore be no equipment greater than 10m in height at Garth SEC);
  - A tunnel head house and an approximately 35m deep tunnel shaft, close to National Grid's existing Garth SEC;
  - Direct burial of a short sections of underground buried cable to connect into the SEC from the tunnel head house;
  - Removal and dismantling of six pylons;
  - Minor amendments to the existing highway network to facilitate construction;
  - Temporary access routes and laydown areas to facilitate construction activities;
  - A section of tunnel.
- *Equipment on the Eastern Side of the Dwyryd Estuary (within Snowdonia National Park)*
  - A new SEC near Cilfor with a permanent access road (this is required to connect the new underground conductor to the remaining existing OHL). This will be constructed prior to, and used during construction;
  - A tunnel head house and an approximately 85m deep shaft, close to the new SEC;
  - A section of tunnel;
  - Potential removal and reinstallation of one pylon at the new Cilfor SEC;
  - Removal and dismantling of two pylons;
  - Temporary access routes and laydown areas to facilitate construction activities;
  - Temporary pylon adjacent to SEC and tunnel head house to facilitate safe construction of the SEC, tunnel and tunnel head house.
- *Works within the Dwyryd Estuary (within the Marine Environment)*
  - Cable tunnel approx. 3.2km long, with an internal diameter of 4.4m, at varying depths below the ground. The tunnel, between the two shafts, will be a minimum of 10m below bedrock at all times.
  - Removal and dismantling of two pylons and their foundations (4ZC030R and 4ZC031 and the associate temporary access tracks to these locations), the removal of the foundations of the previously dismantled pylon 4ZC030, and the temporary access to enable the dismantling of pylon 4ZC032 (although the pylon itself is within the terrestrial environment).

2.2 The proposed tunnel alignment and the search areas for the SEC and tunnel head house locations can be seen in Figure 2.1.



Overview

Legend

- Area of Search for Permanent and Temporary Works
- Proposed Sealing End Compound/ Tunnel Head House Search Area
- National Grid Land Ownership Boundary
- Marine Environment Area
- Overhead Line to be Removed
- Existing National Grid Underground Cable
- Existing National Grid Overhead Line
- Proposed Tunnel
- Temporary Overhead Line Diversion
- Foundation of Former Pylon 4ZC030 to be Removed
- Existing National Grid Pylon to be Removed
- Existing National Grid Pylon to be Retained
- New National Grid Pylon
- New Temporary National Grid Pylon

Rev	Description	Cre'd	Chk'd	App'd	Date
09	NG Ownership	NH	SR	SR	10/10/2018
08	Temporary diversion added	NH	SR	SR	05/10/2018
07	Defunct tower location added	NH	SR	SR	26/09/2018
06	Junction Area removed	NH	SR	SR	16/08/2018
05	SEC & Junction Areas	NH	SR	SR	12/08/2018
04	Marine Environment	NH	SR	SR	11/05/2018
03	SEC search area and AoS update	NH	SR	SR	30/04/2018
02	Revised Tunnel Alignment	NH	SR	SR	03/04/2018
01	Study Area Extended	NH	SR	SR	07/03/2018

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Master Scheme No:	Sub-Scheme No:	Site:
-	-	

Scheme Name:
Visual Impact Provision (VIP) Snowdonia Project

Document Title:

Figure 2.1: The Proposed Project

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2.3 The following paragraphs provide further details of the Proposed Project and an overview of construction, operation and decommissioning methods; these would be subject to detailed design.

Construction

2.4 The Proposed Project will include the construction of a new underground connection (constructed within a tunnel); a new SEC and associated terminal pylon; extension to the existing Garth SEC, two new tunnel head houses and removal of the existing VIP subsection (pylons and conductors). Construction compounds, laydown areas, a temporary pylon and temporary access tracks will be required to facilitate construction activities.

Shaft and Cable Tunnel Construction

Shaft Construction

2.5 In order to construct the tunnel, tunnel shafts will first need to be constructed at the start and end points of the tunnel.

2.6 It is anticipated that the two tunnel shafts will approximately 12.5m and 15m in diameter. It is likely that the shafts will be constructed by a combination of Secant pile walling (embedded retaining wall made of overlapping circular piles), the use of mechanical excavators (using a 360° digger with a breaker) and potentially using the drill and blast technique. The method will be selected once a main works contractor has been selected.

2.7 Drill and blast involves the highly regulated and controlled use of explosives, to break the rock for excavation; it typically involves:

- A large number of carefully positioned small holes drilled into the rock in a specific pattern to specific depths.
- Charging the holes with the correct type and quantity of explosives.
- Detonating the explosive at the correct time delay causing the rock to fracture in an approximately horse shoe cross-section.

2.8 Where drill and blast techniques are used, a rock crushing machine will be required to reduce the size of the excavated rock for transportation and removal.

2.9 Each shaft will need to be lined. It is anticipated that the lining will comprise of sprayed concrete. Shaft construction will be a cyclical process comprising sequential excavation and lining construction in typically 1m advances although this would depend on the stability of the ground encountered.

2.10 Construction through the water table will be addressed by the use of a watertight construction process meaning the shafts will not require dewatering when lower than the groundwater table. This will likely include pre-grouting of rock fissures and joints to prevent or reduce water flows into the excavations.

2.11 A substantial construction compound will be required at each shaft location, and access will be required for bringing in plant and material. The exact size of the construction compound will depend on a number of factors and subject to main contractor preferences but could be approximately 3000m^2 for the western site and 2300m^2 for the east side

Tunnel Construction

2.12 The tunnelling method cannot be confirmed until appointment of the main contractor, however based on the ground investigation and the information obtained to date it is likely that construction using a tunnel boring machine (TBM) which would be used to cut a channel through the ground. The tunnel would then be constructed with precast concrete segments

behind the TBM. Typically, the TBM is launched and received from the shafts at each end of the tunnel. TBM will be fitted with an effective dust-control system and controlled in a way to minimise noise and vibration

2.13 The drive shaft is used for launching the TBM, removing excavated material, supplying materials to the tunnel face and allowing personnel access for construction of the tunnel. The tunnel drive shaft needs to accommodate the plant required to support the tunnel construction such as ventilation ducting and power cables. The size of the reception shaft needs to be adequate to allow removal of the TBM on completion of the tunnel.

2.14 The drill and blast option use the shafts in the same way as above except construction of the tunnel can be undertaken from one shaft or from both.

2.15 The diameter of a tunnel is very much dependant on the quantity of the High Voltage Systems that need to be installed, however it is envisaged that an internal tunnel diameter of 4.4m would be required. The tunnel would be constructed at varying depths and will remain at a minimum of 10m below bedrock at all times.

2.16 Installation of the High Voltage system within the tunnel will utilise the existing site compound and the shafts created to build the tunnel. The work to install the High Voltage System will largely be completed underground with minor activities on the surface at each end to connect the existing infrastructure.

Spoil

2.17 Shaft and tunnel construction will produce a large amount of spoil. It is currently estimated that the total volume of spoil excavated from shaft and tunnel construction will be in the region of 125,000m^3 of material, of which 2,000m^3 will be soft alluvium and the remaining volume is anticipated to be rock.

2.18 The spoil, once removed, will need to be stockpiled temporarily on site. The construction compounds will be designed to hold two to three days of excavated spoil temporarily in case of delays removing it from site. Disposal of spoil would be necessary, either on-site through creation of earth mounding, or off-site, necessitating numerous lorry movements.

2.19 The most commonly used method of removing spoil from a construction site is on road using Heavy Good Vehicles (HGVs). The initial routeing strategy is for the construction traffic to use the A487 and A497 to access the tunnel shafts, SEC and the pylon locations (further details are provided in Section 12 Traffic and Transport of this Screening and Scoping Report).

2.20 The peak construction activity in terms of traffic generation is expected to relate to the excavation of aggregate during tunnelling. Initial forecasts indicate that there will be in the order of 30 loads per day, (60 two-way HGV movements) undertaken by vehicles with a load carrying capacity of 15m^3. During this period, these activities are also forecast to generate around 40 two-way LGV movements. Tunnelling works are expected to take place for approximately 14 months.

Tunnel Head Houses

2.21 Each tunnel shaft will require a head house. The purpose of the tunnel head house is to allow access into the shafts, provide ventilation and to locate plant and equipment. The overall scope of the VIP Project is to mitigate the visual impact of existing electricity infrastructure in nationally protected landscapes, it is therefore important that any tunnel related structures are designed to minimise their visual impact. Tunnel head houses will be constructed at the shaft locations to accommodate:

- Ventilation plant for tunnel, shafts and dedicated access staircase
- Accommodation for operational services such as a control room

- Conductor transition structures
- Shaft access
- Uninterrupted Power Supplies (UPS)
- Limited Welfare facilities

2.22 The tunnel headhouses will be sized to accommodate only the required equipment for the operation of the tunnel. Each will be designed in a way to fit in with the environment and surroundings. The east side headhouse will be sized in a way to remove additional electrical structures and will be approximately 40m x 15m x 12m high. The west side will be approximately 25m x 15m x 6m.

Direct Burial of Cable

2.23 A direct burial cable route would be required to connect the HV System in the tunnel to the existing ones at Garth SEC.

2.24 Direct burial of an underground cable would require a construction corridor along the length of the cable route. This will accommodate the cable trenches, haul road, storage areas for stripped topsoil and sub soil from the cable trench excavation and inclusion of any temporary and permanent land drainage requirements. Following completion of the cable installation, the ground would be returned to its previous use. Hedgerows and other field boundaries would be reinstated. Trees felled would not be replanted over the buried cable but would be replaced locally elsewhere.

Sealing End Compound and Terminal Pylon

2.25 A SEC is required to achieve the transition from an OHL to an underground connection. The SEC is located as close to the existing OHL as possible, thus eliminating the requirement for or minimising the extent of any new OHL required to connect with the existing 4ZC OHL.

Western Side of the Dwyryd Estuary

2.26 The existing SEC at Garth will be retained and extended to accommodate the Proposed Project and any future amendments to electrical infrastructure. Although the footprint of the existing SEC will increase, the existing gantries will be removed. The highest structure at Garth SEC will therefore be up to 10m in height. The existing permanent access to Garth SEC will be utilised during its operation however a new temporary access road is likely to be required during its construction.

Eastern Side of the Dwyryd Estuary

2.27 A new SEC will be required at Cilfor to facilitate the transition from the underground connection to the OHL. A terminal pylon will also be required; this forms the commencement of the 400kV OHL. The SEC will require the construction of a permanent road access which will also service the Tunnel Head House adjacent.

2.28 The Terminal Pylon (Pylon 4ZC027R located between the current OHL and the new Tunnel Head House building) is likely to have piled foundations. The construction working area around the Terminal Pylon would occupy an area on the ground of approximately 50m x 50m. Construction activities would include piling, excavation works, pylon assembly and erection, installation of earthing tape (for lightning protection), and downlead erection from 4ZC027R to the Tunnel Head House.

2.29 The new terminal pylon will be constructed prior to the SEC and will be used to connect the existing OHL to the temporary Pylon, before then being used to connect the existing OHL to the Tunnel Head House. The area of topsoil to be removed for construction activities would be approximately 200m^2.

2.30 Pylon erection will be by either a Mobile Hydraulic Crane, or with a derrick to erect the pylon in small sections. Pylon erection will require a large laydown and assembly area of approximately 50m x 50m (within the 200m^2 area mentioned above for topsoil removal) for laying out and assembling the steelwork into the lifting sections. Steelwork will be delivered to site on trucks and assembled in sections around the pylon base. A tractor with a light crane or tele-handler may assist in the moving of and erecting steelwork on the ground. The first panel will be lifted by the crane and manoeuvred into position over the foundation stubs and fixed into place by locating the connecting bolts (see Figure 2.2).

Figure 2.2: Pylon Erection at Base Level

2.31 Once in place the panel will be stayed to hold its position. Subsequent sections will be assembled using a controlled lift and staying sequence with each panel or boxed section bolted in turn to the previous erected panel until the pylon is complete and secured (see Figure 2.3).

Figure 2.3: Pylon Erection at Upper Levels

Construction of the OHL Temporary Diversion

2.32 A temporary pylon will be required to temporarily divert the OHL during construction. The proposed location of the temporary pylon (4ZC027T) is shown in Figure 2.1.

2.33 This design provides the temporary diversion of the OHL and puts in place the new terminal Pylon 4ZC027R in preparation for connecting the OHL into the SEC.

2.34 The temporary Pylon will require foundations which may be constructed by piling. To construct the foundation of temporary Pylon 4ZC027T a working area of 50m x 50m would be required. The temporary pylon would be erected using a crane. Other construction activities would include excavation works, pylon assembly and erection.

2.35 Access will be required to Pylons 4ZC026 and 4ZC028, and the land in between in order to install backstays and lower conductor to enable the temporary diversion to be installed and Pylon 4ZC027 to be replaced with Terminal Pylon 4ZC027R. This will include two areas for temporary backstays of around 20m x 20m.

Removal of Existing Infrastructure (VIP subsection)

2.36 Removal of the existing infrastructure (the VIP subsection i.e. removal of the OHL from Pylon 4ZC027 to 4ZC037) will take place following installation and commission of the new cables.

Conductor Removal

2.37 Pylon fittings, such as dampers and spacers, will be removed from the conductors. Conductors between pylons could be simply removed by lowering them to the ground and reeling them onto wooden transport drums; although simple and fast this method offers no protection to anything situated in the span such as roads, buildings, railways, walls, hedges, lower voltage power lines and the ground itself. An alternative, and the preferred approach

on the Proposed Project, is using continuous tension stringing whereby the conductor is replaced under tension by a light bond which is then lowered to the ground. The recovery of the light bond will have minimal impact on anything at ground level.

2.38 To keep the road A496 open during conductor removal, scaffolds and net will be erected over the A496. Figure 2.4 shows an example of netted scaffold over a road.

Figure 2.4: A Netted Scaffold Protecting A Road

Pylon Dismantling

2.39 Pylon dismantling and removal can be carried out using a variety of methods depending on the pylon type, location and access. Potential methods include:

- Crane: Pylons can be dismantled using a large mobile hydraulic crane which is positioned on a crane pad at the Pylon location. The crane pad will be approximately 20m x 10m (subject to crane size/site constraints) constructed from plastic or metal panelling. It will take approximately one day to dismantle a Pylon using a crane (following advanced site preparation i.e. installation of the crane pad and progressing of advanced works on the pylon prior to commencement of works with the crane). The sections of the Pylon will be cut/ broken up as they are lowered to the ground using a steelwork breaker/ mechanical shears fitted to an excavator. The cut sections of the pylon are then placed into waste skips (which could be located within the crane pad or on temporary track way joining the crane platform) and removed from site for reuse or recycling.
- Felling: This method avoids the need to use a mobile hydraulic crane but can only be used where there is sufficient room to pull over the Pylon without damaging roads, utility services, and fixed boundary features such as hedges. A wire bond will first be taken and fitted to the top of the Pylon. A winch tractor will be positioned approximately 1.5 to 2 times the Pylon height away from the Pylon. The base of the Pylon (the two back legs of the pylon are cut) is then partially cut through (or use controlled explosives) and the winch tractor used to pull over the Pylon using the attached bond. The sections of the Pylon will then be broken up using a steelwork breaker/ mechanical shears, loaded

into skips and removed from site for reuse or recycling. This method is not suitable for all pylons especially those which are wide.

- Winch and Derrick: This method requires a small mobile winch and a derrick (lifting device) will be taken to the site. The derrick will be raised up to the top of the Pylon such that approximately one third of the derrick is above the top of the Pylon. Four stay wires will be required (for support) at right angles from the top of the derrick down to backstays which are positioned at least one and a half times the maximum height of the derrick away. The Pylon will act as a scaffold and dismantled from the inside in small sections which will be individually lowered to the ground using the winch and derrick.

2.40 It is currently anticipated that the following methods will be used at each Pylon:

Table 2.1: Pylon Dismantling Method

Pylon	Anticipated Dismantling Method
4ZC027	Crane
4ZC028	Crane
4ZC029	Crane
4ZC030R	Crane (or potentially helicopter if further work confirms this is preferable)
4ZC031	Derrick
4ZC032	Derrick
4ZC033	Crane
4ZC034	Crane
4ZC035	Crane
4ZC036	Crane
4ZC037	Crane
Garth Gantry	Crane

2.41 As each pylon is dismantled and laid down in sections a hydraulic shearer mounted on a 360-degree excavator or gas torches will be used to break up the pylon into small sections and load into skips for disposal, reuse or recycling (see Figure 2.5).

Figure 2.5: Hydraulic Shearer Mounted on an Excavator Boom

2.42 Helicopters can be used to lift sections of pylons and remove to a remote lay down area, all in one movement without the need to transfer to a second vehicle for transport. This method requires careful load lifting by the helicopter but avoids the need for access roads to be created.

Pylon Foundation Removal

2.43 The foundations to Pylons 4ZC027 to 4ZC037 consist of either a Pyramid Foundation, Pile Clusters with a Pile Cap or in the case of 4ZC030R (the replacement Pylon built in 2013) a driven steel tube pile for each leg with the leg stub cast into the top of the pile. The foundation removal method for pylons in the terrestrial environment is listed in Table 2.2 below.

Table 2.2: Pylon Foundation Removal in the Terrestrial Environment

Foundation Type	Pylon	Removal Method
Concrete Frustum and Chimney	4ZC027, 4ZC032, 4ZC033, 4ZC034, 4ZC035, 4ZC036 and 4ZC037	Soil will be excavated from around the foundation to a depth of approximately 1.5m and stored for backfilling. The reinforced concrete foundation will be broken out using a hydraulic breaker mounted on an excavator. The broken concrete will be removed from site as waste. The void in the ground will be backfilled using a mixture of the soil previously set aside and soil imported from a local source.
Piled Foundation	4ZC028 and 4ZC029	Soil will be excavated from around the foundation to a depth of approximately 1.5m and stored for backfilling. The reinforced concrete foundation will

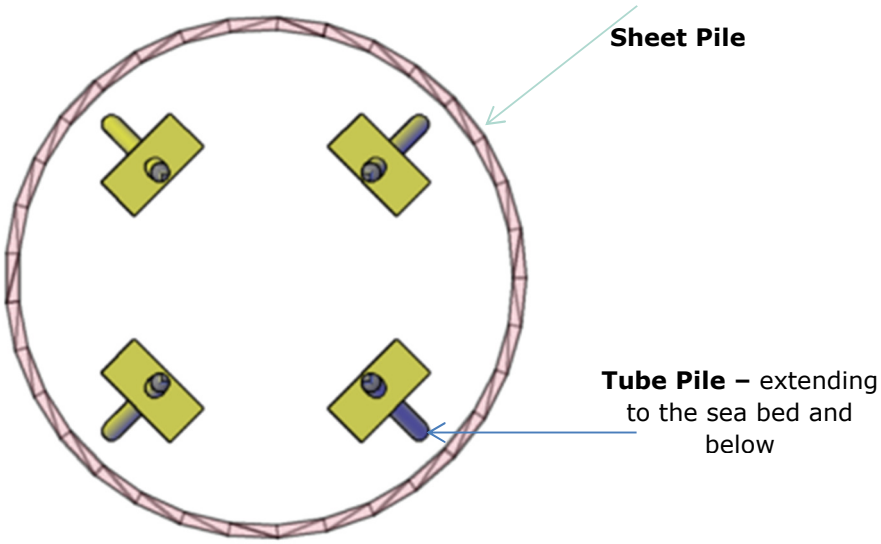
Foundation Type	Pylon	Removal Method
		be broken out using a hydraulic breaker mounted on an excavator. The broken concrete will be removed from site as a waste. It is anticipated that the base of the pile cap is likely to be slightly above or around 1.5m below ground level. However, if the base of the pile cap is deeper than 1.5m below ground level then the pile cap will be removed entirely leaving only the piles in the ground. The void will be backfilled using a mixture of the soil previously set aside and soil imported from a local source.

Marine Works

2.44 The foundation removal method for pylons located within the marine environment which have been discussed and agreed with Natural Resource Wales (NRW) is listed below:

- 4ZC031 will be removed using the Piled Foundation method outlined below.
  - Place temporary trackway or stone road access road across the saltmarsh.
  - Excavate soil from around the foundation to depth of 1.5m and set aside for backfilling.
  - Removal of the pile cap and concrete piles to 1.5m.
  - Backfill with soil set aside and soil imported from local source if necessary.
  - It is anticipated that once the access to the pylon has been installed, 10 days will be required for pylon removal, and a further four days for excavation of foundation (timescales are weather dependant).
- 4ZC030R (replacement pylon for 4ZC030 on the salt marsh installed in 2013) has steel tube piles (762mm in diameter) which have been driven to suitable load bearing strata. The top 2m of the steel tube pile has been cleared out to accept the pylon stubs which are set into the top of the tube with a concrete plug. The tube has then been surrounded with a concrete collar approximately 1.80m x 1.80m x 1.20m, 60cm below ground level. The whole foundation has then been surrounded by a 12m deep sheet pile cofferdam to protect the foundations from tidal action. A cross section through the foundation arrangement is shown in Figure 2.6 below.
- The sand around the tube piles shall be removed to a depth of around 2m. Even though the foundations are inside the cofferdam, water will continue to enter the excavation even at low tide so continuous pumping will be required.
- The foundation collars shall be removed by hydraulic breaker. The preferred approach to removing the steel tube piles is to use a Leader Pile Rig which will grip the pile and remove it vertically with a vibrating action. It is anticipated that the piles will be removed with the concrete plug intact. The cofferdam ring beam shall be removed by using the same Leader Piling Rig which would simultaneously vibrate and lift the metal sheets. The sheets would be cut into manageable sizes and lifted out using a crane.
- Alternatively, if the sheet piles cannot be removed as proposed piles will be exposed to approximately 2m below ground level and cut free from the remainder of the structure.

Figure 2.6: Plan View of 4ZC030R Foundations



The reinforced concrete shall be disposed of and the redundant steelwork removed for recycling. As this area is tidal the void in the ground will fill naturally with local material by tidal action.

It is anticipated that five days will be required for pylon removal and a further four days for excavation of foundation (timescales are weather dependant).

- Pylon 4ZC030 (redundant pylon foundations which sit beyond the shoreline, the pylon was previously removed in 2013 after scour compromised the stability of the foundations). The foundation to each pylon leg consists of eighteen pre-cast concrete piles driven to an unknown depth (the piles are nominally 600mm in diameter). The piles are tied together with a pile cap 7.02 x 4.57 x 1.28m (four independent pile caps). The pile caps each have an extended chimney 0.9m x 0.9m x 1.5m. The pile caps and chimneys are currently visible in the sea (see Figure 2.7).

Figure 2.7: Redundant 4ZC030 Foundations at Low Tide Showing Chimney and the Top of the Pile Cap

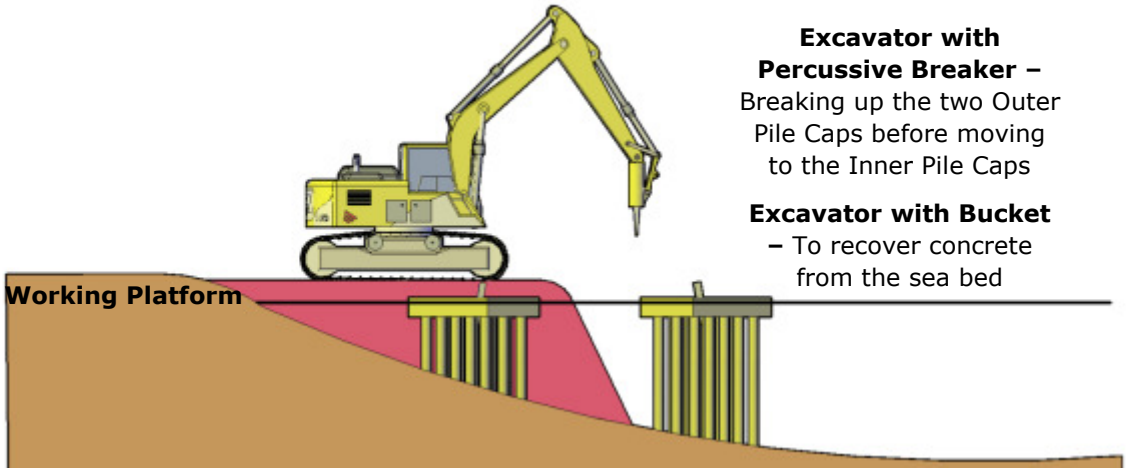
There are occasions when the water level is low enough to access the foundations, however the tidal action has scoured the sand away from the immediate area around each pile cap leaving a margin of deep water between the exposed sand and the pile cap.

The method of removing the foundations addresses the pile caps and the pre-cast concrete piles down to the sea bed level. The works would need to be suspended at high tide and the equipment removed to place above the anticipated water level.

The pre-cast concrete piles are in sections which are not connected (as they were designed to resist compressive forces), therefore it would not be possible to withdraw the piles from the sand by any method other than to excavate them out as far as is reasonably practicable.

The proposed method of foundation removal involves building a working platform so that an excavator with a hydraulic breaker can be located close to the pylon foundations. The working platform would be created by placing boulders in the sea or alternately textile bags filled with granular material. If textile bags are used a capping layer of granular material will be required laid over the top of the bags. The outer pile caps will be broken up and removed before moving to the inner pile caps.

Figure 2.8: Foundation Recovery – Outer Pile Caps



Although the pre-cast concrete piles cannot be totally recovered it will be possible to remove sections of pile within the reach of the excavator, 6- 7m below the level of the working platform which is anticipated to be approximately 1m above low tide level. It is currently anticipated that 21 days will be required for setting up and removal of the working area and a further seven days will be required for excavation of foundation.

- Pylon 4ZC032 is located within the terrestrial environment (see Table 2.2 above) however access will be required to access this pylon across an area of saltmarsh located within the marine environment. This will be undertaken by placing a temporary stone access road/ surface across an existing access track along boundary of SAC (see below for further information).

Temporary Access and Laydown

2.45 The location of Pylons 4ZC027 to 4ZC037 will require temporary access to carry out the dismantling works. In general preference will be given to using plastic or aluminium road panels to construct temporary roads, Figure 2.9 shows a temporary road constructed from plastic (Durabase) panels.

Figure 2.9: Temporary Roadways Using Plastic or Metal Panels

2.46 A number of temporary culverts or clear span bridges will be required to facilitate construction access across linear infrastructure and watercourses.

2.47 Where laydown areas are located next to Pylons for the removal of conductors the temporary working area known as the Equipotential Zone (EPZ) shall be constructed from Aluminium roadway panels. An example of this is shown in Figure 2.10. The required land take is approximately 20 x 40m.

Figure 2.10: Operational EPZ Constructed from Aluminium Panels

2.48 Where the works involve using a crane or a piling rig a level crane pad or piling mat to site machinery will be constructed. Where the ground conditions and terrain permit the crane pad

or pile mat can be constructed from roadway panels, however if the ground is of poor bearing quality or uneven the pad will be constructed from crushed stone.

2.49 The removal of pylons (including the foundations) of 4ZC030, 4ZC030R, 4ZC031 and 4ZC032 will require a temporary access across saltmarsh habitat in the marine environment. National Grid is exploring the use of a helicopter to remove the structure and concrete base of Pylons 4ZC030 and 4ZC031, and the foundations of the redundant Pylon 4ZC030. A helicopter landing site in the vicinity of the Proposed Project will be used to break up the pylons, load the waste into skips and transport the waste offsite. Suitable helicopter landing sites are currently being discussed with statutory consultees. Refuelling of the helicopter will take place off site, potentially in Harlech.

Temporary Works

2.50 Temporary works required for the Proposed Project would include: new access onto public highways; equipment laydown areas; temporary storage of materials and spoil, welfare facilities, office accommodation and parking, the erection of temporary structures (pylons / masts and scaffolding for crossings) whilst cable sealing end and/or OHL works are undertaken.

2.51 The estimated size of the site areas, are subject to main contractor preferences but could be approximately 3000m^2 for the western site and 2300m^2 for the east side of the Dwyryd Estuary.

Operation

2.52 Following completion of the tunnel and installation of the transmission medium, the construction compounds will be restored although permanent tunnel head houses, SEC and permanent access roads will remain. Tunnel Head Houses will provide maintenance access to the tunnel and contain ventilation equipment to regulate the temperature in the tunnel.

2.53 The Terminal Pylon would occupy an area on the ground of around 15m x 15m with the arms extending a further 7.5m either side.

2.54 Maintenance of the Proposed Project will be required during its operational lifetime. Typical maintenance procedures are summarised in Table 2.3.

Table 2.3: Typical Maintenance Works during Operational Lifetime

Project Element	Typical Maintenance works	Frequency
Underground cable/ SEC	Inspections of the tunnel and tunnel head house will be undertaken on a weekly basis. Every six months it will involve going down the shaft so there will be a requirement to have a crane on site. More intensive maintenance every 3-6 years for civil inspection as below: • Weekly remote check of system/alarms (action as necessary). • Monthly - Head House Routine - above ground only; includes site care, security and environmental routines. Inspection and basic maintenance tasks (e.g. check operation, clean/replace filters, report defects). • 6 Monthly- Head house and Shaft Routine – access to shaft bottom; includes site care, security and environmental routines. Inspection and basic maintenance tasks (e.g. check operation, clean/replace filters, report defects).	Monthly Every four years

Project Element	Typical Maintenance works	Frequency
	• 6 Monthly (issued 2 months prior)- Prep for 6 monthly Routine; check training and safety inspections up-to-date and all equipment available. • 6 Yearly Cable Maintenance- Visual inspection of cable and cleats, SVL tests and replacement as necessary. Oversheath tests only where cable has semi-conductive oversheath. • 3-6 Yearly- Civil inspection of shaft and tunnel.	
Terminal Pylons	Infrequent visits for replacement of pylon fittings/ anti climbing devices (ACDs), pylon steelwork / bracing. Vans would be used to carry workers in and out of site and trucks would be used to bring new materials and equipment to site and remove old equipment (using permanent SEC access road). Painting pylon steelwork.	As required Every 10-15 years

Decommissioning

2.55 Decommissioning activities include: removal of the Proposed Project, i.e. transmission medium from the tunnel, SEC and terminal pylon, tunnel head houses, tunnel and permanent access.

2.56 The tunnel, shaft and headhouses will have a design life of 120 years (design life is defined as the mean time before major maintenance). Underground transmission medium has a life expectancy of approximately 40-60 years (although it is expected equipment will last longer than this from National Grids experience of their existing assets). After this time, they could require replacing, assuming the connection is still required. If the connection is no longer required, the circuits would be decommissioned. Unless there was a compelling need for removal of the underground sections, they would remain buried in the ground for sections of direct burial or removed from the tunnel.

2.57 The lifespan of a SEC is approximately 40 years (or maintained to extend its useful life). When the SECs useful life has expired the materials would be removed and taken for recycling. Unless there is a compelling need for removal of the foundations, these would be removed to approximately 1m deep and subsoil and topsoil reinstated. If the foundations were to be removed, similar methods and access would be required as outlined for installation.

2.58 Should there be a need to decommission the tunnel head houses they can be demolished and the constituent materials taken away for recycling. The foundations would be removed up to 1m below ground level (unless a compelling reason to remove entirely).

2.59 A considerable sum of resources would have been expended to construct the tunnel and shafts, therefore a highly compelling reason would need to be found for decommissioning. However, if it is decided to decommission then the shafts and tunnel can be either capped off at the top of the shafts and flooded with water or filled with foamed concrete, depending on the situation at that time.

Programme

2.60 The current indicative programme is that, assuming planning consent, on site works would commence in 2020 and take approximately 4-5 years to complete.